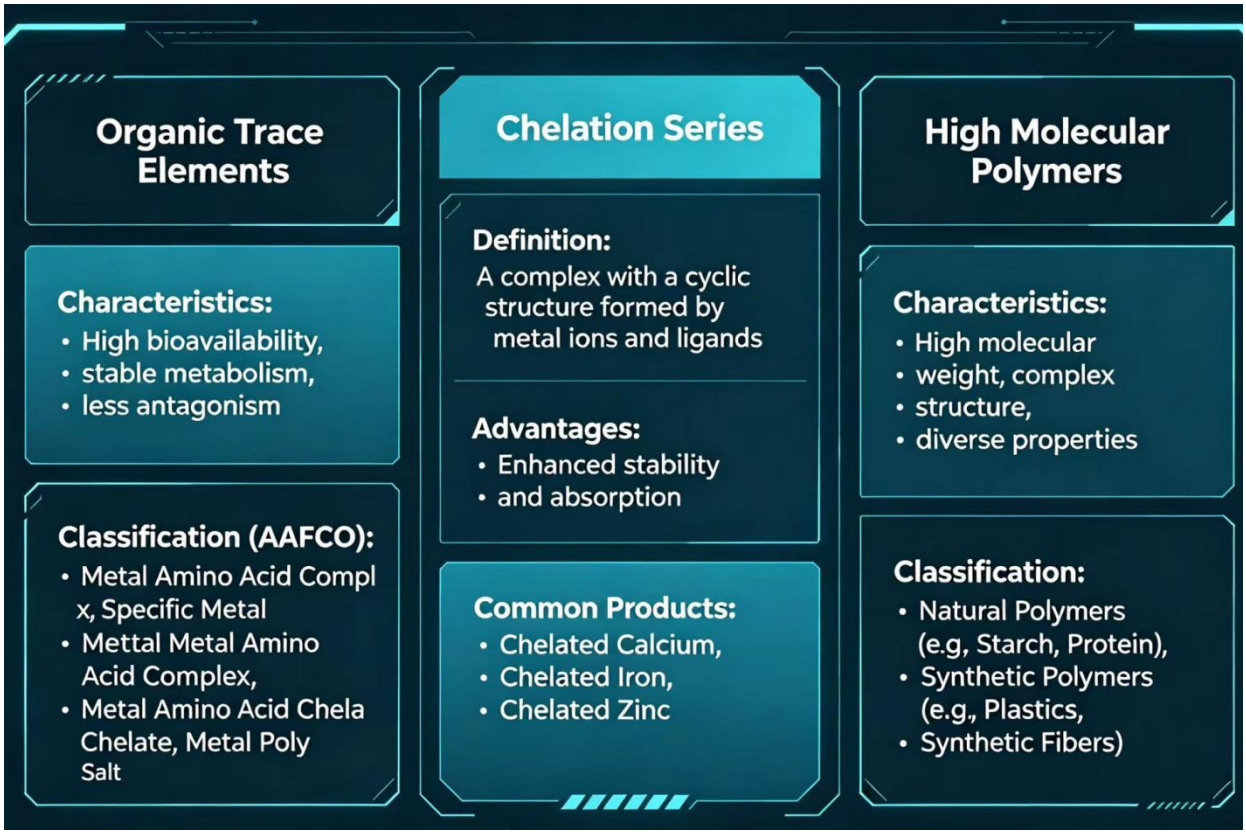


Page 4: Organic Trace Element Chelation and High-Molecular Polymers

Organic trace elements refer to compounds formed by the combination of inorganic salts of trace elements with organic substances and their decomposition products. Among organic trace elements, the chelation series is an extremely important category. The specific introduction is as follows:

(1) Organic Trace Elements

Their core feature is high bioavailability — they are easily absorbed and utilized by animals or the human body, maintain good stability during metabolism in the body, and are less likely to have antagonistic reactions with other substances, enabling them to exert physiological functions more efficiently. They are commonly used in fields such as feed additives and health foods.

According to the definition of the Association of American Feed Control Officials (AAFCO), organic trace element compounds can be divided into 5 categories:

- Metal-amino acid complexes
- Specific metal-amino acid complexes
- Metal-amino acid chelates
- Metal-polysaccharide complexes

- Metal proteinate salts

In addition to high bioavailability and reducing antagonism between minerals, such substances can also enhance the body's disease resistance and improve immune response.

(2) Chelation Series

Chelates are a special type of complexes, referring to compounds with cyclic structures formed by the coordination reaction between one or more groups and a metal ion.

The core advantage of the chelation series lies in its use of chelation technology to combine trace elements with organic ligands, forming stable cyclic structures. This structure can protect trace elements, preventing them from combining with other substances and precipitating in the digestive tract, thereby significantly improving their bioavailability and absorption rate.

Common chelating agents include amino acids, organic acids, and EDTA. Corresponding chelation series products (such as chelated calcium, chelated iron, and chelated zinc) are widely used in agriculture, animal husbandry, and aquaculture, effectively meeting the trace element needs of plants and animals.

(3) High-Molecular Polymers

High-molecular polymers are macromolecular compounds formed by the repeated connection of identical or similar small molecules (monomers) through covalent bonds, with a relative molecular mass $\geqslant 10^4$. Their core features are:

- High molecular weight with polydispersity
- Complex structures (including linear, branched, and network types)
- Diverse and customizable properties

They are mainly divided into two categories:

- Natural polymers: such as starch and proteins
- Synthetic polymers: such as plastics and synthetic fibers

High-molecular polymers are widely used in daily life and industrial fields such as packaging, automobiles, electronics, and medical care, and are important components of modern material systems.

(I) Methionine Chelate and Related Series Products

Methionine chelate series products are organic trace element preparations made by chemically chelating methionine with trace elements such as copper, iron, zinc, manganese, selenium, cobalt, etc. The products are mostly white or light-colored powders with good fluidity and water solubility. They have a five-membered or six-membered cyclic molecular structure and excellent

stability. Because they are highly consistent with the natural trace element forms in animals, they can significantly improve absorption efficiency. They are widelyused in livestock and poultry breeding, aquaculture, pet feeding, as well as nutritional fortification scenarios in food and health products.

(1) Methionine Chelated Zinc:: Synthesized at a molar ratio of 1:1 or 2:1, suitable for the entire growth cycle of pigs and broilers, can promote animal growth, and the zinc residue in feces is ≤18%, and can withstand feed pelleting temperatures of 80-85℃.

(2) DL-Methionine Chelated Zinc: Its bioavailability is higher than that of inorganic zinc, and it can supplement methionine simultaneously. It is suitable for livestock, poultry and aquaculture; it should be used with caution during the peak laying period of laying hens and can withstand pelleting temperatures of 85-90℃.

(3) D-Methionine Chelated Zinc: Chelated with D-methionine, suitable for species sensitive to amino acid configuration such as cats and marine fish; it is prohibited to use during the color-enhancing period of koi, and the feeding should be completed within 1.5 hours after dissolution.

(4) L-Methionine Chelated Manganese: Can prevent skeletal deformities in young animals, suitable for piglets, chicks and dairy cows; high-dose addition is prohibited in the early stage of rumen development of ruminants, helping to maintain animal skeletal health and reproductive performance.

(5) DL-Methionine Chelated Manganese: Can reduce the antagonism between metal ions and supplement methionine simultaneously, suitable for fattening pigs and the growing period of laying hens; the dosage should be controlled in the later laying period of laying hens, and it can improve the growth rate and immunity of livestock and poultry.

(6) D-Methionine Chelated Manganese: The product has strong stability, suitable for species with selective amino acid configuration, can withstand pelleting temperatures of 78-83℃, and the free manganese content is ≤0.55%, ensuring efficient utilization of manganese.

(7) L-Methionine Chelated Copper: Participates in various enzymatic reactions in animals, suitable for all growth stages of livestock and poultry, and the copper residue in feces is ≤16%; **when used with high-phytate feed, feeding should be spaced to avoid affecting absorption.**

(8) DL-Methionine Chelated Copper: Its bioavailability is 40%-60% higher than that of inorganic copper, suitable for livestock and poultry breeding; it is prohibited to add in the early rumen stage of ruminants, can withstand pelleting temperatures of 85-90℃, and can reduce environmental copper pollution.

(9) D-Methionine Chelated Copper: Can supplement D-methionine and copper simultaneously, suitable for sensitive species, and the copper residue in feces is ≤16%; feeding should be completed within 2 hours after dissolution to ensure stable absorption of copper.

(10) L-Methionine Chelated Selenium: Adopts a selenomethionine structure, can enhance the animal's antioxidant capacity and improve reproductive performance, suitable for livestock, poultry and aquaculture, and can withstand pelleting temperatures of 80-85℃.

(11) DL-Methionine Chelated Selenium: The product has good stability and is easy to absorb. In addition to being used in livestock and poultry and aquatic feed, it can also be used as a selenium source in food and health products; the free selenium content is ≤0.15%, ensuring safe supplementation of selenium.

(12) L-Methionine Chelated Calcium: Can resist the interference of oxalic acid and phytic acid in the diet, suitable for animal calcium supplementation and feed addition; when taken by elderly pets, it should be fed with meals, can withstand pelleting temperatures of 82-87℃, and supports bone and teeth health.

(13) DL-Methionine Chelated Calcium: Takes into account calcium supplementation and methionine supplementation, and the cost is easy to control, suitable for food, health products and animal feed fields; pre-mixing treatment should be carried out before mixing with premix to ensure uniform mixing.

(14) D-Methionine Chelated Calcium: Can reduce calcium loss, suitable for high-end animal feed and calcium supplementation scenarios, helping the skeletal development of livestock, poultry and aquatic products; the free calcium content is ≤0.5%, improving the bioavailability of calcium.

(15) L-Methionine Chelated Magnesium: Resists interference from other components in the diet or feed, suitable for livestock and poultry breeding as well as food and health product fields, and can promote animal physiological metabolism; it can withstand pelleting temperatures of 80-85℃, and the free magnesium content is ≤0.55%.

(16) DL-Methionine Chelated Magnesium: Supplements magnesium and methionine simultaneously, helping the skeletal development and physiological metabolism of livestock and poultry, suitable for food, health products and animal feed; it has good miscibility with premix and does not require additional complex treatment.

(17) L-Methionine Chelated Iron: Has high absorption efficiency, can prevent iron-deficiency anemia in animals, suitable for feed, food and health product fields; it can withstand pelleting temperatures of 82-87℃, ensuring stable supplementation of iron.

(18) DL-Methionine Chelated Iron: Resists interference from anti-nutritional factors in the diet, promotes animal growth, suitable for feed, food and health products; the free iron content is ≤0.4%, avoiding iron waste and side effects.

(19) Methionine Chelated Cobalt: Helps in the synthesis of vitamin B12 in animals, regulates metabolism and hematopoietic function, suitable for

livestock and poultry feed; can withstand pelleting temperatures of 80-85℃, and the free cobalt content is ≤0.18%, ensuring efficient utilizationof cobalt.

(20) DL-Methionine Chelated Cobalt: The product has good stability and is easy to absorb, suitable for livestock and poultry feed, helping the synthesis of vitamin B12 and metabolic regulation; pre-mixing should be carried out before mixing with premix to ensure uniform addition.

(21) L-Methionine Chelated Ferrous: Has good palatability, causes little damage to other nutrients, can prevent animal anemia, suitable for feed, food and health product fields; it can withstand pelleting temperatures of 82-87℃, improving the absorption efficiency of ferrous.

(22) DL-Methionine Chelated Ferrous: Resists interference from anti-nutritional factors such as phytic acid, promotes the growth and development of livestock and poultry, suitable for feed, food and health products; the free ferrous content is ≤0.38%, ensuring safe supplementation of ferrous.

(23) L-Methionine Chelated Chromium: Can regulate animal metabolic functions and improve production performance,suitable for livestock and poultry feed and health products; it can withstand pelleting temperatures of 80-85℃, and the free chromium content is ≤0.12%, ensuring precise action of chromium.

(24) DL-Methionine Chelated Chromium: Resists interference from external factors, helps in the metabolic regulation of livestock and poultry, suitable for feed and health product fields; it has good uniformity when mixed with premix, and no additional process adjustment is required.

(25) DL-Methionine Chelated Cobalt: Has the same characteristics as product 20, with strong stability and easy absorption, suitable for livestock and poultry feed; it assists in the synthesis of vitamin B12, regulates animal metabolism and hematopoietic function, and ensures breeding benefits.

(26) L-Methionine Chelated Iodine: The product has strong stability and low irritation, used for iodine supplementation in feed to maintain animal thyroid function, suitable for various breeding scenarios; it can withstand pelleting temperatures of 78-83℃, and the free iodine content is ≤0.16%.

(27) DL-Methionine Chelated Iodine: Can resist the volatilization and loss of iodine, suitable for iodine supplementation in feed, promoting animal growth and development; when mixed with premix, it should be pre-mixed with 8 times the amount of corn flour first to ensure uniform distribution of iodine.

(28) DL-Methionine Chelated Zinc + Manganese (1:1 Compound Type): Supplements zinc and manganese simultaneously, reducing the antagonism when adding a single element, suitable for the brooding period of laying hens and piglet breeding; it can simplify feed formula design.

(29) L-Methionine Chelated Iron (Sustained-Release Granule): Adopts a sustained-release design, with a particle diameter of 1-2mm, slowly releasing iron in the intestine, and the absorption efficiency is increased by 40%;

suitable for piglet weaning period and sensitive pets, avoiding short-term iron excess.

(30) DL-Methionine Chelated Chromium (Aquaculture-Specific Type): Approved by the EU as a salmon feed additive, can regulate the metabolism of aquatic animals and improve stress resistance; designed for the aquaculture market, suitable for high-end aquaculture needs.

(31) Food-Grade Methionine Chelated Copper: It is a blue or light blue powder with good stability, will not destroy vitamins in food or catalyze fat oxidation; it is absorbed by amino acid pinocytosis and is suitable for food nutritional fortification.

(32) Food-Grade Methionine Chelated Iron: Methionine and iron are chelated at a molar ratio of 2:1, which can supplement methionine and iron simultaneously, reducing energy consumption in the body; it can effectively prevent and improve iron-deficiency anemia and is suitable for food nutritional fortification.

(33) Methionine Complexed Manganese: Prepared by complexing methionine and inorganic manganese salt, it is a light gray-brown powder, odorless; it can be used in food, medicine and feed industries, participates in enzyme composition and metabolism, promotes animal growth and improves immunity.

(34) Methionine Complexed Copper (Aquaculture-Specific): It is a light blue powder, odorless, insoluble in water and ethanol; as an aquatic algaecide, it is safer and less irritating than copper sulfate, and can effectively kill harmful algae such as large sand algae and black silk algae.

(35) Hydroxy Methionine Zinc (Aquaculture-Specific): Has a five-membered cyclic chelate structure, can resist the influence of water dissolution and phytic acid in feed, ensuring the continuous release of zinc; the absorption and utilization rate is increased by more than 50%, it has little irritation to the intestines, and can improve the doubling rate and immunity of aquatic animals.

(36) Shengyimei Methionine Complex (Chelate): Adopts a fully organic double chelation process, with no chloride ion or sulfate ion residue, suitable for high-end feed production; it can withstand pelleting temperatures of 88-93℃, achieving "one addition, dual nutrition".

(37) Mingweikuang®: It is a methionine hydroxy analog chelated element product, including chelated elements such as zinc, copper, manganese, etc., suitable for livestock, poultry and aquaculture; different elements can be used alone or in combination according to needs, suitable for diversified breeding scenarios.

(38) D-Methionine Chelated Selenium: Chelated with D-methionine and selenium, suitable for special aquatic products and exotic pets sensitive to amino acid configuration such as grouper and parrots; the dosage should be halved in high-stress scenarios (such as aquatic transportation, pet food changing period), the free selenium content is ≤0.12%, and it can withstand pelleting

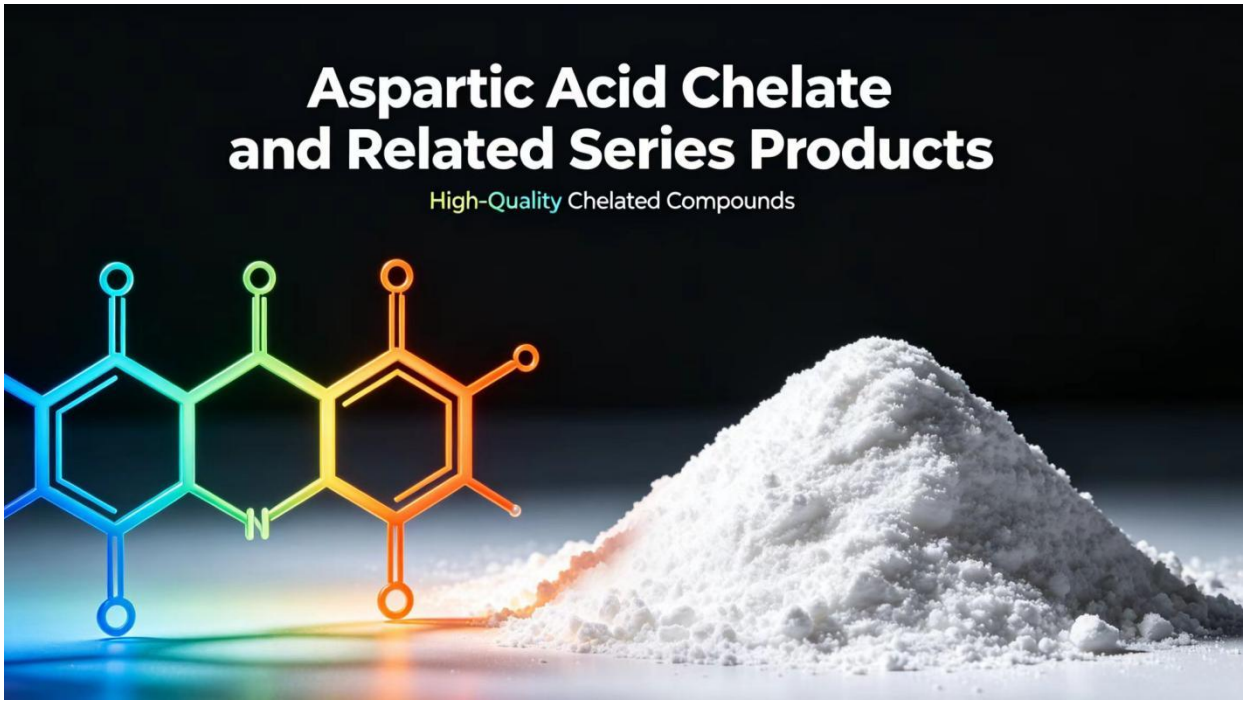
temperatures of 75-80℃ to avoid poisoning caused by excessive selenium.

(39) Methionine Chelated Iodine (Sustained-Release Microcapsule Type): Adopts a starch-gum arabic composite coating process, with a microcapsule diameter of 5-10μm, and the sustained-release time in the intestine of laying hens is extended to 6-8 hours; suitable for high-temperature and high-humidity breeding environments, effectively reducing iodine volatilization loss during the laying period of laying hens, the iodine utilization rate is increased by more than 35%, and no additional pre-mixing is required when mixed with premix.

(40) Methionine Chelated Zinc + Iron (2:1 Compound Type): Zinc and iron are compounded at a molar ratio of 2:1, specially suitable for piglet weaning period (15-28 days old); it can meet the needs of anti-diarrhea (high zinc demand) and anti-anemia (iron supplementation demand) at the same time, the antagonism rate between elements is reduced to below 8%, the zinc and iron residues in feces are ≤15% and ≤12% respectively, and it can withstand pelleting temperatures of 82-87℃.

(41) Food-Grade Methionine Chelated Zinc: It is a white fine powder, odorless, suitable for children's complementary food and elderly nutritional powder scenarios; the intestinal irritation rate for people with lactose intolerance is ≤3%, the zinc absorption rate is 50% higher than that of inorganic zinc, and the stability is not lost when added to acidic foods (pH 3.0-5.0), in line with the GB 14880-2012 Food Nutritional Fortifier Use Standard.

(42) Methionine Chelated Cobalt (Rumen-Protected Type): Adopts a hydrogenated vegetable oil coating process, with a coating rate of ≥92%, which can avoid the degradation of cobalt in the early rumen stage (0-4 hours) of ruminants; suitable for the fattening period of beef cattle and the lactation period of dairy cows, the rumen passage rate of cobalt is increased to more than 85%, and the recommended daily addition amount per dairy cow is 5-8mg, helping to maintain milk production and milk quality.



(II) Aspartic Acid Chelated and Related Series Products

Aspartic acid "captures" metal ions such as calcium and zinc through chemical bonds to form stable chelates. These products feature easy absorption, minimal interference from other foods, and low gastrointestinal irritation. With precisely proportioned raw materials and controlled reaction conditions, they are manufactured into powder form for convenient subsequent processing. The aspartic acid chelated series mainly consists of powdered raw materials formed by chelating aspartic acid (as a ligand) with different metal ions, including the following common types:

(1) L-Aspartic Acid Chelated Zinc (CAS: 36393-20-1): A high-efficiency, low-irritation zinc source that provides both zinc supplementation and L-aspartic acid. Widely used in food nutrition fortification (e.g., infant formula), pharmaceuticals, health products, feed, and industrial fields. Zinc regulates the activity of nearly 300 enzymes in the human body, and its chelated structure avoids binding with phytic acid in food, thereby improving absorption efficiency.

(2) DL-Aspartic Acid Chelated Zinc: More cost-effective than the L-form, with higher bioavailability than inorganic zinc sources such as zinc sulfate. It poses no risk of gastrointestinal irritation and is commonly used in nutrition fortification of ordinary foods (e.g., grains, beverages), additives for livestock and aquatic feed, balancing cost-performance and zinc supplementation effects.

(3) D-Aspartic Acid Chelated Zinc: Suitable for food nutrition fortification and pharmaceutical raw material scenarios. It can simultaneously supplement D-aspartic acid (involved in energy metabolism) and zinc, making it ideal for functional foods and dietary supplements that need to provide both trace

elements and amino acids.

(4) L-Aspartic Acid Chelated Copper: Copper is a component of key enzymes such as superoxide dismutase, playing a crucial role in nervous system development and immune function. Its bioavailability is 1.5-2 times that of copper sulfate, and it is widely used in food fortification, pharmaceuticals, health products, feed (to prevent copper deficiency in animals), and agricultural foliar fertilizers.

(5) DL-Aspartic Acid Chelated Copper: Formed by chelating DL-aspartic acid with copper ions. It is stable at pH 3-10 and easily soluble in water. Compared with copper sulfate, it reduces damage to vitamins and is used in feed additives, ordinary food fortification, and some pharmaceutical preparations.

(6) D-Aspartic Acid Chelated Copper: Easily soluble in water with good chemical stability, it efficiently supplements copper and D-aspartic acid. Suitable for foods such as dairy products and nutrition bars, as well as auxiliary therapeutic drugs for copper deficiency, especially for liquid products requiring high solubility.

(7) L-Aspartic Acid Copper Sulfate: A blue crystalline powder that provides dual nutrition of copper and amino acids. The sulfate group helps regulate product osmotic pressure, and it is widely used in food fortification, pharmaceuticals, health products, feed, and agricultural foliar fertilizers.

(8) L-Aspartic Acid Chelated Potassium (CAS: 14007-45-5): With a solubility of 150g/100mL in water at 25℃, it has no bitter taste like potassium chloride. It regulates electrolyte balance and maintains normal cardiac function, commonly used in sports drinks, low-sodium salt, and pharmaceutical electrolyte supplements.

(9) DL-Aspartic Acid Chelated Potassium (CAS: 923-09-1): Potassium absorption rate is 20%-30% higher than that of potassium chloride, with low gastrointestinal irritation. Applied in elderly food, functional beverages, and health products to meet the potassium needs of specific groups such as hypertensive patients and athletes.

(10) L-Aspartic Acid Chelated Manganese: Manganese is a key component of arginase and superoxide dismutase, participating in bone formation and energy metabolism. With high bioavailability, it is used as a food fortifier (e.g., breakfast cereals, infant complementary food), feed additive, and pharmaceutical intermediate.

(11) DL-Aspartic Acid Chelated Manganese: Has a chelation stability constant of 10^{18}, avoiding binding with oxalic acid and phytic acid. Used in food fortification, pharmaceutical trace element supplementation, aquatic feed (to prevent growth retardation), and agricultural fertilizers (to improve photosynthetic efficiency).

(12) L-Aspartic Acid Potassium Hydrochloride: Combines potassium supplementation with mild acidification function, and the hydrochloride form

enhances stability. Used in pharmaceuticals (auxiliary treatment of hypokalemia), sports drink fortification, and agricultural fertilizer synergists (to promote potassium absorption).

(13) L-Aspartic Acid Potassium Dihydrate: Contains two molecules of crystal water, with better stability than the anhydrous form. In the pharmaceutical field, it prevents and treats hypokalemia; in the food field, it serves as a potassium fortifier and flavoring agent; in the feed field, it promotes animal growth; and in scientific research, it is used as a buffer.

(14) DL-Aspartic Acid Chelated Potassium (CAS: 14434-35-6): Potassium content is about 12%-14% with high bioavailability. In the pharmaceutical field, it prevents and treats hypokalemia; in the food field, it acts as an acidity regulator; and in the industrial field, it is used for water treatment rust prevention and textile auxiliaries.

(15) DL-Aspartic Acid Monopotassium Salt (CAS: 923-09-1): Adjusts pH in the range of 3.5-5.5, with an addition amount of 0.01%-0.5%. Improves palatability in food, and is used as a water treatment corrosion inhibitor, electroplating coating homogenizer, and organic synthesis intermediate in industry.

(16) DL-Aspartic Acid Potassium Hydrochloride: Combines potassium supplementation with acidification function, without the irritation of potassium chloride. Suitable for sports drinks and dairy products; in pharmaceuticals, it maintains myocardial and neurological function; and in industry, it improves electroplating coating adhesion.

(17) L-Aspartic Acid Potassium Magnesium: Provides synergistic supplementation of potassium and magnesium, where magnesium promotes the transport of potassium into cells. Prevents and treats hypokalemia, hypomagnesemia, and arrhythmia, and assists in the treatment of coronary heart disease and hepatitis, commonly found in oral preparations and injections.

(18) DL-Aspartic Acid Potassium Magnesium: Used as an electrolyte supplement in the pharmaceutical field to prevent and treat hypokalemia and hypomagnesemia, especially for populations with electrolyte disorders caused by long-term diuretic use. It can also be used as a dual nutrition fortifier for potassium and magnesium in food and beverages.

(19) L-Aspartic Acid Chelated Magnesium (CAS: 2068-80-6): Forms a stable five-membered ring chelate with magnesium ions, and the magnesium absorption rate is more than 40% higher than that of magnesium sulfate. In the pharmaceutical field, it prevents and treats hypomagnesemia; in the food field, it serves as a magnesium fortifier; and in the health product field, it supports bone health.

(20) DL-Aspartic Acid Chelated Magnesium (CAS: 1187-91-3): Features high stability and easy solubility in water, efficiently supplementing magnesium. In industry, it is used as a metal corrosion inhibitor (for corrosion

protection of steel and aluminum products); in the textile field, it improves the uniformity of dyeing and enhances fabric softness.

(21) D-Aspartic Acid Chelated Magnesium: Easily soluble in water (solubility of 80g/100mL at 25℃) with high chemical stability, combining magnesium supplementation with pH adjustment (6.0-7.5) function. Suitable for dairy products, beverages, baked goods, etc., especially liquid products.

(22) L-Aspartic Acid Chelated Magnesium Salt (CAS: 18962-61-3): Magnesium forms multi-dentate coordination with L-aspartic acid, resulting in high intestinal absorption rate and no risk of magnesium oxalate precipitation. In food, it acts as a magnesium fortifier and mild acidity regulator (without affecting flavor); in pharmaceuticals, it relieves muscle fatigue; and in industry, it is used for water treatment corrosion inhibition and pH adjustment.

(23) L-Aspartic Acid Chelated Magnesium Potassium (CAS: 67528-13-6): Exhibits synergistic effects of potassium and magnesium (magnesium promotes potassium absorption, and potassium maintains magnesium balance). In the pharmaceutical field, it supplements potassium and magnesium, used for hypokalemia, hypomagnesemia, and arrhythmia caused by digitalis poisoning, and assists in the treatment of coronary heart disease and hepatic encephalopathy, commonly found in compound preparations.

(24) L-Aspartic Acid Magnesium Dihydrate (CAS: 215533-00-9): Contains two molecules of crystal water (moisture content 12%-14%) with good stability. In pharmaceuticals, it improves hypomagnesemia and migraine; in food, it serves as a magnesium fortifier (suitable for sports drinks and dairy products); and in feed, it improves the meat quality of livestock and poultry (reducing fat deposition).

(25) L-Aspartic Acid Chelated Magnesium Hydrochloride: Available in dihydrate and anhydrous forms (anhydrous form suitable for low-moisture food). The magnesium absorption rate is 35% higher than that of magnesium oxide. Used to supplement magnesium, improve symptoms such as insomnia and muscle weakness, and suitable for pharmaceutical and food nutrition fortification (e.g., protein powder, meal replacement powder).

(26) DL-Aspartic Acid Magnesium Tetrahydrate (CAS: 215528-79-3): Contains four molecules of crystal water, with excellent water solubility (90g/100mL at 25℃) and magnesium content of 8%-10%. In the nutrition field, it is used as a food fortifier and dietary supplement ingredient; in pharmaceuticals, it is used to prepare drugs for treating magnesium deficiency; and in cosmetics, it acts as a skin conditioner (enhancing moisturizing properties).

(27) DL-Aspartic Acid Magnesium (Tetrahydrate) (CAS: 7018-07-7): In pharmaceuticals, it is used for treating magnesium deficiency (high bioavailability and low gastrointestinal irritation); in cosmetics, it improves the skin barrier; and in laboratories, it is used as a standard substance for analyzing magnesium content or a reaction intermediate.

(28) Magnesium Aspartate Hydrochloride Hydrate (CAS: 91198-22-0): The hydrochloride form enhances stability and solubility. In pharmaceuticals, it serves as a raw material for magnesium supplements (auxiliary treatment of arrhythmia); in the nutrition field, it is used in sports nutrition products and functional beverages; and in scientific research, it is used as a standard substance for analyzing magnesium content or a synthetic intermediate.

(29) L-Aspartic Acid Chelated Calcium (CAS: 21059-46-1): Has a natural amino acid configuration compatible with human metabolism. Its bioavailability is 2-3 times that of calcium carbonate, without the risk of flatulence or constipation. It is a common calcium fortifier in high-end health food, infant formula, and special medical purpose formula food, suitable for people with weak gastrointestinal function.

(30) DL-Aspartic Acid Chelated Calcium: A racemic mixture, about 30% more cost-effective than the L-form, with bioavailability 1.5-2 times that of calcium carbonate. Mostly used as a feed additive (to prevent skeletal dysplasia in livestock and poultry) and nutrition fortifier in ordinary food (grains, biscuits), balancing cost and calcium supplementation effects.

(31) D-Aspartic Acid Chelated Calcium: Has a chelation stability constant of 10^{16}, good water solubility (60g/100mL at 25℃), and low gastrointestinal irritation. Widely used in liquid calcium drinks, jelly, calcium supplements, and auxiliary treatment of osteoporosis, suitable for people with swallowing difficulties.

(32) L-Aspartic Acid Calcium Hydrochloride (CAS: 92533-40-9): The hydrochloride form avoids precipitation with carbonate ions and improves absorption rate. Used as an active ingredient in calcium supplements, suitable for nutritional drinks and instant solid beverages; in pharmaceuticals, it has potential applications in preventing and treating rickets and osteoporosis (suitable for people with insufficient gastric acid secretion).

(33) L-Aspartic Acid Chelated Calcium Magnesium: Has a calcium-magnesium ratio of 2:1 (meeting human needs), where magnesium promotes calcium deposition in bones (reducing calcium deposition on blood vessel walls). Added to milk, calcium tablets, sports drinks, etc.; in pharmaceuticals, it is used to prevent osteoporosis, electrolyte disorders, and leg cramps.

(34) L-Aspartic Acid Chelated Sodium (CAS: 3792-50-5): Sodium content is 10%-12%, with no salty taste and little impact on blood pressure. Used for sodium supplementation after athletes sweat heavily (losing 500-1000mg of sodium per hour) to maintain electrolyte balance, suitable for sports nutrition products and invisible sodium supplementation in low-sodium food.

(35) DL-Aspartic Acid Chelated Sodium: A white crystalline powder, easily soluble in water (120g/100mL at 25℃). In food, it acts as a flavor enhancer (enhancing the umami taste of monosodium glutamate) and flavor modifier

(alleviating sweetness); in industry, it is used as a complexing agent, buffer (pH 4.0-6.0), and electroplating additive (improving coating smoothness).

(36) Tetrasodium Dicarboxymethyl Aspartate (CAS: 34612-80-1): A strong chelating agent (chelation capacity 400mg $CaCO_3$ /g) that can chelate metal ions such as calcium, magnesium, and iron. In industry, it is used for water treatment (scale removal), detergents (phosphate-free and environmentally friendly), textile printing and dyeing (preventing dye discoloration); in food/cosmetics, it acts as a stabilizer (delaying oxidation); and in coatings, it serves as a dispersant (improving fluidity).

(37) L-Aspartic Acid Chelated Selenium: An organic selenium preparation (similar structure to selenomethionine) with bioavailability 3-4 times that of sodium selenite and low toxicity. Used to supplement selenium, enhance immunity, and resist oxidation, suitable for health products, food fortification (e.g., selenium-enriched grains), and nutritional intervention in selenium-deficient areas.

(38) L-Aspartic Acid Selenium Complex: The amino acid chelate structure improves selenium absorption rate and reduces gastrointestinal irritation. As a selenium nutritional supplement, it supports the synthesis of selenium-containing enzymes, applied in the food and health product fields to assist in exerting immune regulation and antioxidant effects.

(39) L-Aspartic Acid Nanoselenium: Combines nanoselenium (high activity) with L-aspartic acid (stabilization and efficiency enhancement). In the nutrition field, it serves as a high-efficiency selenium supplement; in food/health products, it improves nutritional value; and in agriculture, it is used as a selenium-enriched fertilizer (increasing crop selenium content and stress resistance) to support the production of selenium-enriched agricultural products.

(40) L-Aspartic Acid Chromium Hydrochloride: The hydrochloride form enhances stability and solubility. As a chromium supplement, it assists in maintaining normal glucose metabolism, used for chromium fortification in food and health products to meet the needs of people managing blood sugar.

(41) DL-Aspartic Acid Chromium Hydrochloride: The amino acid chelate structure improves chromium bioavailability. As a chromium nutritional supplement, it assists in glucose metabolism regulation, suitable for fortification in ordinary food and health products, balancing cost and efficacy.

(42) L-Aspartic Acid Niacin Chromium: Niacin and amino acids synergistically improve chromium utilization and enhance stability. As a chromium supplement, it assists in glucose metabolism, used in the food and health product fields, suitable for functional products requiring precise chromium supplementation.

(43) DL-Aspartic Acid Niacin Chromium: The niacin chelate structure reduces gastrointestinal irritation caused by chromium. As a chromium nutritional

supplement, it assists in maintaining glucose metabolism, used for fortification in food and health products to meet the chromium intake needs of specific groups.

(44) L-Aspartic Acid Chelated Cobalt: Cobalt is a key component in vitamin B12 synthesis, crucial for hematopoietic function and the nervous system. As a cobalt supplement, it is used in special diets, health products, and pharmaceutical raw materials to prevent problems caused by cobalt deficiency.

(45) L-Aspartic Acid Chelated Cobalt Sulfate: The sulfate form improves cobalt solubility and stability. As a cobalt supplement, it aids in vitamin B12 synthesis, added to health products and special diets; in pharmaceuticals, it has potential applications in improving hematopoietic function affected by cobalt deficiency.

(46) DL-Aspartic Acid Chelated Cobalt: The amino acid chelate structure improves cobalt absorption rate. As a cobalt nutritional supplement, it is used in food fortification, health products, and pharmaceutical fields to assist in maintaining the normal physiological function of vitamin B12.

(47) L-Aspartic Acid Chelated Molybdenum: Molybdenum is a component of enzymes related to purine metabolism and iron utilization. As a molybdenum supplement, it is used in food fortification and health products to maintain normal human metabolism and prevent physiological function abnormalities caused by molybdenum deficiency.

(48) L-Aspartic Acid Chelated Iron: Bioavailability is twice that of ferrous sulfate, with no iron odor or gastrointestinal irritation. As a core ingredient in iron supplements, it improves iron deficiency, added to grains, dairy products, and beverages; in pharmaceuticals, it is used to prepare preparations for iron deficiency anemia.

(49) DL-Aspartic Acid Chelated Iron: The amino acid chelate structure improves iron absorption and avoids binding with phytic acid. As an iron nutritional supplement, it is used for fortification in food and health products to meet the iron supplementation needs of the general population, suitable for various food forms.

(50) L-Aspartic Acid Chelated Ferrous Iron: The ferrous form is easily absorbed by the human body, with no risk of oxidative discoloration. As an iron supplement, it improves iron deficiency anemia and is added to milk powder, grains, and nutrition bars; in pharmaceuticals, it is used for the prevention and treatment of iron deficiency.

(51) DL-Aspartic Acid Chelated Ferrous Iron: Features high stability and higher iron absorption rate than inorganic ferrous salts. As an iron supplement, it is used for fortification in dairy products, grains, and beverages; in pharmaceuticals, it is used for the prevention or treatment of iron-related diseases.

(52) L-Aspartic Acid Chelated Ferrous Sulfate: The sulfate form enhances the stability and solubility of ferrous iron. As an iron supplement, it improves

iron deficiency anemia and is added to grains and nutritional drinks; in pharmaceuticals, it is used in preparations for iron-related diseases.

(53) L-Aspartic Acid Chelated Nickel: Nickel is a cofactor for enzymes such as urease and participates in lipid metabolism. As a nickel supplement, it is used in special diets, health products, and scientific research fields to prevent metabolic abnormalities caused by nickel deficiency (must comply with national relevant usage standards).

(54) DL-Aspartic Acid Chelated Vanadium: Vanadium assists in regulating glucose metabolism and lipid metabolism. As a functional raw material, it is used in health products and scientific research fields, suitable for products related to blood sugar and lipid management (dosage must be strictly controlled to meet safety standards).

(55) L-Aspartic Acid Chelated Strontium: Strontium can promote bone formation and inhibit bone resorption. As a raw material related to bone health, it is used in health products and special diets to assist in preventing osteoporosis, suitable for middle-aged and elderly functional foods.

(III) Polyaspartic Acid Macromolecular Polymer Series Products

The core of the polyaspartic acid chelated series is green products formed by combining polyaspartic acid as the main body with metal ions/functional components through chelation. They feature high bioavailability (avoiding nutrient fixation and loss) and full-cycle environmental degradability (natural decomposition without residues), and are internationally recognized as "green functional chemicals". Covering four major fields—agriculture (fertilizer efficiency enhancement/crop nutrient supplementation), industry (watertreatment/materials), daily chemicals/food (nutrition

fortification/conditioning), and environmental protection (remediation/adsorption)—this series integrates all mentioned categories without duplication, supplements the latest applications and scientific research achievements, and retains the core value of each product.

(1) Polyaspartic Acid (CAS: 25608-40-6): An environmentally friendly macromolecular chelating agent/dispersant with a biodegradation rate exceeding 60% within 28 days. In agriculture, it increases nutrient absorption by over 30%, reduces fertilizer loss by 20%, promotes root growth, accelerates ripening by 7-10 days, extends the harvest period by 10-15 days, and increases the trace element content of crops by 3-4 times. In industrial water treatment, it achieves a 100% scale inhibition rate against calcium carbonate, suitable for circulating water, boiler water, reverse osmosis water and other scenarios, and also has a corrosion inhibition effect, showing synergistic efficiency when compounded with organophosphorus, zinc salts, etc. In daily chemicals, it serves as a moisturizer—high-molecular-weight products have moisturizing performance equivalent to hyaluronic acid (HA) and can enhance skin elasticity; it can also be used as a hair conditioner to improve hair texture and feel.

(2) Sodium Polyaspartate (including 3 configurations: CAS 181828-06-8/34345-47-6/31871-95-1): A highly soluble sodium salt with a scale inhibition rate exceeding 90% in water treatment (suitable for circulating water, boiler water, reverse osmosis systems). It can replace phosphorus-containing agents to avoid water eutrophication. In agriculture, when combined with chemical fertilizers, it increases yield by 10%~30% and reduces chemical fertilizer usage by 30%, and can also improve soil (regulate pH, enhance water and fertilizer retention capacity). In daily chemicals/industry, it acts as a chelating agent, dispersant, and moisturizer, suitable for detergents (replacing STPP), cosmetics, leather tanning, and textile printing and dyeing fields.

(3) Potassium Polyaspartate (including potassium salt, CAS: 64723-18-8): Chelates potassium ions to prevent soil fixation, increases crop potassium absorption by 25%, and promotes stem lodging resistance. In daily chemicals, it serves as a moisturizer/chelating agent. In water treatment, its scale inhibition rate exceeds 80%. The potassium salt can be used as a wine additive to prevent tartaric acid precipitation and as an electrolyte supplement in sports drinks.

(4) Calcium Polyaspartate (including calcium salt, CAS: 10389-09-0): In agriculture, it is used as a calcium fertilizer (increases calcium absorption by 40%, prevents fruit cracking and blossom-end rot) and can be compounded with nitrogen, phosphorus, and potassium. In industrial water treatment, it converts calcium salts into soft scale. In feed, its bioavailability is 30% higher than that of traditional calcium sources (improving eggshell hardness). The calcium salt (such as calcium aspartate powder) has low irritation and is suitable for food calcium fortification and elderly

nutritional supplements.

(5) Magnesium Polyaspartate (including L-form, CAS: 2068-80-6): Supplements magnesium for plants (a core component of chlorophyll) and quickly alleviates magnesium deficiency chlorosis (the greening rate of citrus leaves reaches over 85%). In feed, it improves animal stress resistance (increases aquatic survival rate by 15%). In pharmaceuticals/food, it serves as a magnesium nutritional fortifier, suitable for auxiliary conditioning of hypomagnesemia.

(6) Zinc Polyaspartate (including zinc salt, PASP-Zn): Reduces soil zinc precipitation and alleviates crop zinc deficiency (little leaf disease). In feed, its absorption rate is 50% higher than that of inorganic zinc (enhancing immunity). In food/daily chemicals, it acts as a zinc fortifier. The zinc salt chelates through carboxyl groups to improve zinc mobility, suitable for adding to infant complementary food.

(7) Iron Polyaspartate (including ferrous iron): Stabilizes iron ions (especially Fe^{2+}) and corrects crop iron deficiency chlorosis. It is easily absorbed in feed (preventing livestock and poultry anemia). In food/daily chemicals, it serves as an iron supplement. Environmentally, it can adsorb heavy metals, assisting in soil heavy metal remediation.

(8) Manganese Polyaspartate: Supplements manganese for plants (an enzyme activator), prevents striped chlorosis caused by manganese deficiency, and enhances stress resistance. In feed, it can improve the skeletal development and reproductive performance of livestock and poultry.

(9) Polyaspartic Acid Chelated Cobalt: A feed additive for ruminants (supplies cobalt for vitamin B_{12} synthesis) and prevents megaloblastic anemia. For leguminous crops, it promotes nodule development, improves nitrogen fixation efficiency, and reduces nitrogen fertilizer dependence.

(10) Phosphorus Polyaspartate: Activates fixed phosphorus in soil, converts it into available form, promotes root phosphorus absorption, and increases phosphorus utilization rate by over 40%. Suitable for acidic soil, it reduces phosphorus fixation and loss.

(11) Copper Polyaspartate: Reduces copper loss, promotes plant copper absorption, prevents poor grain filling caused by copper deficiency, and participates in key links of photosynthesis/respiration. In feed, it can enhance the immunity of livestock and poultry and reduce the incidence of diarrhea.

(12) Sodium Iron Polyaspartate: Simultaneously chelates iron and sodium—iron promotes chlorophyll synthesis, and sodium assists in osmotic regulation. Suitable for crops at the edge of saline-alkali land, it improves crop salt tolerance.

(13) Molybdenum Polyaspartate: Improves molybdenum solubility and promotes plant molybdenum absorption (a component of nitrate reductase/nitrogenase), facilitating nitrogen metabolism. Suitable for leguminous plants and

cruciferous crops, it enhances protein synthesis efficiency.

(14) Polyaspartic Acid Chelated Selenium (PASP-Se): Transports selenium to plants, increases crop selenium content and antioxidant capacity, suitable for the cultivation of selenium-enriched tea and grains. It can increase tea yield by 15-30% and improve amino acid content. In the food field, it serves as an organic selenium supplement with higher safety than inorganic selenium.

(15) Polyaspartic Acid Chelated Titanium: Promotes chlorophyll synthesis, enhances photosystem activity, increases photosynthetic intensity by more than 20%, and improves crop quality (increases sugar content by 1-2 degrees and vitamin content by 15%). Suitable for the cultivation of fruits, vegetables, and Chinese medicinal materials.

(16) Polyaspartic Acid Chelated Boron (PASP-B): Improves boron stability and absorption rate, promotes pollen germination/pollen tube elongation, reduces flower and fruit drop, and increases fruit setting rate by 10-20%. Suitable for application during the flowering period of boron-demanding crops such as fruit trees and rapeseed.

(17) Polyaspartic Acid Chelated Silicon (dual-use in agriculture and cosmetics): In agriculture, it serves as a silicon fertilizer (enhances stem toughness, reduces pest and disease incidence by 30%) and improves crop lodging resistance. In cosmetics, it acts as a skin feel regulator (improves lotion smoothness and strengthens the skin barrier), suitable for creams, serums and other products.

(18) Iminodisuccinic Acid Sodium Salt: A series of derived green chelating agents that can replace refractory degradation reagents such as EDTA, complying with national green chemical standards. Suitable for water treatment and daily chemicals, it can enhance chelating efficiency when compounded with PASP.

(19) Polyaspartic Acid Composite Iron-Copper: Simultaneously supplies iron and copper, synergistically improving iron deficiency chlorosis and copper deficiency premature senescence, suitable for cash crops such as fruit trees and flowers. In feed, it can enhance the hematopoietic function and immunity of livestock and poultry.

(20) Calcium-Enhanced MSOD (Polyaspartic Acid Chelated Type): Combines polyaspartic acid, calcium, and MSOD—supplements calcium for plants and provides antioxidant protection (resisting high-temperature stress), reducing flower drop rate under high temperature. It is an anti-aging raw material in food, suitable for functional oral liquids and nutrition bars.

(21) Nickel Polyaspartate: A trace nutrient source for specific crops (beans, cruciferous crops), assisting in promoting metabolism and increasing pod setting rate. In scientific research, it is used for enzyme activity regulation studies and must comply with national usage standards.

(22) Vanadium Polyaspartate (Research Stage): Its potential in metabolic

regulation is explored in laboratories, and it has not yet formed commercial products. Continuous attention to scientific research transformation progress is required.

(23) Strontium Polyaspartate: Focuses on bone health, assists in increasing bone density, suitable for middle-aged and elderly people with bone loss, and used in the research and development of osteoporosis prevention-related nutritional products. In feed, it can improve the bone strength of egg-laying poultry.

(24) Lithium Polyaspartate: An auxiliary preparation for mental illnesses, regulating neurotransmitters and improving depression/manic symptoms. It must be used under professional medical guidance to avoid the risk of unauthorized medication.

(25) Ammonium Polyaspartate: In agriculture, it serves as a nitrogen fertilizer synergist, reducing nitrogen volatilization and loss, and promoting crop leaves to be bright green. Suitable for leafy vegetables, it can increase nitrogen utilization rate by 60% after addition. In aquaculture, it can be used as a nutrient source for plankton.

(26) Germanium Polyaspartate: Its antioxidant and immune regulation functions are explored, temporarily used in health product research and development, and further clinical verification of its safety and effectiveness is required.

(27) Cadmium Polyaspartate (Research Grade): Used in soil cadmium pollution remediation research, chelating and fixing cadmium ions to reduce crop absorption. It is not a commercial product, and strict control of usage scenarios is required.

(28) Hydroxyl-Containing Polyaspartic Acid Derivatives: Modified by introducing hydroxyl groups, the calcium phosphate scale inhibition rate is increased to over 85% (only about 50% for ordinary products under the same conditions) with better dispersion performance. Suitable for industrial water treatment in high phosphate ion environments (such as power plant circulating water).

(29) Polyaspartic Acid-Acrylic Acid Grafted Copolymer: After grafting acrylic acid,the scale inhibition rate against calcium carbonate is increased from 80% to over 95%, enhancing the chelating ability with scaling ions. Suitable for high-hardness industrial circulating water systems, with temperature resistance up to 100℃ and above.

(30) Cross-Linked Polyaspartic Acid Hydrogel: Forms a three-dimensional network structure with glutaraldehyde as a cross-linking agent, having excellent water absorption and retention capacity with a water absorption ratio of hundreds of times its own weight. It has potential application value in agricultural water retention and drug sustained-release fields.

(31) Polyaspartic Acid Drug Carrier (Laboratory Stage): Utilizing pH-responsive sustained-release properties, it can encapsulate anti-tumor drugs

such as cisplatin, improving drug targeting and stability. It is also explored in biodegradable scaffold fields,处于 the initial stage of pharmaceutical research and development.

(32) Polyaspartic Acid Basic Compound Preparations: Such as peptide urea, synergistic compound fertilizers, and crop conditioners, which can be used for seed dressing, spraying, or drip irrigation. They have the functions of fertilizer efficiency enhancement, phytotoxicity relief, and root promotion, and can increase pesticide efficacy by 15-20% when combined with pesticides. Among them, peptide urea can increase nitrogen utilization rate to over 50% and yield per mu by more than 20% after addition, suitable for various crops such as wheat, corn, and cotton.

(33) Polyaspartic Acid Medium and Trace Element Foliar Fertilizer: Chelates calcium, magnesium, boron, zinc, etc., with small molecules for easy absorption, quickly alleviating crop nutrient deficiency (chlorosis/deformation). Suitable for the flowering and fruit setting period of crops, with visible effects 7 days after spraying.

(34) Polyaspartic Acid Macronutrient Water-Soluble Fertilizer (Nitrogen, Phosphorus, Potassium + Medium and Trace Elements): Comprehensive nutrients ($N+P_2O_5+K_2O \geq 50\%$) and high absorption efficiency, suitable for the whole growth cycle of fruits, vegetables, and flowers, with a drip irrigation utilization rate of over 90%.

(35) Polyaspartic Acid Modified Bentonite Fertilizer Carrier: Loads chelated nutrients, with a slow-release fertilizer efficiency period of 3-6 months, increasing utilization rate by 25% and reducing loss by 15%. Suitable for wheat and corn base fertilizers, reducing fertilization frequency.

(36) Polyaspartic Acid Slow-Release Chelated Fertilizer: Controls nutrient release for long-term fertilizer supply, reducing fertilization times by 2-3 times and costs by 15-20%. Suitable for greenhouse vegetables, reducing the impact of continuous cropping obstacles.

(37) Polyaspartic Acid Stress-Resistant Chelated Fertilizer: Chelates trace elements + compounds stress-resistant components such as proline, enhancing crop cold and drought resistance. Suitable for areas with variable climates, it can increase corn root weight by 20% and improve lodging resistance rate.

(38) Polyaspartic Acid High-Potassium Water-Soluble Fertilizer (Potassium≥ 30%): Chelates calcium and magnesium, promoting fruit expansion, coloring, and sugar accumulation. Suitable for the coloring period of grapes and citrus, it can increase fruit sugar content by 1-3 degrees and coloring uniformity by 20%.

(39) Polyaspartic Acid Potassium-Zinc-Boron Compound Fertilizer: Potassium prevents lodging/promotes fruit development, zinc promotes auxin synthesis, and boron prevents flower and fruit drop, comprehensively improving crop performance. Suitable for the fruit expansion period of fruit trees and the booting period of field crops.

(40) Polyaspartic Acid Calcium-Zinc-Manganese Compound Fertilizer: Meets the synergistic needs of three elements, promoting 18% increase in photosynthetic efficiency, root development, and enzyme activity regulation. Suitable for the seedling stage of vegetables and the young fruit stage of fruit trees.

(41) Polyaspartic Acid Potassium-Zinc-Magnesium Compound Fertilizer: Potassium promotes fruit expansion, zinc protects leaves, and magnesium maintains chlorophyll, synergistically improving stress resistance (drought resistance) and reducing yield loss under drought stress。

(42) Polyaspartic Acid Grafted Copolymer Functional Materials: Used to produce superabsorbent polymers (diapers, agricultural water-retaining agents, highly absorbent and degradable), water treatment flocculants (absorbing suspended solids, increasing clarity by 30%); it can also be used as a high-temperature resistant drilling fluid thinner for oil and gas development, with salt resistance exceeding 200,000 ppm and viscosity reduction rate >80%.

(43) Polyaspartic Acid Modified Bentonite Environmental Protection Materials: Used in industrial soil heavy metal remediation (lead and cadmium fixation efficiency of over 85%), wastewater treatment (removing COD by 20-40%); in agriculture, it improves soil (increasing water and fertilizer retention capacity by 30%), suitable for sandy soil and continuous cropping plots.

(44) Polyaspartic Acid Fruit and Vegetable-Specific Compound Fertilizer: Chelates calcium, boron, and zinc (ratio 2:1:1), preventing fruit cracking and malformation (reducing incidence by 40%), improving fruit hardness and shelf life by 2-3 days. Suitable for berry crops such as strawberries, tomatoes, and cherries.

(45) Polyaspartic Acid Field Crop-Specific Fertilizer: Chelates nitrogen, phosphorus, and potassium (ratio 3:1:2) + zinc and manganese, promoting tillering (increasing by 1-2), lodging resistance, and improving 1000-grain weight by 5-8%. Suitable for wheat and corn, seed dressing with improved varieties can stably increase yield by 10-15%.

(46) Mineral Source Seaweed-Polyaspartic Acid Organic Water-Soluble Fertilizer: Compounds mineral source fulvic acid (≥150g/L) and seaweed extract (≥200g/L), with functions such as promoting root explosion, rapid seedling establishment (2-3 days earlier), preventing chlorosis, and flower and fruit preservation. The number of effective viable bacteria is ≥200 million/ml, suitable for continuous cropping plots, reducing the incidence of soil-borne diseases.

(47) Polyaspartic Acid Ester Resin (such as TD520): Can prepare high-solid-content two-component polyurea coatings with a film hardness of 2H, outstanding wear resistance, and excellent weather resistance, water resistance, and acid-alkali resistance. Suitable for floor and waterproofing engineering fields.

(48) Polyaspartic Acid Tea-Specific Fertilizer: Suitable for application during the tea bud germination period and after picking. It can increase tea bud density by 20%, 100-bud weight by 15%, increase new shoots and amino acid content, and increase yield by 15-30%. It can be compounded with insecticides and fungicides for synergistic effect.

(49) Polyaspartic Acid Phosphorus-Free Detergent Auxiliary: Replaces traditional phosphorus-containing auxiliaries, with strong chelating ability for calcium and magnesium ions, improving decontamination effect by 15%, and being easily biodegradable, complying with environmental protection detergent standards. Suitable for laundry detergents, washing powders and other products.

(50) Polyaspartic Acid Papermaking Auxiliary: Serves as a dispersant and retention aid, improving the dispersion uniformity of pulp fibers, reducing fiber loss, increasing paper formation by 18%, and enhancing ash retention rate by 10%. Suitable for the production of cultural paper and packaging paper.

(51) Polyaspartic Acid Ceramic Additive: Improves the fluidity and stability of ceramic slurries, reduces sedimentation and stratification, and enhances the density and surface finish of sintered ceramic products. Suitable for the production of daily-use ceramics and industrial ceramics.

(52) Polyaspartic Acid Aquaculture-Specific Fertilizer: Chelates nitrogen, phosphorus, potassium, and trace elements, promoting plankton reproduction (increasing by 30%) to provide natural bait for fish and shrimp. Meanwhile, it improves the water environment (reducing ammonia nitrogen content) and increases aquaculture survival rate by 10-15%.

(53) Polyaspartic Acid Flower-Specific Fertilizer: Chelates nitrogen, phosphorus, potassium, boron, and zinc, promoting flowering (1-2 weeks earlier), increasing flower yield (by 20%), extending the flowering period (3-5 days), and enhancing petal color and flower stem toughness. Suitable for ornamental flowers such as roses and phalaenopsis.

(54) Polyaspartic Acid Tobacco-Specific Fertilizer: Chelates nitrogen, phosphorus, potassium, magnesium, and zinc, promoting uniform tobacco leaf growth, increasing the proportion of high-grade tobacco leaves by 8-10%, and enhancing the content of aromatic substances in tobacco leaves. Suitable for the cultivation of flue-cured tobacco and sun-cured tobacco, meeting the quality improvement requirements of tobacco monopolies.

(55) Pharmaceutical-Grade Polyaspartic Acid Raw Material: High-purity (≥ 99%) products can be used as raw materials for amino acid preparation synthesis and nutritional additives in cosmetics. Suitable for high-end medical beauty skin care products and oral nutritional supplements.

(IV) Glycine Chelated Copper Sulfate: Combining organic copper and sulfate, it resists soil

Fixation (copper utilization increased by 50%) and has good water solubility. In agriculture, it is used as a copper fertilizer (foliar spraying to prevent copper deficiency in crops); in feed, it serves as a copper source (promoting enzyme activity in livestock and poultry, such as tyrosinase); in food, it acts as a nutritional fortifier (suitable for special diets), with high stability and no irritation.

(1) Glycine chelated calcium (agricultural grade): commonly used calcium fertilizer in agriculture, forming a "calcium glycine" biological missile, with a root absorption rate exceeding 85%, and a xylem transport speed four times faster than traditional calcium; Water soluble fertilizers do not exhibit antagonistic reactions, can quickly supplement calcium to prevent fruit cracking and navel rot, promote root development, and improve soil aggregate structure.

(2) Glycine chelated zinc (agricultural grade): a highly efficient source of zinc for plants, quickly involved in enzyme synthesis after being absorbed by roots, assisting photosynthesis (increasing photosynthetic efficiency by 15%), enhancing crop stress resistance (resistance to low temperatures and diseases), and increasing yield by 10-20%. It is commonly used in foliar fertilizers, water-soluble fertilizers, and is suitable for fruits, vegetables, and field crops.

(3) Glycine chelated iron (agricultural grade): Targeted correction of plant iron deficiency yellowing, promotion of chlorophyll synthesis (leaf greening rate of over 90%), improvement of photosynthetic efficiency, avoidance of small and poor fruit quality caused by iron deficiency, suitable for alkaline

soil (reducing iron fixation), can be foliar sprayed or drip irrigated.

(4) Glycine chelated magnesium (CAS: 14783-68-7): provides high activity magnesium for plants, directly participates in chlorophyll construction, prevents magnesium deficiency induced leaf yellowing and growth arrest, enhances crop stress resistance (drought resistance, high temperature resistance), and can also increase fruit sugar content (increase sweetness by 1-2 degrees), suitable for fruit trees, vegetables, and traditional Chinese medicine.

(5) Glycine magnesium sulfate: a composite magnesium supplement that combines the advantages of glycine magnesium (high bioavailability, minimal gastrointestinal irritation) and magnesium sulfate (good water solubility), providing simultaneous magnesium and sulfur supplementation; Used in medicine/health products to improve hypomagnesemia (relieve muscle spasms and fatigue) and support cardiovascular health; Used as a nutritional enhancer in food/feed, suitable for middle-aged and elderly people, sports enthusiasts, and livestock and poultry breeding.

(6) Glycine chelated copper (agricultural grade): a core source of copper nutrition for plants, involved in photosynthetic electron transfer and antioxidant systems, preventing copper deficiency induced grain defects and leaf deformities, enhancing crop disease resistance (resistance to downy mildew and anthracnose), improving yield and quality, and suitable for fruit trees, wheat, and rapeseed.

(7) Glycine chelated manganese (agricultural grade): participates in key processes of plant photosynthesis and nitrogen metabolism, prevents manganese deficient stripe like chlorosis, regulates enzyme activity (such as nitrate reductase), promotes nutrient absorption, enhances crop stress resistance, and is suitable for beans, corn, and tobacco.

(8) Glycine chelated ferrous (universal grade): Glycine is stably chelated with ferrous, with a bioavailability three times that of ferrous sulfate. It has minimal irritation to the gastrointestinal tract (no iron odor) and is less susceptible to interference from phytic acid and oxalic acid; Used as a nutritional enhancer in food (added to milk powder and grains), as an iron supplement in health products, and to prevent iron deficiency anemia in livestock and poultry feed.

(9) Glycine chelated calcium (CAS: 35947-07-0, food/pharmaceutical grade): Calcium chelates with glycine at a ratio of 1:2, with an absorption rate 40% higher than calcium carbonate, and good gastrointestinal tolerance (no bloating or constipation); Commonly used as dietary supplements (calcium tablets, oral liquids), suitable for infants, pregnant women, and the elderly to supplement calcium, and can also be added to functional foods (such as calcium fortified milk).

(10) Sodium glycinate chelate (CAS: 6000-44-8): used as a flavoring agent in food (enhancing the freshness of monosodium glutamate by 30%), pH regulator

(adjusting range 5.0-7.0), and moisturizer (extending the shelf life of bread and pastries); Used in industry for electroplating solutions (to improve coating uniformity) and detergents (to enhance cleaning power); Used as a drug synthesis intermediate in medicine (such as amino acid injection).

(11) Glycine chelated zinc (CAS: 7214-08-6, food/pharmaceutical grade): a highly active organic zinc source with an absorption rate twice that of zinc sulfate; Fortify grains and dairy products in food to meet the zinc supplementation needs of children and pregnant women; Formulated into tablets and capsules in health products to improve the immune system caused by zinc deficiency; Used as an active ingredient in zinc supplements in medicine to assist in the treatment of growth and development delays.

(12) Glycine chelated zinc salt monohydrate (CAS: 14281-83-5): containing one molecule of crystalline water, with better stability than anhydrous substance, and a zinc content of about 22%; Adding zinc supplements to milk powder and complementary foods, suitable for infants and young children (easily absorbed, non irritating); Health products/medicine, focusing on precise zinc supplementation to reduce gastrointestinal discomfort.

(13) Glycine chelated zinc hydrochloride: The hydrochloride form enhances the solubility of zinc (with a solubility of 30g/100mL at 25 ℃) and has high bioavailability; Fortified beverages and cereal bars in food, suitable for teenagers and the elderly; Used as a raw material in health products, it can assist in improving zinc deficiency related symptoms in medicine, especially suitable for liquid preparations (such as zinc supplementation oral liquid).

(14) Glycine chelated zinc sulfate: It has the advantages of high absorption of organic zinc and solubility in sulfate water, with a zinc content of about 18%; Fortify dairy products and biscuits in food to meet daily zinc supplementation needs; Made into capsules in health products, suitable for pregnant and lactating women; Assisted treatment of zinc deficiency in medicine can lead to loss of appetite, weakened immunity, and reduced impact on gut microbiota.

(15) Glycine chelated potassium (CAS: 15743-44-9): Glycine chelates with potassium in a 1:1 ratio, with good water solubility (no bitter taste of potassium chloride) and high absorption rate; Using potassium fertilizer in agriculture (to promote fruit swelling and resist lodging), suitable for the swelling period of fruits and vegetables; Electrolyte supplements (sports drinks) are used in food, and medication is used to assist in the prevention and treatment of hypokalemia (maintaining myocardial function).

(16) Potassium glycinate complex: used in food for sports drinks, low sodium salt (replacing some sodium chloride, reducing sodium by 30%), supplementing potassium while regulating flavor; Made into powder in health products, suitable for high blood pressure and athletes (maintaining electrolyte balance); New potassium fertilizers are used in agriculture to promote crop potassium absorption (with a utilization rate 25% higher than potassium

chloride) and prevent soil compaction.

(17) Glycine chelated selenium (agricultural grade): an organic selenium source (seleno amino acid structure) that is absorbed by plants and converted into selenoproteins to increase the selenium content of agricultural products (such as selenium rich rice and tea); After foliar spraying, the selenium absorption rate reaches 80%, which is suitable for crops in selenium deficient areas and can enhance crop stress resistance (disease and pest resistance).

(18) Glycine selenium complex (food/pharmaceutical grade): Good stability (not decomposed at pH 3-10), 4 times higher bioavailability than sodium selenite, and low toxicity; Fortify grains and dairy products in food, make capsules in health products to enhance immunity and antioxidant properties, and assist in improving Keshan disease and Kashin Beck disease caused by selenium deficiency in medicine.

(19) Glycine chelated cobalt salt (CAS: 14221-43-3): a blue crystalline solid with good water solubility; In industry, it is used as a catalyst (for oxidation and hydrogenation reactions, improving reaction selectivity by 90%), and for flue gas denitrification and desulfurization (neutral to weakly alkaline, with a NO removal rate of over 95% at 50 ℃, synergistic with urea); Additives are used in electroplating to enhance the corrosion resistance of the coating and reduce pinholes.

(20) Glycine chelated molybdenum (agricultural grade): a specialized molybdenum source for leguminous crops, promoting nitrogen fixation in rhizobia (increasing nitrogen fixation by 30%), participating in photosynthesis and nitrogen metabolism; Foliar spraying or soil base application to prevent yellowing of leaves and less podding caused by molybdenum deficiency, which is suitable for soybeans, peanuts and astragalus; Molybdenum supplements for livestock and poultry in feed (promoting metabolic enzyme synthesis).

(21) Glycine chelated boron (CAS: 77356-05-9): Used as boron fertilizer in agriculture, it promotes pollen germination, pollen tube elongation (increases fruit setting rate by 15-20%), prevents flower and fruit drop, abnormal fruit, and is suitable for fruit trees (apples, citrus), rapeseed, and cotton; Satisfy the boron requirements of livestock and poultry in feed (to maintain bone development) and avoid growth retardation caused by boron deficiency.

(22) Glycine chelated cobalt salt sulfate: blue crystal, chelated cobalt binds with sulfate ions, with excellent water solubility and strong stability; Improve oxidation, hydrogenation, and desulfurization reaction rates in industrial catalysis (efficiency increased by 25%); Improve the uniformity of the coating during electroplating (reduce coating pores); Used in hydrometallurgy for thiosulfate extraction of gold (with a gold leaching rate of 94.85% under alkaline conditions and a 40% reduction in thiosulfate

consumption).

(23) Glycine chelated ferrous (CAS: 2150-34-9): used as iron supplement fertilizer in agriculture (to correct iron deficiency yellowing and accelerate leaf greening), fortified grains and dairy products in food (without iron smell, not affecting flavor), and prevention of livestock and poultry anemia in feed (to increase hemoglobin content by 15%); The chelating structure avoids ferrous oxidation and is more stable than ferrous sulfate.

(24) Glycine ferrous sulfate (CAS: 17169-60-7): The double salt structure combines the advantages of high absorption of organic iron and solubility in sulfate solution; Suitable for piglets and chicks in feed (preventing iron deficiency anemia and increasing survival rate by 10%); Correcting iron deficiency in crops in agriculture (especially in alkaline soils), and enhancing beverages and nutritional powders in food (easily soluble, non precipitating).

(25) Glycine chelated manganese (CAS: 14281-77-7): used as manganese fertilizer in agriculture (foliar spraying to prevent manganese deficiency and green loss, increasing photosynthetic efficiency by 18%); Promote the development of animal bones in feed (reduce osteoporosis) and improve reproductive performance (increase egg production rate by 5%); Fortified grains and beverages in food (with high bioavailability and no impact on food properties).

(26) Glycine chelated manganese hydrochloride: The hydrochloride form enhances the solubility of manganese (suitable for liquid fertilizers and oral liquids); Correcting manganese deficiency in agriculture (soil base application or foliar spraying can be used), promoting crop metabolism; Manganese source in feed (easily absorbed by livestock and poultry, reducing fecal manganese emissions); Fortified liquid products in food (such as nutritional drinks) have no odor.

(27) Glycine chelated manganese sulfate: Sulfate enhances manganese stability and water solubility; Using manganese fertilizer in agriculture (to prevent manganese deficiency and yellowing, suitable for corn and wheat); The composition of animal enzyme systems in feed (such as superoxide dismutase) enhances immunity; Fortified grains and dairy products in food (with high bioavailability and no impact on taste).

(28) Glycine chelated iron (food/feed grade): fortified milk powder and cereal in food (no iron smell, not affecting color), suitable for aquatic products and livestock in feed (to prevent anemia and promote growth); The chelation structure avoids antagonism between iron and other nutrients, with an absorption rate three times higher than inorganic iron, reducing intestinal irritation.

(29) Glycine iron complex (CAS: 2150-34-9): light yellow crystal, slightly soluble in water, suitable for solid products; Fortify biscuits and nutrient bars in food (with good stability and high temperature resistance), use them

as iron supplements for piglets in feed (to maintain hemoglobin levels and prevent anemia), and use them as slow-release iron fertilizers in agriculture (suitable for sandy soil to reduce loss).

(30) Glycine chelated ferrous (agricultural grade): Targeted correction of iron deficiency in crops (such as peach and grape yellowing disease), visible green transformation after 7 days of foliar spraying; Chelating structures resist soil fixation (especially in alkaline soils), increase iron utilization by 60%, and promote crop nutrient absorption (such as phosphorus and zinc), thereby improving yield and quality.

(31) Glycine ferrous sulfate (agricultural grade): Good water solubility, fast absorption, suitable for liquid fertilizers and foliar fertilizers; Correcting iron deficiency yellowing in crops (such as citrus and strawberry), improving photosynthetic efficiency, and reducing flower and fruit drop; It can also enhance crop stress resistance (drought resistance, disease resistance) and adapt to alkaline soil areas in the north.

(32) Glycine chelated ferrous chloride: The hydrochloride salt enhances the solubility of ferrous ions (suitable for high concentration liquid fertilizers); Fortified oral liquid and nutritious beverage in food (no sediment, good taste), suitable for chicks and juveniles in feed (anti anemia, increased survival rate by 8%); Used as a rapid iron supplement in agriculture, it has a quick effect after foliar spraying.

(33) Glycine chelated chromium (CAS: 68891-98-5): fortified health foods in food (such as hypoglycemic milk powder) to assist in regulating glucose metabolism; Suitable for livestock and poultry (such as beef cattle and broiler chickens) in feed, promoting metabolism and improving production performance (increasing weight gain rate by 10%); It is also used for special medical formula food to supplement chromium for diabetes patients.

(34) Glycine chelated chromium hydrochloride: The hydrochloride form enhances the stability and solubility of chromium; Fortify grains and beverages in food, suitable for people with blood sugar management; Using chromium as a source in feed to promote protein synthesis and reduce fat deposition in livestock and poultry (increasing lean meat percentage by 5%); High bioavailability, reducing interference with the absorption of other minerals.

(35) Glycine iron complex (feed grade): light yellow to brownish yellow powder, slightly soluble in water; Focusing on iron supplementation for piglets (administered orally for 3 days after birth to maintain hemoglobin levels and prevent iron deficiency anemia) can also enhance piglet immunity (reduce diarrhea rate by 15%) and promote growth and development (increase weaning weight by 200g).

(36) Glycine Nicotinic Acid Chromium: Nicotinic acid and glycine synergistically enhance chromium absorption rate (25% higher than pure glycine chromium); In the field of nutrition supplement, capsules are made to assist in regulating sugar metabolism (suitable for people with pre

diabetes); Fortify grains and health products in food, promote animal metabolism in feed (such as increasing egg production rate by 7% in laying hens), and reduce stress reactions.

(37) Glycine chelated copper (CAS: 13479-54-4): used as copper fertilizer in agriculture (to correct copper deficiency in fruit trees, such as apple top blight), to promote photosynthesis; Suitable aquatic products (such as shrimp and fish) in feed to prevent immune deficiency caused by copper deficiency (increase survival rate by 12%); In industry, it is used as a catalyst for chemical oxidation reactions and as an electroplating additive to enhance the glossiness of coatings.

(38) Glycine chelated copper sulfate: Organic copper binds with sulfate and is resistant to soil fixation (increasing copper utilization by 50%), with good water solubility; Copper fertilizer is used in agriculture (foliar spraying to prevent crop copper deficiency), copper source is used in feed (to promote animal enzyme activity, such as tyrosinase), and nutrient fortifier is used in food (suitable for special diets), with strong stability and no irritation.

(39) Food/Feed-Grade Glycine Chelated Selenium: An organic selenium source (selenium content approximately 1.2%), easily absorbed by humans/animals (absorption rate over 90%). In food, it is used to fortify selenium-enriched products (e.g., selenium tablets, selenium-enriched eggs); in health products, it acts as an antioxidant (enhancing immunity); in feed, it is suitable for livestock, poultry, and aquatic animals (e.g., selenium-enriched pork, selenium-enriched eggs) to increase product added value.

(40) Food/Feed-Grade Glycine Chelated Molybdenum: A high-activity molybdenum source. In food, it serves as a nutritional fortifier (suitable for special diets to meet molybdenum needs); in feed, it promotes rumen metabolism in ruminants (e.g., increasing milk production of dairy cows by 8%) and prevents metabolic disorders in livestock and poultry caused by molybdenum deficiency. It has high bioavailability and reduces molybdenum accumulation in the environment.

(41) Glycine Chelated Aluminum (CAS: 13682-92-3): In medicine, it acts as an antacid (neutralizing gastric acid, protecting gastric mucosa, and relieving gastric ulcers); in food, it serves as a nutritional fortifier (suitable for specific groups to supplement aluminum); in agriculture, it acts as a micro-fertilizer (promoting crop root development, suitable for acidic soils); in industry, it is used as a detergent additive (preventing dirt deposition), an electroplating solution additive (improving coating adhesion), and a hydrogel cross-linking agent (preparing superabsorbent hydrogels).

(42) Glycine Citrate: Formed by the reaction of glycine and citric acid at a 1:1 ratio, it has good water solubility (100g/100mL at 25℃) and strong buffering capacity (pH 3.0-6.0). In food, it acts as a sour taste regulator (suitable for beverages and jelly, with mild taste) and a stabilizer

(extending the shelf life of fruit juices); in medicine, it serves as a drug solubilizer (improving the solubility of poorly soluble drugs) and a pH regulator (for oral liquids); in cosmetics, it acts as a humectant (enhancing skin moisture retention) and a pH balancer (for lotions and serums).

(43) Glycine Lysine Magnesium: Magnesium is synergistically chelated with glycine and lysine, with bioavailability 50% higher than that of magnesium oxide. In health products, it serves as a magnesium supplement (relieving anxiety, improving sleep, suitable for stressed groups); in food, it fortifies functional foods (e.g., sports nutrition products) and promotes bone health (synergistically enhancing calcium absorption and reducing bone loss); it also participates in energy metabolism, relieves fatigue, and maintains cardiovascular health (regulating blood pressure).

(44) Glycine Glutamine Magnesium: The three components (magnesium, glycine, and glutamine) work synergistically, with high magnesium absorption rate (no gastrointestinal irritation). In health products, it serves as a dietary supplement (relieving muscle fatigue, improving sleep) and provides glutamine for intestinal mucosal cells (maintaining intestinal barrier function and preventing intestinal leakage); in food, it fortifies meal replacement powders and nutrition bars, suitable for fitness enthusiasts and post-surgery groups; it also helps maintain electrolyte balance and supports neuromuscular function.

(45) Glycine Chelated Nickel (CAS: 13477-94-6): In agriculture, it acts as a micro-fertilizer (suitable for legumes and cruciferous crops, promoting metabolic enzyme synthesis and increasing pod formation rate); in industry, it serves as a catalyst(for hydrogenation and dehydrogenation reactions, improving reaction efficiency); in scientific research, it is used for enzyme activity studies and must comply with national usage standards (to avoid excess).

(46) Research-Grade Glycine Chelated Vanadium: Its potential in glucose metabolism regulation (assisting in improving insulin sensitivity) is explored in laboratories, and it is temporarily used in health product research and development; in agriculture, it is used in small quantities for crop stress resistance research (e.g., salt-alkali resistance) and is not a commercial product, requiring continuous attention to safety.

(47) Glycine Chelated Strontium: In medicine/health products, it serves as a raw material for bone health (promoting bone formation, inhibiting bone resorption, suitable for middle-aged and elderly people with osteoporosis); in food, it fortifies special diets (e.g., bone health milk powder); in agriculture, it acts as a micro-fertilizer (enhancing crop calcium absorption and improving stem toughness).

(48) Pharmaceutical-Grade Glycine Chelated Lithium: An auxiliary preparation for mental illnesses (regulating neurotransmitters and improving depression/manic symptoms), which must be used under the guidance of a

doctor; in scientific research, it is used for neuroprotective studies, and unauthorized use should be avoided (due to potential toxicity risks).

(49) Glycine Chelated Silicon: In agriculture, it acts as a silicon fertilizer (enhancing crop stem toughness, improving lodging resistance and disease/pest resistance, suitable for rice and wheat); in cosmetics, it acts as a skin feel regulator (improving lotion smoothness and strengthening the skin barrier); in food, it serves as a nutritional fortifier (suitable for joint health-related products).

(50) Glycine Chelated Titanium: As a core component of foliar fertilizers in agriculture, it improves photosynthetic intensity by over 20% by promoting chlorophyll synthesis and photosystem activity, increasing fruit sugar content by 1-2 degrees and vitamin content by 15%, suitable for fruit, vegetable, and Chinese medicinal material cultivation; it is still in the research and development stage in the health product field, with itsantioxidant and immune regulation potential to be further verified by clinical studies.

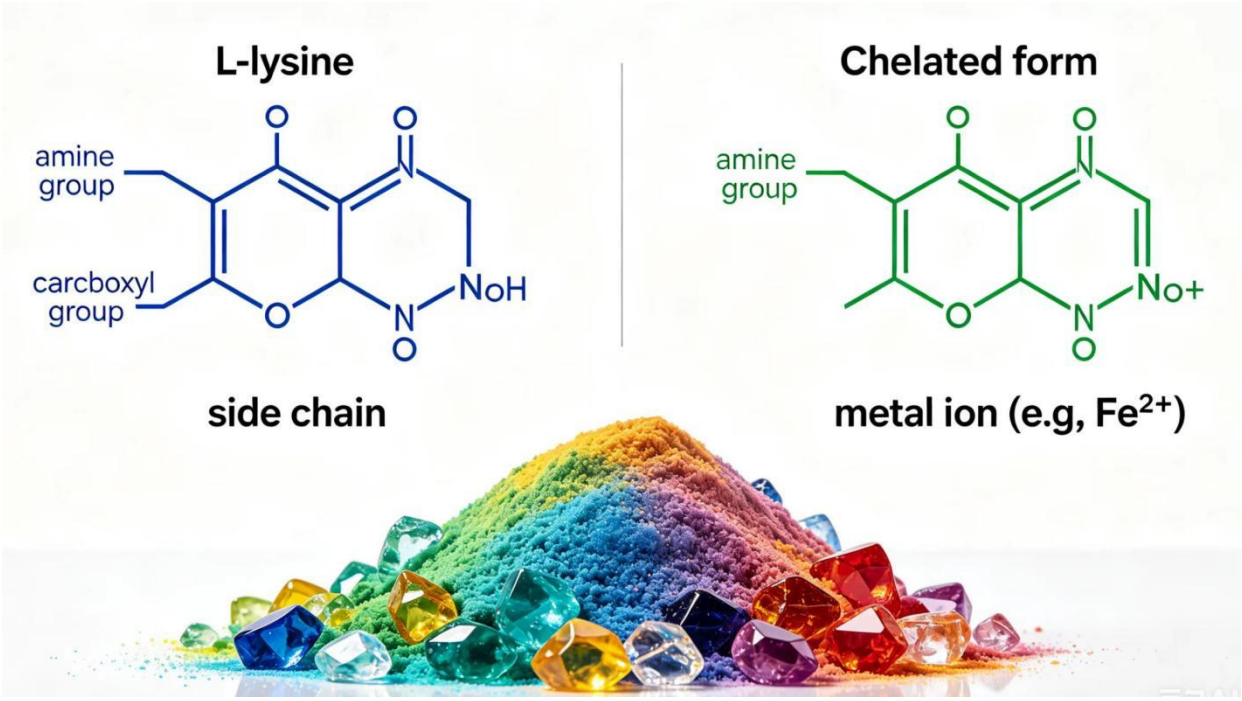
(51) Glycine Chelated Borate: Combining glycine chelated boron with borate to enhance stability and water solubility, it is suitable for alkaline soils in agriculture (reducing boron fixation), promotes crop pollen tube elongation, and increases fruit set rate by 18%-25%, especially suitable for fruit trees during flowering and rapeseed during the bolting stage; in industry, it is used as a flame retardant additive to improve the fire resistance of materials

(52) Industrial/Research-Grade Glycine Chelated Tungsten: In industry, it serves as a catalyst for hydrodesulfurization reactions in petrochemical engineering, improving desulfurization efficiency (reducing sulfur content in oil products to below 10ppm); in the research field, it is used for the development of new battery materials to explore its application potential in energy storage, and it is not yet used in food or agriculture.

(53) Glycine Chelated Germanium: In health products, it acts as an auxiliary antioxidant component, claiming to scavenge free radicals and improve microcirculation (must comply with national health food declaration standards); in agriculture, it is used in small quantities for high-end flower cultivation to promote petal coloring and extend flowering period; in industry, it is used for surface treatment of semiconductor materials to improve material conductivity.

(54) Industrial/Agricultural-Grade Glycine Chelated Lanthanum: In industry, it serves as a glass clarifier to reduce bubbles and impurities in glass and improve glass transparency; in agriculture, it acts as a component of rare earth micro-fertilizers, and small-scale application can enhance crop stress resistance (resistance to heavy metal stress) and improve crop absorption efficiency of nitrogen, phosphorus, and potassium, suitable for crop cultivation in contaminated soil.

(55) Glycine-Proline Chelated Calcium: An innovative dual-amino acid chelated calcium. Glycine improves calcium absorption, while proline enhances calcium deposition efficiency in bones, with bioavailability 30% higher than that of single glycine chelated calcium. In medicine/health products, it is suitable for middle-aged and elderly people with osteoporosis to reduce bone loss; in food, it is used in high-end calcium-fortified products (e.g., infant formula milk powder, elderly nutritional powder) with mild properties and no gastrointestinal irritation.



(V) Lysine Chelate and Related Series Products

The core of the lysine chelate series is the formation of stable six-membered cyclic organic chelates between L-lysine (as the chelating agent) and metal ions. Its key advantages include high bioavailability (preventing metal ions from being fixed by soil/intestinal tract, with utilization rate 30%-80% higher than that of inorganic salts) and low irritation (no damage to crop roots, no irritation to animal gastrointestinal tracts). It covers three mature fields—feed (animal nutrition supplementation), fertilizers (crop nutrient supplementation and efficiency enhancement), food/health products (human nutritional fortification)—as well as cutting-edge pharmaceutical R&D scenarios, with superior practicality.

(1) Feed-Grade Lysine Chelated Zinc: Produced via chelation reaction using L-lysine and food-grade zinc powder as raw materials. It has good palatability (no metallic odor), with zinc absorption rate 30%+ higher than that of zinc sulfate. The growth-promoting effect of lysine and the immunity-enhancing effect of zinc work synergistically, increasing the daily weight gain of livestock, poultry, and aquatic animals by 10%-15%. It prevents skin inflammation (e.g., skin keratinization in piglets) and growth retardation caused by zinc deficiency, suitable for sensitive breeding scenarios such as

piglets, chicks, and sea bass.

(2) Feed-Grade Lysine Chelated Calcium: Calcium ions form a stable chelate with L-lysine at a 1:2 ratio, with absorption rate 2-3 times that of calcium carbonate and no risk of constipation. It strengthens animal bone health (e.g., increasing eggshell hardness of laying hens by 20%, preventing rickets in piglets) and promotes milk production of dairy cows, suitable for breeding categories such as laying hens, sows, and beef cattle.

(3) Feed-Grade Lysine Chelated Iron (Including Complexed Iron): A dark brown powder slightly soluble in water, covering overlapping product categories. It provides precise iron supplementation for animals, preventing/treating iron-deficiency anemia (e.g., when administered orally to piglets 3 days after birth, hemoglobin content increases by 15%). It promotes hemoglobin synthesis, improves listlessness and growth retardation, and its absorption is not interfered by phytic acid or oxalic acid in feed.

(4) Feed-Grade Lysine Chelated Ferrous: L-lysine chelates with Fe^{2+}, with bioavailability 50%+ higher than that of ferrous sulfate and low irritation to the gastrointestinal tract of young animals (no diarrhea risk). Suitable for sensitive groups such as chicks and weaned piglets, it simultaneously supplements lysine to promote growth and reduces the damage of inorganic iron to intestinal flora.

(5) Feed-Grade Lysine Chelated Magnesium: L-lysine chelates with magnesium ions, with utilization rate 40% higher than that of magnesium oxide and easy absorption by the intestines. It improves animal stress response (e.g., reduced feed intake caused by high-temperature stress in summer), enhances reproductive capacity (increasing sow litter rate by 8%), and prevents neurological disorders (e.g., muscle tremors in cattle) caused by magnesium deficiency.

(6) Feed-Grade Lysine Chelated Manganese: A highly stable organic manganese source with utilization rate over 60% higher than that of manganese sulfate, and its absorption is not affected by phytic acid. It supplements manganese to promote animal bone development (preventing slipped tendon disease in chickens) and improve reproductive function (increasing sperm motility of breeding males by 20%), suitable for breeding chickens and breeding pigs.

(7) Feed-Grade Lysine Chelated Copper: Chelated copper has strong stability, with bioavailability over twice that of copper sulfate, reducing the cumulative toxicity of copper in the liver (lowering liver copper content by 30%). It promotes animal hematopoietic function and enzyme activity (e.g., tyrosinase, improving fur color) and prevents immune decline caused by copper deficiency.

(8) Feed-Grade Lysine Chelated Selenium: Selenium forms a stable chelate with lysine, with absorption rate 80% higher than that of sodium selenite, effectively increasing selenium levels in animals (e.g., selenium content in laying hens reaches 0.3mg/kg). It enhances antioxidant capacity and immunity,

reducing the incidence of respiratory diseases in livestock and poultry, suitable for beef cattle, laying hens, and aquatic breeding.

(9) Feed-Grade Lysine Chelated Cobalt: Specifically designed for ruminants, it provides cobalt to promote rumen microorganisms in synthesizing vitamin B_{12}, improving digestive function (increasing crude fiber digestibility by 12%) and growth performance. It prevents anemia and emaciation (e.g., anemia in lambs) caused by cobalt deficiency.

(10) Feed-Grade Lysine Chelated Molybdenum: Suitable for ruminants and monogastric animals, it supplements molybdenum to maintain xanthine oxidase activity (participating in purine metabolism) and regulates physiological functions in synergy with copper, preventing metabolic disorders (e.g., diarrhea and growth stagnation in cattle) caused by molybdenum deficiency.

(11) Feed-Grade Lysine Chelated Chromium: An organic chromium source easily absorbed by animal intestines, it regulates blood glucose metabolism and fat deposition in livestock and poultry (increasing lean meat rate by 5%). It improves production performance under stress (e.g., alleviating weight loss of piglets caused by weaning stress), suitable for fattening pigs and broiler breeding.

(12) Feed-Grade Lysine Chelated Calcium-Zinc Complex: Simultaneously supplements calcium and zinc, with lysine preventing absorption antagonism between the two elements. Suitable for bone development and immune system construction of young animals (e.g., puppies, piglets); when used for laying hens, it can simultaneously improve eggshell quality (reducing breakage rate by 10%) and egg production rate (increasing by 5%).

(13) Feed-Grade Lysine Chelated Iron-Copper-Manganese Complex: Integrates three essential trace elements, synergistically promoting animal hematopoietic function, enzyme activity regulation, and bone development, while reducing absorption conflicts caused by single nutrient supplementation. Suitable for the fattening period of livestock and poultry (e.g., late fattening stage of beef cattle, increasing weight gain rate by 8%) and the seedling stage of aquatic products.

(14) Feed-Grade Lysine-Methionine Chelated Zinc: Combines two essential amino acids to further improve the bioavailability of zinc (25% higher than that of single lysine chelated zinc), providing both amino acid nutrition and trace element supplementation. It promotes the growth and stress resistance of aquatic animals (e.g., sea bass, prawns) (increasing survival rate by 12%), suitable for high-density aquatic breeding.

(15) Feed-Grade Lysine Chelated Trace Element Premix: Customized according to animal species (pigs, chickens, cattle) and growth stages (e.g., early stage of piglets, peak laying period of laying hens), it integrates chelated elements such as zinc, iron, manganese, and copper. It can be directly added to basic feed, simplifying the feeding process and ensuring nutritional balance (avoiding errors in manual batching).

(16) Feed-Grade Lysine-Trehalose Chelated Magnesium: Combines trehalose to enhance magnesium stability (extending storage period by 6 months), and trehalose also has stress-resistant effects. Suitable for stress scenarios such as high temperature and transportation (e.g., heat prevention for laying hens in summer, piglet transfer), it supplements magnesium to maintain neuromuscular function.

(17) Fertilizer-Grade Lysine Chelated Zinc: Specifically designed for crops, with zinc utilizationrate 40%+ higher than that of zinc sulfate. Foliar spraying or drip irrigation can quickly alleviate zinc deficiency symptoms in crops (e.g., maize dwarf mosaic disease, citrus mottled leaves). It promotes photosynthesis and flower bud differentiation (increasing fruit set rate by 15%), suitable for fruit trees, field crops, and vegetables.

(18) Fertilizer-Grade Lysine Chelated Calcium: Small-molecule chelates are easily absorbed by crop leaves and roots, and can be quickly transported to fruits (increasing calcium accumulation in fruits by 30%). It prevents fruit cracking (e.g., reducing cracking rate of tomatoes and cherries by 25%) and blossom-end rot, and extends fruit shelf life (e.g., extending strawberry freshness period by 2-3 days). It has better stability in acidic soils than calcium nitrate.

(19) Fertilizer-Grade Lysine Chelated Iron: Not easily fixed in alkaline soils (avoiding formation of iron hydroxide precipitation), foliar spraying can efficiently correct iron-deficiency chlorosis in crops (e.g., greening rate of grape and rose leaves reaches 90%). It promotes chlorophyll synthesis, restores leaf greenness, and improves photosynthetic efficiency (increasing crop yield by 10%).

(20) Fertilizer-Grade Lysine Chelated Magnesium: Supplements magnesium (a core component of chlorophyll) for crops, alleviating leaf yellowing caused by magnesium deficiency (e.g., interveinal yellowing of banana and citrus leaves). It enhances photosynthate accumulation (increasing fruit sweetness by 1-2 degrees) and improves yield, suitable for fruit trees, vegetables, and cash crops.

(21) Fertilizer-Grade Lysine Chelated Boron: Improves boron stability and absorption rate (50% higher than that of borax), promoting crop pollen germination and pollen tube elongation (increasing pollen tube length by 20%). It reduces flower and fruit drop (e.g., reducing flower drop rate of peppers and strawberries by 18%) and promotes plump seeds and fruit development, suitable for application during the flowering and fruit-setting period.

(22) Fertilizer-Grade Lysine Chelated Selenium: Used for planting selenium-enriched agricultural products, with crop selenium absorption rate reaching over 80% after foliar spraying (e.g., for garlic, the best absorption effect is achieved by spraying at 1.6μmol/L concentration, pH 3, under sufficient light and 25-35℃). It significantly increases selenium content (e.g.,

selenium content in selenium-enriched rice reaches 0.15mg/kg) and antioxidant capacity of vegetables and grains.

(23) Fertilizer-Grade Lysine Chelated Manganese: Supplements manganese (an enzyme activator, e.g., superoxide dismutase) for crops, preventing striped chlorosis caused by manganese deficiency (e.g., leaf stripes of wheat and sugar beets). It enhances crop stress resistance (drought and disease resistance) and nutrient conversion efficiency, suitable for field crops and cash crops.

(24) Fertilizer-Grade Lysine Chelated Molybdenum: Improves molybdenum solubility in soil (avoiding formation of calcium molybdate precipitation), promotes root nodule development and nitrogen fixation efficiency of legumes (increasing nitrogen fixation by 25%), and supports nitrogen metabolism. It improves the quality of cruciferous crops (e.g., reducing nitrate content of cabbage by 15%), suitable for soybeans, peanuts, and rapeseed.

(25) Lysine Chelated Medium-Trace Element Foliar Fertilizer: Integrates chelated elements such as zinc, calcium, boron, and iron, with penetrants (e.g., polyethylene glycol) added to enhance absorption. Suitable for the seedling stage (promoting roots) and flowering-fruit-setting stage (preventing nutrient deficiency) of crops, it quickly alleviates various nutrient deficiency symptoms (e.g., yellowing, deformity) and improves stress resistance.

(26) Lysine-Mineralized Fulvic Acid Compound Fertilizer: Combines mineralized fulvic acid (≥150g/L) with lysine chelated trace elements, providing multiple effects of promoting root growth (increasing fresh root weight by 30%), improving soil (increasing soil organic matter), and enhancing nutrient efficiency. Suitable for continuous cropping soil and organic agriculture, it activates soil microorganisms (e.g., doubling the number of nitrogen-fixing bacteria) and reduces chemical fertilizer loss.

(27) Lysine Chelated High-Calcium High-Boron Fertilizer: Designed for the fruit enlargement stage of fruits and vegetables (calcium-boron ratio 5:1), the high-proportion calciumand boron work synergistically to prevent fruit cracking and malformation (e.g., reducing grape cracking rate by 30%) and improve fruit hardness and gloss. Suitable for cash crops such as strawberries, grapes, and kiwifruits, with the best effect when sprayed 15 days before harvest.

(28) Lysine-Seaweed Extract Chelated Fertilizer: Combines seaweed extract (containing natural growth hormones) to enhance stress resistance, and lysine chelated elements such as zinc and magnesium to promote growth. It improves crop drought resistance (reducing yield loss by 15% under drought conditions) and cold resistance, and enhances fruit flavor (e.g., increasing sugar-acid ratio of tomatoes by 20%) and nutritional value.

(29) Lysine Chelated Wheat-Specific Fertilizer: Chelates elements such as zinc, manganese, and iron, with lysine added to promote flag leaf retention

(extending photosynthesis time by 5-7 days) and grain filling. It increases grain protein content (by 1-2 percentage points) and thousand-grain weight (by 5g), and enhances wheat lodging resistance (increasing stem thickness by 0.1cm).

(30) Lysine Chelated Tomato-Specific Fertilizer: Spraying during the flowering period can increase fruit set rate by 18%; application during the fruit enlargement period reduces nitrate content (by 20%) and improves fruit taste. It simultaneously prevents blossom-end rot (reducing incidence by 25%) and fruit cracking, suitable for greenhouse and open-field tomato cultivation.

(31) Lysine Chelated Fruit Tree-Specific Fertilizer (Flowering Stage Type): Mainly contains lysine chelated boron and zinc, with amino acid additives added to promote flower bud differentiation of fruit trees (increasing effective flower rate by 20%) and enhance pollen vitality. It reduces flower drop caused by late spring cold (improving cold resistance by 15%), suitable for the flowering period of fruit trees such as apples, citrus, and pears.

(32) Lysine Chelated Vegetable-Specific Fertilizer (Seedling Stage Type): Chelates elements such as iron, manganese, and zinc to promote root development of vegetable seedlings (increasing root length by 30%) and keep leaves green. It reduces seedling diseases (e.g., reducing damping-off incidence by 18%), suitable for the seedling stage of vegetables such as tomatoes, cucumbers, and peppers.

(33) Food-Grade L-Lysine Chelated Calcium: An organic calcium source with good water solubility (15g/100mL at 25℃) and low gastrointestinal irritation (no flatulence or constipation). Suitable for infants (added to formula milk powder), pregnant and lactating women (supplementing calcium while providing lysine to promote fetal development), and the elderly (preventing osteoporosis), it can be used in calcium tablets, nutritional powders, and liquid calcium drinks.

(34) Food-Grade L-Lysine Chelated Zinc: As a food nutritional fortifier, its zinc absorption rate is 40% higher than that of zinc gluconate. Used in children's growth milk powder (adding 5-8mg zinc per 100g milk powder) and chewable tablets (fruit flavor), it supplements zinc and lysine, promoting children's growth and development (increasing height by 1-2cm/year) and improving immunity (reducing cold incidence by 20%).

(35) Food-Grade L-Lysine Chelated Iron: Suitable for people with iron-deficiency anemia (e.g., pregnant women, lactating women), it has high bioavailability (50% higher than that of ferrous sulfate) and no gastrointestinal irritation (no nausea or diarrhea). It can be added to iron-supplementing oral liquids (sweet and sour taste), nutritional cereals (adding 10-15mg iron per 100g cereal), and meal replacement powders.

(36) Healthcare-Grade Lysine Calcium-Zinc Compound Chewable Tablets: Contains L-lysine hydrochloride (≥100mg/tablet), lysine chelated calcium (≥

150mg/tablet), and lysine chelated zinc (≥5mg/tablet); some products add taurine (promoting brain development) and vitamin D (promoting calcium absorption). Complying with national health food standards, it has a sweet and sour taste (e.g., orange flavor) easily accepted by children, providing comprehensive nutrition for growth.

(37) Healthcare-Grade Lysine Chelated Magnesium Soft Capsules: Each capsule contains ≥100mg lysine chelated magnesium, used for adult magnesium supplementation (e.g., people under high pressure, those staying up late). It improves fatigue (increasing energy recovery speed by 25%) and sleep quality (reducing falling asleep time by 15 minutes), suitable for people with unbalanced diets and sedentary lifestyles.

(38) Healthcare-Grade Lysine Selenium Nutritional Powder: A selenium-enriched nutritional supplement (containing ≥100μg selenium per 100g), with lysine chelated selenium as the core and maltodextrin added to improve taste. It increases human selenium levels to enhance antioxidant capacity (increasing glutathione peroxidase activity by 30%), suitable for the elderly and people with low immunity, and can be taken with warm water.

(39) Healthcare-Grade Lysine Compound Vitamin-Mineral Tablets: Based on lysine (≥50mg/tablet), it combines 12 vitamins (e.g., vitamin A, D, B group) and 8 minerals (calcium, zinc, iron, etc.). Complying with national standards such as GB24154 General Rules for Sports Nutrition Foods, it provides comprehensive nutrition, suitable for children in the growth and development stage (6-12 years old) and adults with nutrient deficiencies (e.g., vegetarians).

(40) Healthcare-Grade Lysine Chelated Chromium Chewable Tablets: Each tablet contains ≥100μg lysine chelated chromium, suitable for people with high blood sugar (e.g., pre-diabetes). It assists in regulating blood glucose metabolism (reducing postprandial blood glucose peak by 10%-15%), with sorbitol added to improve taste and no sucrose, making it suitable for people needing blood sugar control.

(41) Food-Grade Lysine-Vitamin D Chelated Calcium Oral Liquid: Combines lysine chelated calcium (≥200mg/100mL) and vitamin D (≥5μg/100mL), with vitamin D promoting calcium absorption (increasing absorption rate by 30%). The liquid dosage form is easily absorbed by infants and the elderly with swallowing difficulties, containing no essence or pigments, suitable for the whole family to supplement calcium.

(42) Healthcare-Grade Lysine Chelated Iron Protein Powder: Based on whey protein powder (protein content ≥70%), it adds lysine chelated iron (≥15mg/100g) and vitamin C (promoting iron absorption). Suitable for fitness enthusiasts (supplementing iron while building muscle) and post-surgery recovery groups (supplementing nutrition and preventing anemia), it dissolves without precipitation or iron-like odor.

(43) Lysine-Zinc Chelated AKT Inhibitor (Research Stage): Innovatively forms

a zinc ion-dependent chelate by combining L-lysine with the AKT1 (E17K) mutation site, achieving selective and long-acting inhibition of mutant AKT1 (inhibition rate up to 90%). It shows potential in the research of treating cancers such as breast cancer and ovarian cancer, and can avoid side effects such as hyperglycemia and weight gain caused by traditional inhibitors.

(44) Lysine Chelated Platinum Drug Carrier (Laboratory Stage): Uses the targeting property of lysine (targeting lysine receptors on the surface of tumor cells) and chelating ability to construct a carrier for platinum-based anti-tumor drugs (e.g., cisplatin). It improves the targeting property (increasing drug concentration at tumor sites by 3 times) and stability of the drug, while reducing toxicity to normal cells (e.g., reducing nephrotoxicity by 40%).

(45) Lysine Chelated Manganese Magnetic Resonance Contrast Agent (Research Stage): Explores the use of L-lysine chelated manganese as a magnetic resonance imaging (MRI) contrast agent, leveraging the paramagnetism of manganese (enhancing imaging signals) and the biocompatibility of lysine (no hepatotoxicity). It improves imaging clarity (increasing tissue contrast by 25%) and tissue targeting (e.g., liver and brain imaging), and is expected to replace traditional gadolinium-based contrast agents.

(46) Lysine Chelated Copper Antibacterial Coating (Research Stage): Coats lysine chelated copper on the surface of medical devices (e.g., catheters, artificial joints), utilizing the antibacterial property of copper ions (killing Escherichia coli, Staphylococcus aureus, etc.) and the biocompatibility of lysine. It reduces medical device-related infections (lowering infection rate by 30%) and has strong coating adhesion (service life up to 6 months).

(47) Lysine Chelated Iron Oral Sustained-Release Preparation (Under Development): Uses lysine chelated iron as the core and adopts enteric coating technology to make sustained-release tablets. It realizes the slow release of iron (release time up to 12 hours), avoiding a sudden increase in blood iron concentration (reducing oxidative stress), suitable for long-term iron-supplementing groups (e.g., patients with chronic iron-deficiency anemia).

(48) Industrial/Research-Grade Lysine Chelated Nickel: Used as a catalyst in industry for hydrogenation reactions in organic synthesis (e.g., benzene hydrogenation to cyclohexane, increasing reaction efficiency by 20%); in the research field, it is used for enzyme activity studies (e.g., urease activator). It is temporarily not used in food, feed, or agricultural fields, and its dosage must be strictly controlled (to avoid toxicity).

(49) Agricultural/Cosmetic-Grade Lysine Chelated Silicon: In agriculture, it is used as a silicon fertilizer to enhance crop stem toughness (e.g., increasing rice lodging resistance by 25%) and disease/pest resistance (e.g., reducing rice planthopper incidence by 18%); in the cosmetic field, it is

used in skincare products as a skin feel regulator (improving lotion smoothness and strengthening the skin barrier), suitable for face creams and serums.

(50) Pharmaceutical/Healthcare-Grade Lysine Chelated Strontium: In medicine, it is used for auxiliary treatment of osteoporosis (promoting bone formation, inhibiting bone resorption, and increasing bone mineral density); in health products, it is added to bone health products (e.g., calcium tablets), suitable for middle-aged and elderly people with bone loss; in agriculture, it is used in small quantities for fruit and vegetable cultivation to improve fruit calcium absorption efficiency (e.g., increasing cherry hardness by 10%).

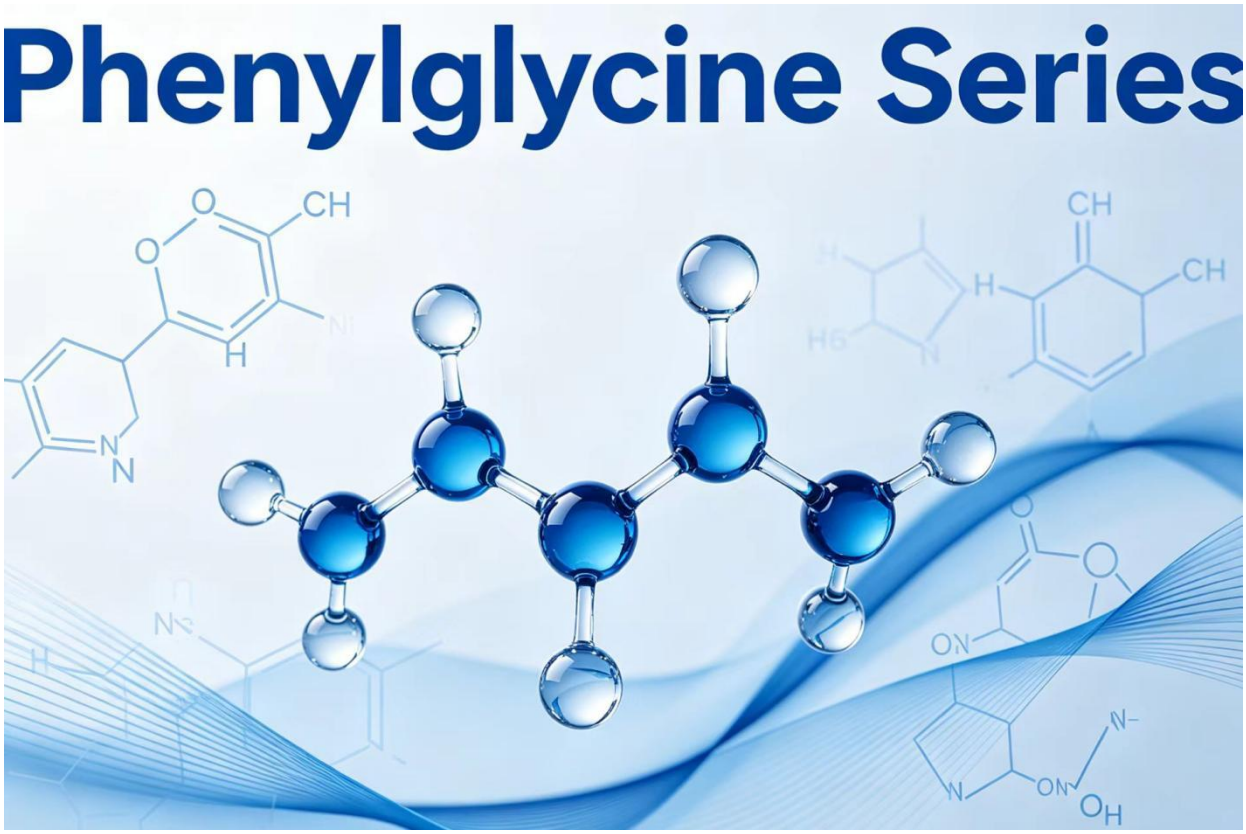
(51) Pharmaceutical-Grade Lysine Chelated Lithium (For Research): A research preparation for mental illnesses (regulating neurotransmitters and improving depression/mania symptoms), which must be used under the control of professional laboratories; it is temporarily not commercialized, and unauthorized contact should be avoided (due to potential toxicity risks).

(52) Agricultural/Feed-Grade Lysine-Chitosan Chelated Zinc: Combines chitosan to enhance the sustained-release property of zinc (extending the zinc releasecycle in soil by 15 days), suitable for sandy soils in agriculture (reducing zinc loss); in feed, it increases the residence time of zinc in the animal intestine (increasing absorption rate by 15%), suitable for aquatic breeding (e.g., increasing prawn survival rate by 8%).

(53) Agricultural-Grade Lysine Chelated Titanium: Foliar spraying can promote the activity of the crop photosynthetic system (increasing photosynthetic efficiency by 20%) and improve fruit quality (e.g., increasing glucose content by 1-2 degrees and vitamin C content by 15%). It is suitable for the cultivation of fruits, vegetables, and Chinese medicinal materials, especially in areas with insufficient light.

(54) Research-Grade Lysine Chelated Vanadium: Its potential in metabolic regulation (assisting in improving insulin sensitivity) is explored in laboratories, and it is temporarily used in diabetes-related research; in agriculture, it is used in small quantities for crop stress resistance tests (e.g., salt-alkali resistance). It is not a commercial product, and safety data should be paid attention to.

(55) Cosmetic/Healthcare-Grade Lysine-Hyaluronic Acid Chelated Calcium: In cosmetics, it is used as a skin moisturizer (combining with the barrier repair effect of calcium to improve skin dryness); in health products, it is used as a calcium supplement (hyaluronic acid promotes calcium deposition in joint cartilage, suitable for people with joint discomfort), suitable for mid-to-high-end health and cosmetic products.



(VI)Phenylglycine Series

Phenylglycine is a high-activity aromatic amino acid raw material with excellent complexing performance. It can effectively chelate various trace elements and maintain stable nutritional activity. Available in DL, L and D configurations with high purity and stable quality. Widely used in agricultural fertilizers, feed additives, pharmaceutical intermediates, industrial water treatment and metal surface treatment industries.

(1) DL-Phenylglycine (CAS 2835-06-5)： A mass-produced general basic chelating ligand, widely used in agricultural chelated fertilizers, industrial water treatment and metal complexation, and serves as the raw material for resolution and preparation of L-type and D-type phenylglycine.

(2) L-Phenylglycine (CAS 2935-35-5)： High-purity biological grade material, applied for trace element chelation in high-end feed, pharmaceutical antibiotic intermediates, chiral peptide synthesis, and high-activity nutritional chelating raw materials for food industry.

(3) D-Phenylglycine (CAS 875-74-1)： A specialized chiral raw material, mainly used for synthetic intermediates of cephalosporin and penicillin, chiral catalytic metal chelates, and customized chelating products in fine chemical industry.

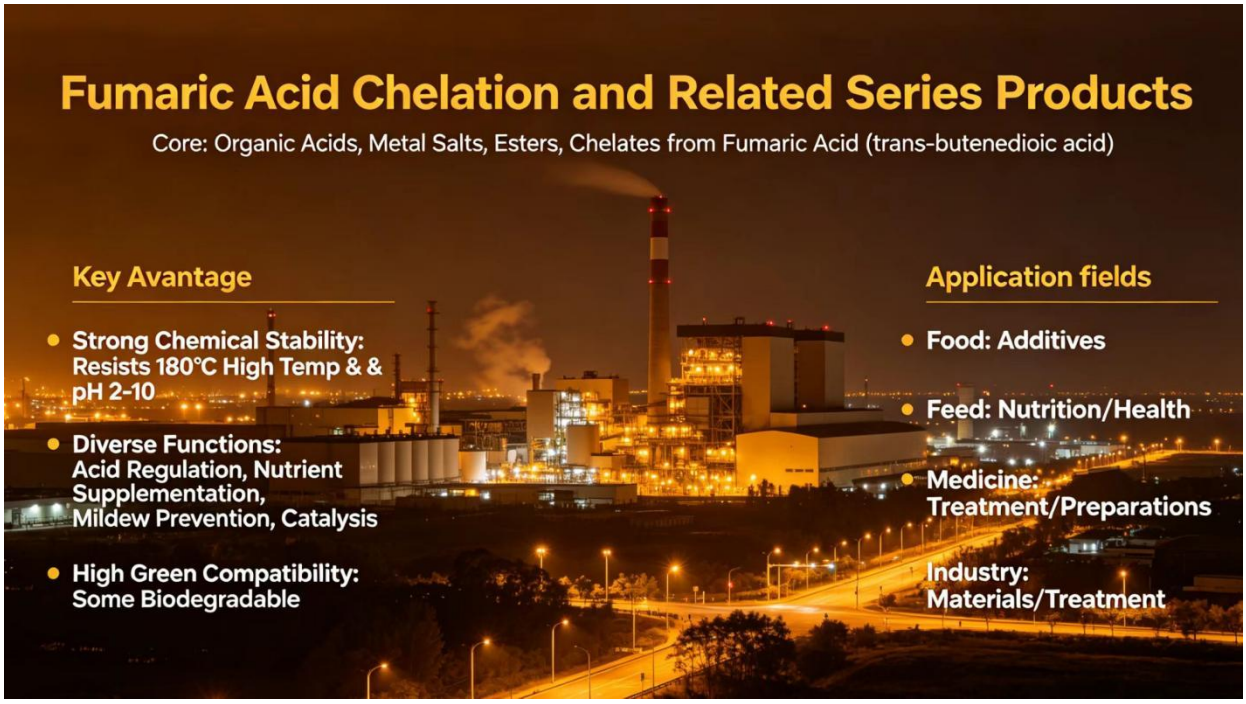
(4) DL-p-Hydroxyphenylglycine (CAS 938-97-6): A mainstream industrial derivative chelating material, widely adopted in high-end foliar water-soluble fertilizers, feed nutrition fortification, and mass production precursors for D-type pharmaceutical intermediates.

(5) L-p-Hydroxyphenylglycine (CAS 32462-30-9): High-activity biological chelating agent, specially used for high-end daily chemical formulas, pharmaceutical carrier chelation, and trace element complexation for health care products.

(6) D-p-Hydroxyphenylglycine (CAS 22818-40-2): Core pharmaceutical intermediate for amoxicillin and cephalosporin products, applied in pharmaceutical-grade metal chelation and complexing raw materials for high-end chiral drugs.

(7) Industrial Composite Phenylglycine Chelator: Adopt DL-Phenylglycine CAS 2835-06-5

Application: Suitable for heavy metal chelation of circulating industrial water, metal surface passivation treatment, and general formula compounding of multi-element compound water-soluble fertilizers.



(VIII) Fumaric Acid Chelate and Related Series Products

Derived from fumaric acid, including organic acids, metal salts, esters and chelates. Stable in chemical property, it has functions of acid regulation and bacteriostasis. Widely used in food, feed, pharmaceutical and industrial

synthesis fields.

(1) Food-Grade Fumaric Acid (CAS: 110-17-8): A white crystalline powder with a solubility of 13.8g/100mL in hot water (25℃). It acts as an acidulant (suitable for fruit candies and carbonated drinks, with acidity 1.5 times that of citric acid) and a preservative (inhibiting fruit and vegetable browning, extending freshness by 3-5 days). The global market size reached 4.725 billion yuan in 2025, with China accounting for over 60% of supply, making it the main supplier.

(2) Food-Grade Dimethyl Fumarate (CAS: 624-49-7): White needle-like crystals, slightly soluble in water. A high-efficiency mildew inhibitor (inhibiting molds and yeasts) suitable for the storage of bread and pastries (addition amount ≤0.1g/kg). It must comply with GB 2760 to avoid skin irritation caused by off-label use.

(3) Food-Grade Zinc Fumarate (CAS: 52723-61-2): A white powder slightly soluble in water (0.1g/100mL). A zinc fortifier (added to infant complementary foods and cereal flakes, with 3-5mg zinc per 100g), its absorption rate is 25% higher than that of zinc sulfate, with no metallic odor.

(4) Food-Grade Sodium Hydrogen Fumarate (CAS: 17013-01-3): A white crystalline powder with good water solubility. It serves as a baking leavening agent (suitable for cakes and bread, compounded with sodium bicarbonate for uniform gas production without collapse) and an acidulant (balancing beverage taste, replacing part of citric acid).

(5) Food-Grade Potassium Hydrogen Fumarate (CAS: 137-66-6): A white crystalline powder easily soluble in water. It acts as an acidulant (suitable for jams and pickled products, with a pH adjustment range of 3.0-4.5) and a buffer (maintaining pH stability of sports drinks), and can also be used as a reference reagent in analytical chemistry.

(6) Food-Grade Fumaric Acid Chelated Iron: A brownish-yellow powder with a chelation degree of over 90%. A dedicated iron supplement for infants (added to formula milk powder, no risk of green stools or gastrointestinal irritation) and a raw material for adult iron-supplementing oral liquids (absorption rate 30% higher than that of ferrous fumarate).

(7) Food-Grade Fumaric Acid Chelated Zinc: White crystals with strong stability (no decomposition at pH 3-9). A raw material for children's zinc-supplementing chewable tablets (fruity flavor, containing 5mg zinc per tablet), suitable for picky eaters and children with growth retardation caused by zinc deficiency.

(8) Food-Grade Fumaric Acid Chelated Magnesium: A white powder with increased solubility in acidic environments (solubility up to 20g/100mL at pH 4). A magnesium supplement for the middle-aged and elderly (added to nutritional powders to relieve fatigue and improve sleep), suitable for people with weak gastrointestinal functions.

(9) Food-Grade Fumaric Acid-Vitamin E Compound Preservative: Powdered, with a compound ratio of 1:0.5. Dedicated to oil and nut foods (chelating metal ions to prevent oxidation + vitamin E for antioxidation, doubling shelf life), complying with organic food additive standards.

(10) Food-Grade Fumaric Acid-Based Compound Leavening Agent: A white powder containing 30% fumaric acid, 40% sodium bicarbonate, and 30% starch. It slowly releases CO_2 during baking (gas production time 1.5 times longer than alum leavening agents), making bread and biscuits fluffy in texture and avoiding collapse at high temperatures.

(11) Food-Grade Fumaric Acid Polyester Packaging Material: A biodegradable polymer that decomposes into CO_2 and water in the natural environment within 6 months. Used for food packaging films (e.g., fresh food trays) and disposable tableware, meeting the requirements of the EU "Plastic Restriction Directive".

(12) Food-Grade Methyl Fumarate: A colorless liquid slightly soluble in water. An intermediate for food flavor synthesis (preparing fruit flavors) and a trace preservative (suitable for high-end fruit juices to inhibit yeast reproduction).

(13) Food-Grade Fumaric Acid Compound Acidulant: Compound of fumaric acid, malic acid, and citric acid (ratio 2:3:5). Suitable for jellies and candies, with mild acidity (non-irritating) and the ability to mask the bitterness of raw materials (e.g., traditional Chinese medicine ingredients in functional drinks).

(14) Feed-Grade Ferrous Fumarate (CAS: 141-01-5): Orange-red powder, almost insoluble in water. An iron supplement for livestock, poultry, and aquatic animals (added after piglet weaning, increasing hemoglobin content by 15% and reducing weight loss caused by anemia). Enterprises such as Nanning Zeweier can produce products with a purity of over 98%, and the detection method complies with GB/T 21694. It should be avoided to be used with tannic acid-containing feed (e.g., tea seed cake).

(15) Feed-Grade Zinc Fumarate (CAS: 52723-61-2): A white powder suitable for aquaculture (added to the feed of sea bass and prawns, with zinc absorption rate 40% higher than that of zinc sulfate, reducing zinc pollution in water). It prevents skin inflammation (e.g., skin keratinization in piglets) in livestock and poultry feed.

(16) Feed-Grade Fumaric Acid Chelated Iron: A brownish-yellow powder resistant to interference from phytic acid in feed. Used for iron supplementation in sensitive groups such as chicks and fry (no gastrointestinal irritation, increasing survival rate by 12%), and its absorption rate can be further improved when compounded with vitamin C.

(17) Feed-Grade Fumaric Acid Chelated Manganese: A light pink powder resistant to fixation in soil/feed. Added to laying hen feed (preventing slipped tendon disease and increasing eggshell strength by 20%); it promotes

growth in beef cattle feed, increasing daily weight gain by 8%.

(18) Feed-Grade Fumaric Acid Chelated Copper: Blue crystals with low cumulative toxicity (liver copper content 30% lower than that in the copper sulfate group). Added to piglet feed (promoting hematopoietic function and reducing diarrhea rate by 15%); it enhances disease resistance (e.g., white spot syndrome resistance in prawns) in aquatic feed.

(19) Feed-Grade Fumaric Acid Compound Acidifier: A white powder containing 40% fumaric acid, 30% citric acid, and 30% lactic acid. Added to piglet and chick feed (lowering intestinal pH to 3.8-4.2, inhibiting Escherichia coli and Salmonella, and increasing calcium and phosphorus utilization by 25%). Enterprises such as Nanning Zeweier have mature products, suitable for large-scale breeding.

(20) Feed-Grade Dimethyl Fumarate Complex: White granules compounded with montmorillonite (ratio 7:3). Used for mildew prevention in young animal feed (e.g., creep feed for suckling pigs, extending mildew-proof period to 60 days when moisture content is 14%), reducing the irritation of dimethyl fumarate (avoiding intestinal mucosa damage).

(21) Feed-Grade Fumaric Acid Chelated Multi-Mineral Premix: Granular, containing zinc, iron, manganese, and copper (ratio 5:3:1:1). Customized according to animal species (e.g., formula for laying hens in peak production, formula for finishing pigs in late stage), it can be directly added to basic feed, simplifying the batching process and avoiding nutritional imbalance.

(22) Feed-Grade Fumaric Acid-Bentonite Compound Mold Inhibitor: Compound of 20% fumaric acid and 80% bentonite. The adsorption of bentonite extends mildew-proof validity (effective for 30 days even in feed with high moisture content of 16%), suitable for storage in humid southern regions (e.g., Guangdong, Guangxi), with no residue risk.

(23) Feed-Grade Fumaric Acid Chelated Magnesium: A white powder suitable for ruminants (added to dairy cow and beef cattle feed, preventing muscle tremors caused by magnesium deficiency and increasing milk production by 10%); it is added during high-temperature stress to alleviate reduced feed intake.

(24) Feed-Grade Fumaric Acid-Based Feed Attractant: Compound of fumaric acid and sweetener (ratio 3:1). Added to piglet and aquatic feed (increasing feed intake by 20% and reducing creep feed waste), masking the bitterness of drugs in feed (e.g., antibiotics).

(25) Feed-Grade Fumaric Acid Chelated Selenium: A white powder with a selenium content of 0.1%-0.2%. Added to laying hen feed (producing selenium-enriched eggs with a selenium content of 0.3mg/kg); it enhances antioxidant capacity in beef cattle feed and reduces meat quality deterioration caused by transportation stress.

(26) Pharmaceutical-Grade Fumaric Acid (CAS: 110-17-8): White crystals, an intermediate for pharmaceutical synthesis (preparing ketotifen fumarate and

formoterol fumarate); it can also be used as a laxative excipient to stimulate intestinal peristalsis and relieve constipation.

(27) Pharmaceutical-Grade Methyl Fumarate (CAS: 3068-76-6): A colorless liquid, an intermediate for antibiotic synthesis (e.g., preparing cephalosporins); it is also used in external preparations for skin diseases to inhibit fungal growth (e.g., foot fungus ointment).

(28) Dimethyl Fumarate Sustained-Release Capsules (Pharmaceutical Preparation): Capsules with white pellets as contents. They protect nerve cells by activating the Nrf2 signaling pathway and are approved for the treatment of multiple sclerosis, with annual sales exceeding 1.5 billion US dollars in the North American and European markets. They must be stored away from light (to prevent decomposition).

(29) Ferrous Fumarate Granules (Pharmaceutical Preparation): Brownish granules with good water solubility (with solubilizer added). A dedicated iron supplement for children and the elderly (each sachet contains 30mg Fe^{2+}, with fruity flavor masking the odor), and the dosage should be adjusted according to body weight (3-5mg/kg per day for children).

(30) Zinc Fumarate Chewable Tablets (Pharmaceutical Preparation): White/light yellow tablets with a sweet and sour taste (orange, strawberry flavor). A zinc supplement for children and people with swallowing difficulties (each tablet contains 10mg zinc, with a bioavailability of 90%), and should be taken after meals to reduce gastrointestinal irritation.

(31) Ferrous Fumarate Capsules (Pharmaceutical Preparation): Hard capsules with brownish powder as contents. A preparation for treating iron-deficiency anemia in adults (each capsule contains 50mg Fe^{2+}, with the capsule shell masking the odor). Strong tea should be avoided during medication (tannic acid affects absorption).

(32) Fumaric Acid Monoethyl Ester-Anticancer Drug Conjugate (R&D Stage): Fumaric acid monoethyl ester modifies drugs such as paclitaxel and doxorubicin. It changes the permeability of tumor cell membranes, improves drug targeting (drug concentration at tumor sites increased by 3 times), and reduces toxicity to the heart and bone marrow. Global pharmaceutical companies are in Phase II clinical trials.

(33) Ketotifen Fumarate (Pharmaceutical Preparation): White tablets, an antihistamine. Used for the treatment of allergic rhinitis and asthma (inhibiting mast cell histamine release, with an onset time of 2-3 days). Drowsiness is the main side effect, and driving should be avoided during medication.

(34) Formoterol Fumarate (Pharmaceutical Preparation): An inhalant, a bronchodilator. Used for the maintenance treatment of chronic obstructive pulmonary disease (COPD) and asthma (fast onset, with effects lasting 12 hours). It must be used as prescribed by a doctor to avoid palpitations caused by overdose.

(35) Pharmaceutical-Grade Fumaric Acid Chelated Calcium: A white powder with good water solubility. Used for adjuvant treatment of osteoporosis in the middle-aged and elderly (supplementing 500mg calcium per day, compounded with vitamin D to promote absorption), with low gastrointestinal irritation, suitable for people with insufficient gastric acid secretion.

(36) Pharmaceutical-Grade Dimethyl Fumarate External Ointment: Ointment containing 0.5%-1% dimethyl fumarate. Used for the treatment of psoriasis (psoriasis) to inhibit excessive proliferation of skin cells. Contact with mucous membranes (e.g., eyes, mouth) should be avoided.

(37) Industrial-Grade Fumaric Acid (CAS: 110-17-8): White crystals, a core raw material for unsaturated polyester resins (accounting for 20%-30% of the resin formula). Used in anti-corrosion coatings for ships and pipelines; the resin has a hardness of 2H after curing and is resistant to acid and alkali corrosion. It can also be used as an additive in oilfield drilling fluids to adjust viscosity.

(38) Industrial-Grade Diethyl Fumarate (CAS: 623-91-6): A colorless liquid soluble in ethanol and ether. An intermediate for pharmaceutical, flavor, and dye synthesis (preparing the flavor ethyl fumarate with a fruity aroma); it can also be used as a cross-linking agent for polymer materials to improve resin heat resistance.

(39) Industrial-Grade Dibutyl Fumarate (CAS: 85-77-0): A colorless liquid insoluble in water. A plastic/rubber plasticizer (suitable for PVC and nitrile rubber, improving flexibility and reducing the low-temperature embrittlement temperature by 10℃); it can also be used as an intermediate in organic synthesis to prepare insecticides.

(40) Industrial-Grade Diisopropyl Fumarate (CAS: 623-47-2): A colorless liquid soluble in most organic solvents. An intermediate for pesticide synthesis (preparing the high-efficiency and low-toxicity herbicide "isopropyl ester grass ether"); it is used in medicine to synthesize antiepileptic drugs.

(41) Industrial-Grade Diphenyl Fumarate (CAS: 102-90-3): White crystals insoluble in water. A polymerization monomer for polymer materials (copolymerized with styrene to improve resin heat resistance, increasing the heat distortion temperature by 15℃); it can also be used as a plastic flame retardant additive to enhance flame retardancy.

(42) Industrial-Grade Dioctyl Fumarate (CAS: 141-02-6): A colorless oily liquid insoluble in water. A PVC plasticizer (suitable for pipes and cable materials used in cold regions, with excellent low-temperature toughness and remaining flexible at -20℃); it can also be used as a lubricating oil additive to improve wear resistance.

(43) Industrial-Grade Fumaric Acid Polyester: A biodegradable polymer with a melting point of 120-130℃. Used for agricultural mulch films (biodegrading

in 3-6 months in the natural environment to reduce soil white pollution) and tissue engineering scaffolds (with good cell compatibility). The global demand for green packaging market increases by 18% annually, and China accounts for over 50% of production capacity.

(44) Industrial-Grade Fumaric Acid-Modified Epoxy Resin: After incorporating fumaric acid, the epoxy value increases to 0.5-0.6eq/100g. Suitable for anti-corrosion coatings for ships and bridges; the coating hardness is 20% higher than that of ordinary epoxy resins, and VOC emissions are reduced by 30%, complying with the EU REACH standard.

(45) Industrial-Grade Fumaric Acid-Lignin Compound Adhesive: Compound of 25% fumaric acid and 75% lignin. Used in wood-based panel production (replacing formaldehyde-based adhesives, with formaldehyde emission ≤0.01mg/m³), suitable for the European and American formaldehyde-free building materials market. Wanhua Chemical in China has realized industrial production.

(46) Industrial-Grade Fumaric Acid Metal Rust Remover: Compound of 30% fumaric acid, 5% corrosion inhibitor, and 65% water. Used for metal pretreatment before electroplating and painting (quickly removing rust, with a reaction time of 10-15 minutes); its corrosiveness is only 1/3 that of traditional hydrochloric acid rust removers, suitable for precision instrument parts (e.g., electronic component pins).

(47) Industrial-Grade Fumaric Acid Compound Resin Additive: Paste containing 40% fumaric acid, 30% plasticizer, and 30% stabilizer. Added during the production of unsaturated polyester resins, it improves curing speed (shortening to 2-3 hours) and enhances resin toughness (increasing impact strength by 15kJ/m²), suitable for fiberglass-reinforced plastic products.

(48) Industrial-Grade Fumaric Acid-Acrylic Acid Copolymer: A white powder with good water solubility (30% solubility at 25℃). An antiscalant for industrial water treatment, it chelates calcium and magnesium ions with a scale inhibition rate of 95%, suitable for power plant circulating water and boiler water systems, with heat resistance up to 120℃.

(49) Industrial-Grade Diisobutyl Fumarate: A colorless liquid with excellent low-temperature fluidity (remaining unfrozen at -30℃). A plasticizer suitable for PVC pipes and automotive interiors used in cold regions, it improves the low-temperature impact resistance of materials and prevents cracking at low temperatures.

(50) Industrial-Grade Glycidyl Fumarate: A colorless liquid with an epoxy value of 0.7-0.8eq/100g. A cross-linking agent for epoxy resins, suitable for high-end electronic materials such as copper-clad laminates to improve insulation performance; it can also be used as a pharmaceutical intermediate for synthesizing antibacterial drugs.

(51) Industrial-Grade Dimethyl Fumarate Mold Inhibitor: A white powder with a purity of 99%. Used for mildew prevention in textiles and leather (e.g., sofa leather, tent fabric) with an addition amount of 0.2%-0.5% and a mildew-

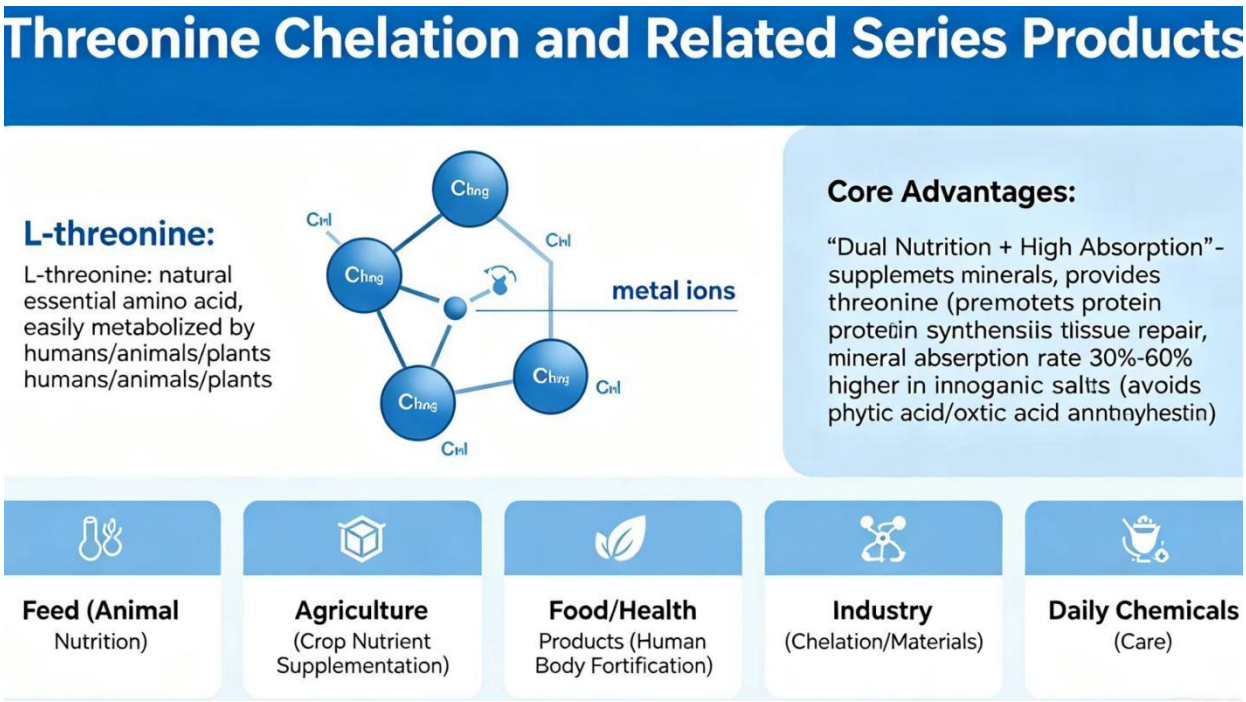
proof period of 1-2 years. It must be labeled with "Avoid direct skin contact".

(52) Industrial-Grade Fumaric Acid-Based Concrete Admixture: A liquid containing 20% fumaric acid and 80% water reducer. Added to concrete, it improves fluidity, reduces water-cement ratio, and increases compressive strength by 15%, suitable for mass concrete projects such as bridges and dams.

(53) Industrial-Grade Fumaric Acid Chelated Heavy Metal Treatment Agent: A brownish-yellow liquid with a chelation degree of over 95%. Used for electroplating wastewater treatment, it chelates lead, cadmium, and nickel ions with a removal rate of 99%, reducing sludge volume by 40% compared with traditional agents and complying with the GB 21900 discharge standard.

(54) Industrial-Grade Butyl Fumarate: A colorless liquid soluble in organic solvents. An intermediate for pesticide synthesis (preparing the low-toxicity insecticide "butyl dinotefuran"); it can also be used as a coating solvent suitable for environmentally friendly latex paints to reduce VOC emissions.

(55) Industrial-Grade Dipropyl Fumarate: A colorless liquid with strong heat resistance (thermal decomposition temperature of 200℃). A plasticizer for plastic parts used in high-temperature environments (e.g., plastic parts around automotive engines, oven liners), it improves the heat aging resistance of materials and extends their service life.



(IX) Threonine Chelate and Related Series Products

Made from L-threonine to form stable metal chelates with good absorption. Applied in feed nutrition, crop fertilization, food nutrition, daily chemicals and industrial complexing fields.

(1) Feed-Grade Threonine Chelated Zinc: Synthesized from threonine and zinc oxide at a 2:1 molar ratio, with zinc content ≥18.5% and chelation rate ≥ 95%. Added to piglet feed (80-120mg/kg), its zinc absorption rate is 50% higher than that of zinc sulfate, preventing skin keratinization and increasing daily weight gain by 10%; added to aquatic feed (for sea bass/prawns), it reduces zinc pollution in water and increases survival rate by 15%, complying with the GB/T 22488 feed standard.

(2) Feed-Grade Threonine Chelated Iron: Chelated from threonine and ferrous chloride, with iron content ≥15% and no iron-like odor. Added to chick/fry feed (60-100mg/kg), its bioavailability is twice that of ferrous sulfate, preventing iron-deficiency anemia (hemoglobin increased by 20%) and avoiding intestinal flora imbalance.

(3) Feed-Grade Threonine Chelated Calcium-Magnesium: With a calcium-magnesium ratio of 3:1 and free threonine ≥25%. Added to laying hen feed (200-300mg/kg), it reduces eggshell breakage rate by 25% and extends the peak laying period; added to dairy cow feed, it increases milk production by 8% and improves calcium content in milk.

(4) Feed-Grade Threonine Chelated Copper: With copper content of approximately 20% and low cumulative toxicity (liver copper content reduced by 40%). Added to beef cattle feed (10-15mg/kg), it promotes hematopoiesis and improves fur color; added to piglet feed, it reduces diarrhea rate by 18%.

(5) Feed-Grade Threonine Chelated Manganese: With manganese content ≥16% and resistance to phytic acid interference. Added to breeding chicken feed (50-80mg/kg), it prevents slipped tendon disease and increases fertilization rate of breeding eggs by 20%; added to beef cattle feed, it reduces the incidence of rickets.

(6) Feed-Grade Threonine Chelated Cobalt: With cobalt content of 10%-12%, dedicated to ruminants. Added to dairy cow/sheep feed (0.1-0.3mg/kg), it promotes rumen microorganisms to synthesize vitamin B_{12}, increases crude fiber digestibility by 15%, and prevents cobalt-deficiency anemia.

(7) Feed-Grade Threonine Chelated Multi-Mineral Compound: Core components include threonine chelated zinc (15%), manganese (12%), iron (10%), compounded with vitamins A/D (1:0.5) and phytase. Customized according to livestock and poultry species (formulas for early-stage piglets/peak laying period of laying hens), with free amino acids ≥20%, it regulates amino acid balance, reduces nitrogen content in feces by 30% (reducing pollution), and can be directly mixed into feed without secondary batching.

(8) Threonine Residue Compound Feed Raw Material: Using threonine mother liquor (containing 20% threonine and 52% protein), sprayed on corn germ meal and dried, with protein ≥40% and threonine ≥5%. It replaces 20% soybean meal in fattening pig feed, reducing costs by 15% without affecting growth performance.

(9) Feed-Grade Threonine Chelated Selenium: With selenium content of 0.1%-0.2% (selenothreonine structure). Added to laying hen feed (0.3-0.5mg/kg), it produces selenium-enriched eggs (selenium content 0.3mg/kg); added to broiler feed, it resists transportation stress and reduces mortality by 8%.

(10) Feed-Grade Threonine Chelated Potassium: With potassium content ≥12% and good water solubility. Added to laying hen feed (100-150mg/kg) in high-temperature seasons, it maintains electrolyte balance and reduces feed intake decline caused by heat stress.

(11) Threonine-Probiotic Compound Feed Additive: Contains threonine chelated zinc (5%) + Bacillus subtilis (10^9CFU/g). Added to piglets after weaning, it supplements zinc to promote growth + regulates intestinal flora (lactic acid bacteria increased by 2 times), reducing diarrhea rate by 25%.

(12) Feed-Grade Threonine Chelated Vanadium: Explored in laboratories for use in beef cattle feed to assist in regulating glucose metabolism and increasing lean meat rate by 5%; not yet commercialized, requiring safety verification.

(13) Fertilizer-Grade Threonine Chelated Zinc: With zinc content ≥15% and full water solubility (30g/100mL at 25℃). Foliar spraying controls maize dwarf mosaic disease/citrus mottled leaves, with new leaves turning green in 7 days, and zinc absorption rate 40% higher than that of zinc sulfate; soil basal application in alkaline soils avoids zinc fixation.

(14) Fertilizer-Grade Threonine Chelated Iron: With iron content ≥12% and alkali resistance (no precipitation at pH 8-9). Foliar spraying corrects iron-deficiency chlorosis in grapes/roses, with a greening rate of 90%; compounded with NPK, it increases photosynthetic efficiency by 18% and yield by 10%.

(15) Fertilizer-Grade Threonine Chelated Calcium-Magnesium: With a calcium-magnesium ratio of 2:1, suitable for the fruit enlargement stage of fruits and vegetables. Sprayed on tomatoes/strawberries, it reduces cracking rate by 30% and blossom-end rot incidence by 25%, extending fruit shelf life by 2-3 days; soil basal application in acidic soils increases pH by 0.5-1.0.

(16) Fertilizer-Grade Threonine Chelated Copper: With copper content ≥18%. Sprayed on apples/pears during flowering, it promotes pollen development and increases fruit set rate by 15%; it controls copper-deficiency top blight and reduces anthracnose incidence by 20%.

(17) Fertilizer-Grade Threonine Chelated Manganese: With manganese content ≥14%. Sprayed on wheat/sugar beets, it alleviates striped chlorosis and increases thousand-grain weight by 5g; compounded with molybdenum fertilizer, it increases nitrogen fixation efficiency of legumes by 25%.

(18) Agricultural-Grade Threonine Stress-Resistant Compound Aqueous Agent: Contains 4-46g/L threonine, 100g/L fulvic acid, and 50g/L amino acids. Sprayed on cotton/tomatoes, it promotes insect-resistant protein synthesis (cotton bollworm egg laying reduced by 40%), resists drought (yield loss reduced by 15%), and resists downy mildew (incidence reduced by 20%).

(19) Fertilizer-Grade Threonine Chelated Selenium: With selenium content ≥ 0.5%. Sprayed on selenium-enriched tea/rice, it achieves a selenium absorption rate of 80%, with selenium content in selenium-enriched rice reaching 0.15mg/kg, increasing the added value of agricultural products.

(20) Fertilizer-Grade Threonine Chelated Boron: With boron content ≥10%. Sprayed on rapeseed/fruit trees during flowering, it increases pollen tube elongation rate by 20% and pod setting rate/fruit set rate by 25%; compounded with zinc fertilizer, it synergistically enhances stress resistance.

(21) Threonine-Polyglutamic Acid Compound Foliar Fertilizer: Contains threonine chelated zinc/iron (5%) + polyglutamic acid (3%). Sprayed on greenhouse tomatoes/cucumbers, it increases fresh root weight by 30%, increases yield in continuous cropping soil by 12%, and reduces soil-borne diseases.

(22) Fertilizer-Grade Threonine Chelated Titanium: With titanium content ≥ 0.1%. Sprayed on fruits and vegetables, it increases chlorophyll content by 18% and photosynthetic intensity by 20%, increasing fruit sugar content by 1-2 degrees and vitamin C by 15%, suitable for areas with insufficient light.

(23) Fertilizer-Grade Threonine Chelated Silicon: With silicon content ≥ 20%. Soil basal application on rice/wheat enhances stem toughness, increases lodging resistance by 30%, and reduces rice planthopper incidence by 25%.

(24) Food-Grade Threonine Chelated Zinc: With zinc content ≥15%, complying with GB 14880-2012. Added to children's milk powder (5-8mg/100g) and chewable tablets (fruity flavor), its zinc absorption rate is 30% higher than that of zinc gluconate, promoting height growth (1-2cm/year) and enhancing immunity.

(25) Food-Grade Threonine Chelated Iron: With iron content ≥10% and no gastrointestinal irritation. Added to iron-supplementing oral liquids/nutritional cereals (10-15mg/100g), it is taken by pregnant/lactating women to increase hemoglobin by 15% and improve iron-deficiency anemia.

(26) Food-Grade Threonine Chelated Calcium-Magnesium: With calcium content ≥20% and magnesium content ≥8%. Added to middle-aged and elderly calcium tablets/liquid calcium, its calcium absorption rate is 40% higher than that of calcium carbonate, suitable for people with insufficient gastric acid, increasing bone mineral density by 5%.

(27) Food-Grade Threonine Chelated Copper: With copper content ≥18%. Added to cereal flakes (0.5-1mg/100g), it meets the daily copper requirement of adults (1.2mg/day) and maintains immune function and connective tissue health.

(28) Food-Grade Threonine Chelated Manganese: With manganese content ≥12%. Added to compound vitamin tablets (1mg/tablet), it maintains nervous system and bone function, suitable for vegetarians (low manganese absorption from plant-based foods).

(29) Food-Grade Threonine Nutritional Compound Powder: Contains threonine

(10%) + glucose (60%) + B vitamins (5%). Added to infant milk powder (2-3g/100g) and sports drinks (0.5g/100mL), it strengthens amino acid nutrition and accelerates post-exercise fatigue relief by 25%.

(30) Threonine-Natural Ingredient Compound Health Product: Contains threonine (20%) + lentinan (10%)+ quercetin (5%). Capsules (0.5g/capsule) enhance polysaccharide anti-tumor activity by 20% and flavonoid antioxidant efficiency by 30%, suitable for people with low immunity and sub-health.

(31) Food-Grade Threonine Chelated Selenium: With selenium content ≥0.1%. Added to selenium-enriched selenium tablets/eggs, its selenium absorption rate is 80% higher than that of sodium selenite, increasing glutathione peroxidase activity by 30%, suitable for people in selenium-deficient areas.

(32) Food-Grade Threonine Chelated Chromium: With chromium content ≥0.2%. Added to blood sugar-lowering milk powder/meal replacement powder (100μg/100g), it reduces postprandial blood glucose peak by 10%, suitable for people in the pre-diabetic stage.

(33) Threonine-Collagen Compound Health Product: Contains threonine (15%) + collagen peptides (60%). Oral liquid (10mL/bottle), threonine promotes collagen synthesis, increasing skin moisture content by 15%, suitable for women's anti-aging.

(34) Food-Grade Threonine Chelated Strontium: With strontium content ≥15%. Added to bone health milk powder (50mg/100g), it promotes bone formation and inhibits bone resorption, suitable for middle-aged and elderly people with osteoporosis.

(35) Threonine-N,N-Diacetic Acid (THDA) Complex: A colorless liquid with a chelation capacity of 400mg $CaCO_3$ /g. Added to industrial detergents (replacing EDTA), it prevents soap scum and increases decontamination power by 15%; added to oilfield drilling fluids, it prevents calcium and magnesium ion scaling.

(36) 4-(Carboxymethyl)-2-methyl-6-oxomorpholine-3-carboxylic Acid: A closed-loop product of THDA, white powder. A delayed chelating agent for oil/gas fields (active release delayed to 48 hours at 80℃), suitable for deep well drilling to avoid high-temperature failure.

(37) Threonine-N,N-Diacetic Acid Mixed Alkali Metal Salt (sodium-potassium 3:1): Remains liquid at 60% high concentration (viscosity ≤50mPa·s) and does not freeze at -10℃. Added to textile printing and dyeing/electroplating solutions, it is easy to transport and has no precipitation, improving production efficiency.

(38) L-Threonine-O-Phosphate (CAS: 1114-81-4): White crystals with purity ≥98%. A biochemical reagent (for amino acid metabolism research) and pharmaceutical intermediate (for synthesizing antiviral phosphate drugs), with clear demand in biopharmaceutical R&D.

(39) Threonine Methyl Ester Hydrochloride: White powder, easily soluble in

ethanol. A starting material for peptide synthesis (thymosin/growth hormone) and antidepressant intermediate, with a process yield ≥90%, suitable for fine chemicals.

(40) Industrial-Grade Threonine Chelated Copper: With copper content ≥20%. A colorant for PVC/rubber (blue products) and coating catalyst (curing speed increased by 20%); an electroplating additive that improves coating uniformity and reduces pinholes.

(41) Industrial-Grade Threonine Chelated Manganese: With manganese content ≥16%. Used for steel phosphating (corrosion resistance increased by 30%) and catalyst for benzene oxidation to phenol (efficiency increased by 15%).

(42) Threonine-Based Polymer Chelating Agent: Graft copolymer of threonine and acrylic acid, white powder. Used for electroplating wastewater treatment (lead/cadmium removal rate 99%), reducing sludge volume by 40% compared with traditional agents.

(43) Threonine-Modified Epoxy Resin: Impact strength increased by 25% after incorporating threonine. An electronic packaging material (chip packaging) that shows no cracking after 1000 hours of aging at 85℃/85%RH, with excellent moisture and heat resistance.

(44) Industrial-Grade Threonine Chelated Tungsten: With tungsten content ≥ 30%. Used for hard alloy preparation (hardness up to HRC 65), suitable for cutting tools/molds; a catalyst for petroleum hydrodesulfurization (desulfurization efficiency increased by 20%).

(45) Industrial-Grade Threonine Chelated Nickel: With nickel content ≥18%. An electroplating brightener (coating gloss increased by 30%) and chemical hydrogenation catalyst (reaction selectivity increased by 15%), suitable for precision electronics/pharmaceutical synthesis.

(46) N-Acetyl-L-Threonine: White powder with a skin irritation score of 0. A cosmetic moisturizer (added 3%-5% to face creams/serums), with moisturizing performance comparable to hyaluronic acid, reducing transepidermal water loss by 20%; a food acidulant (added 0.1%-0.3% to high-end fruit juices), with a mild taste.

(47) Cosmetic-Grade Threonine Compound Conditioner: Contains threonine (5%) + vitamin C (3%) + tea polyphenols (2%). Added to whitening serums/masks, it promotes absorption of active ingredients, reduces melanin content by 15% and free radical scavenging rate by 40%, with a risk index of Grade 1, suitable for pregnant women.

(48) Daily Chemical-Grade Threonine Chelated Zinc: With zinc content ≥15%. Added 1%-2% to oil-controlling cleansers/toners, it inhibits Propionibacterium acnes (bacteria amount reduced by 60%) and reduces sebum secretion by 25%, suitable for oily sensitive skin.

(49) Threonine-Ceramide Compound Moisturizer: Contains threonine (4%) + ceramide (1%). Added to hand creams/body lotions, it increases skin moisture

content of dry skin by 30% and repairs the barrier, suitable for autumn and winter.

(50) Daily Chemical-Grade Threonine Chelated Magnesium: With magnesium content ≥8%. Added 0.5%-1% to shampoo, it regulates scalp oil, reduces dandruff by 40%, and at the same time moisturizes hair and reduces frizz.

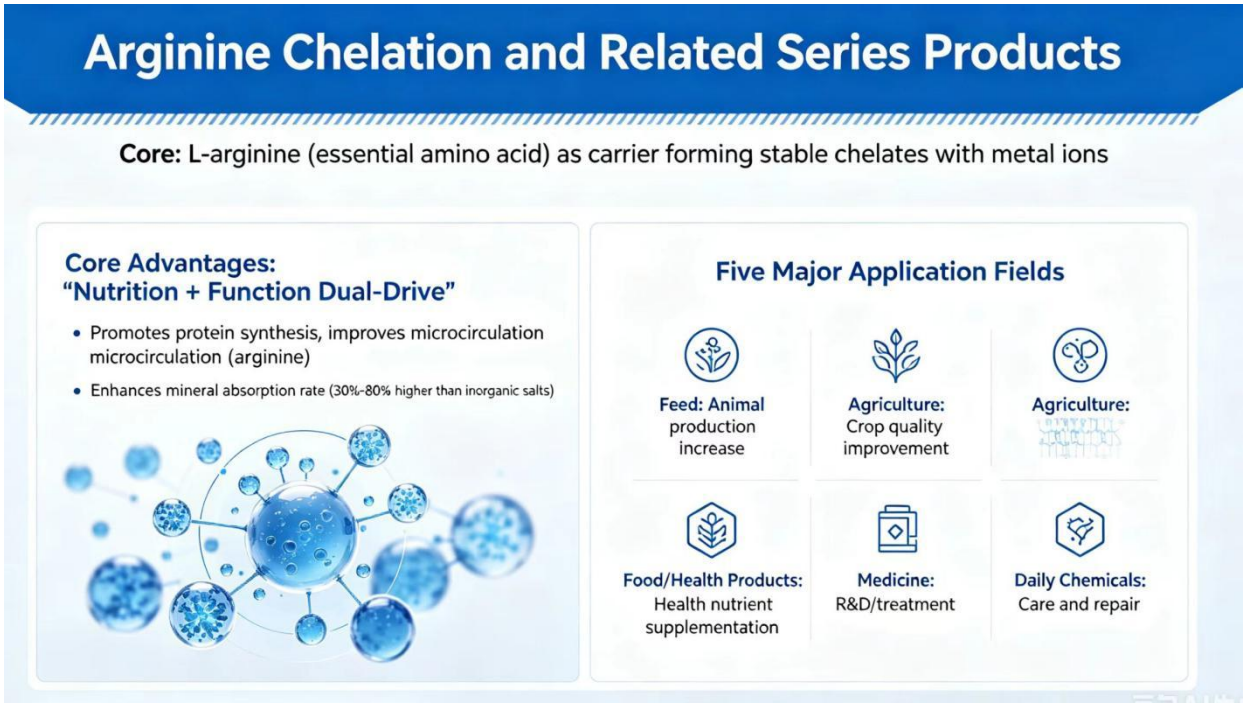
(51) Threonine Compound Antioxidant Serum: Contains threonine (5%) + ergothioneine (2%) + vitamin E (1%). Added to eye creams, it fades fine lines (reducing fine line depth by 15%) and resists blue light damage, suitable for people who stay up late.

(52) Pharmaceutical-Grade L-Threonine-O-Phosphate: With a purity of ≥99.5%. An intermediate for antiviral drugs (anti-hepatitis B virus drugs), improving drug water solubility and bioavailability.

(53) Pharmaceutical-Grade Threonine Methyl Ester Hydrochloride: A raw material for peptide drug synthesis (insulin/oxytocin), with a purity of 99% for amino acid protection units, reducing side reactions.

(54) Pharmaceutical-Grade Threonine Chelated Iron: With an iron content of ≥12%. A raw material for sustained-release iron-supplementing tablets (100mg/tablet), which releases slowly for 12 hours to avoid a sudden increase in blood iron, suitable for patients with chronic iron-deficiency anemia.

(55) Threonine-Drug Conjugate (R&D Item): Threonine is used as a targeting carrier and conjugated with paclitaxel. The drug concentration at tumor sites is increased by 3 times, reducing toxicity to normal cells, and it is in the preclinical research stage.



(X) Arginine Chelated and Associated Product Series

Various salts, esters and chelating derivatives are prepared from fumaric acid. It can adjust acidity and inhibit microbial growth, used for food acid regulation, feed formulation, pharmaceutical intermediate synthesis and industrial chemical synthesis.

I. Feed Field (Animal Nutrition + Breeding Efficiency Enhancement)

(1) Arginine Chelated Iron (Feed-specific): Iron content ≥15%, no need for vitamin C to assist absorption; added to piglet/chick feed (60-100mg/kg), it improves iron-deficiency anemia (hemoglobin increases by 20%), reduces growth retardation, and increases daily weight gain by 12%.

(2) Arginine Chelated Manganese (Feed-specific): Manganese content ≥16%, resistant to phytic acid interference; added to sow feed (50-80mg/kg), it increases the number of piglets per litter by 1-2; when added to layer feed, it improves eggshell strength by 25% and reduces breakage rate by 18%.

(3) Arginine Chelated Copper (Feed-specific): Copper content ≥20%; added to weaned piglet feed (10-15mg/kg), it increases weight gain by 15-20% and reduces feed conversion ratio by 5-10%; when added to poultry feed, it enhances immunity and reduces the incidence of respiratory diseases by 20%.

(4) Arginine Chelated Zinc (Feed-specific): Zinc content ≥18%; added to broiler/fattening pig feed (80-120mg/kg), it reduces diarrhea incidence by 25%, improves feed utilization rate by 15%, and avoids zinc loss caused by phytic acid.

(5) Arginine Chelated Magnesium (Feed-specific): Magnesium content ≥8%;

added to ruminant (cattle/sheep) feed (100-150mg/kg), it prevents magnesium-deficiency neurological disorders (such as muscle tremors), increases feed intake by 10%, and boosts milk production of dairy cows by 8%.

(6) Arginine Chelated Cobalt (Feed-specific): Cobalt content 10%-12%; added to high-yield dairy cow feed (0.1-0.3mg/kg), it stimulates bone marrow hematopoiesis, improves anemia, and enhances milk quality (milk protein content increases by 0.5 percentage points).

(7) Arginine Chelated Nickel (Aquaculture-specific): Nickel content ≥5%; added to fish and shrimp feed (5-300g/ton), it enhances immunity, reduces disease incidence by 30%, and decreases water-soluble loss of metal ions (water pollution reduces by 40%).

(8) Arginine Chelated Vanadium (Feed-specific): Vanadium content ≥0.1%; added to fattening pig/broiler feed (0.05-0.1mg/kg), it improves growth efficiency by 15%, optimizes glucose and lipid metabolism, and shortens the breeding cycle by 7-10 days.

(9) Arginine Chelated Selenium (Feed-specific): Selenium content 0.1%-0.2%; added to livestock and poultry feed (0.3-0.5mg/kg), it enhances stress resistance (transport mortality reduces by 10%); when added to aquaculture feed, it improves disease resistance and increases survival rate by 12%.

(10) Arginine Chelated Potassium (Feed-specific): Potassium content ≥12%; added to high-yield dairy cow/beef cattle feed (100-150mg/kg), it maintains fluid balance and energy metabolism, and prevents milk production decline and muscle weakness.

(11) Universal Compound Agent for Livestock and Poultry: Arginine chelated iron (15%) + manganese (12%) + zinc (10), compounded with vitamin A/D (1:0.5); it provides one-stop trace element supplementation, balances dietary nutrition, improves feed conversion rate by 15%, and is suitable for general use in pigs, chickens, and ducks.

(12) Aquaculture-specific Compound Agent: Arginine chelated copper (8%) + zinc (12), compounded with prebiotics (oligosaccharides); it enhances the stress resistance of fish and shrimp (high-temperature survival rate increases by 20%), reduces the loss of metal ions in water, and balances growth promotion and environmental protection.

(13) Feed-grade Arginine Chelated Multi-mineral Compound: Core components include arginine chelated iron (10%), zinc (15%), manganese (12), compounded with vitamin A/E (2:1) and phytase; free amino acid ≥18%; it comprehensively improves the growth performance (daily weight gain increases by 15%) and immunity oflivestock and poultry, and reduces breeding costs by 20%.

(14) Arginine Residue Compound Feed Raw Material: Using arginine mother liquor (containing 18% arginine and 50% crude protein), mixed with soybean meal at a ratio of 1:4 and dried; protein content ≥45%; it can replace 20% fish meal in aquaculture feed, reducing costs by 15% without affecting the growth rate of fish and shrimp.

(15) Arginine Chelated Chromium (Feed-specific): Chromium content ≥0.2%; added to fattening pig feed (0.1-0.2mg/kg), it increases lean meat rate by 5%, reduces fat deposition, and is suitable for high-end pork breeding.

(16) Arginine Chelated Molybdenum (Feed-specific): Molybdenum content ≥5%; added to ruminant feed (0.5-1mg/kg), it maintains purine metabolism, prevents molybdenum-deficiency diarrhea, and is suitable for beef cattle and sheep breeding.

II. Agricultural Field (Crop Nutrient Supplementation + Stress Resistance and Quality Improvement)

(17) Arginine Chelated Copper (Agriculture-specific): Copper content ≥18%; sprayed as foliar fertilizer for fruits and vegetables (diluted 500-800 times), it enhances disease resistance (anthracnose incidence reduces by 25%), decreases fruit cracking (e.g., tomato cracking rate reduces by 30%), increases fruit sweetness by 1-2 degrees, and improves storage and transportation resistance.

(18) Arginine Chelated Potassium (Agriculture-specific): Potassium content ≥20%; sprayed on strawberries and tomatoes during the fruit expansion period (diluted 300-500 times), it supplements potassium, enhances lodging resistance, improves fruit quality (sugar-acid ratio increases by 20%), and boosts yield by 15%.

(19) Arginine Chelated Selenium (Agriculture-specific): Selenium content approximately 0.5%; sprayed on rice and wheat during the filling stage (diluted 1000 times), it increases selenium content in grains to 0.15mg/kg (selenium-rich standard), and at the same time enhances crop lodging resistance (stem thickness increases by 0.1cm) and disease and pest resistance.

(20) Arginine Chelated Boron (Agriculture-specific): Boron content approximately 8%; sprayed on rapeseed and tomatoes during the flowering period (diluted 800 times), it promotes pollen germination and pollen tube elongation (pollen tube length increases by 20%), improves fruit setting rate by 15%-20%, and prevents "flowering without fruiting".

(21) Arginine Chelated Rare Earth (Agriculture-specific): Rare earth content ≥5%; applied as root irrigation for crops at the seedling stage (diluted 500 times), it promotes root development (fresh root weight increases by 30%), enhances photosynthesis (photosynthetic efficiency increases by 18%), and improves quality (e.g., vitamin C content in vegetables increases by 15%) and yield (increases by 10%).

(22) Agricultural Stress Resistance Compound Agent: Arginine chelated selenium (0.5%) + potassium (15%), compounded with fulvic acid (5%); sprayed on crops before drought/saline-alkali stress (diluted 500 times), it enhances stress resistance (yield reduction under drought conditions decreases by 20%) and improves quality simultaneously.

(23) Agricultural Arginine Stress Resistance Compound Aqueous Agent:

Contains arginine (8g/L), fulvic acid (5g/L), and zinc (2g/L); sprayed on corn and cotton in arid/saline-alkali areas, it promotes root development (root length increases by 25%), improves drought and salt tolerance, and increases yield by 12%.

(24) Arginine Chelated Calcium (Agriculture-specific): Calcium content ≥ 20%; sprayed on grapes and cherries during the fruit expansion period (diluted 600 times), it prevents fruit cracking (cracking rate reduces by 35%) and blossom-end rot, increases fruit firmness by 20%, and extends shelf life by 2-3 days.

(25) Arginine Chelated Magnesium (Agriculture-specific): Magnesium content ≥10%; sprayed on bananas and citrus when magnesium-deficiency chlorosis occurs (diluted 500 times), it achieves a leaf greening rate of 90%, increases photosynthate accumulation, and raises fruit sweetness by 1 degree.

(26) Arginine Chelated Manganese (Agriculture-specific): Manganese content ≥14%; sprayed on wheat and sugar beets (diluted 800 times), it alleviates striped chlorosis, improves enzyme activity (nitrate reductase activity increases by 25%), and increases 1000-grain weight by 5g.

(27) Arginine Chelated Titanium (Agriculture-specific): Titanium content ≥ 0.1%; sprayed on fruits and vegetables during the fruit expansion period (diluted 1000 times), it increases chlorophyll content by 18%, enhances photosynthetic intensity by 20%, and improves fruit color uniformity by 25%, suitable for apple and citrus cultivation.

(28) Arginine Chelated Silicon (Agriculture-specific): Silicon content ≥ 20%; sprayed on rice and wheat during the jointing stage (diluted 500 times), it enhances stem toughness, increases lodging resistance rate by 30%, and reduces the incidence of rice planthoppers by 25%.

III. Food/Healthcare Product Field (Human Nutritional Fortification)

(29) Arginine Chelated Iron (Food-specific): Iron content ≥12%, no gastrointestinal irritation such as nausea and constipation; used as a raw material for iron-supplementing oral liquids for pregnant/lactating women (containing 15mg Fe^{2+} per 100mL); when taken by people with sensitive gastrointestinal tracts, it increases hemoglobin by 15% and improves iron-deficiency anemia.

(30) Arginine Chelated Calcium (Food/Healthcare Product-specific): Calcium content ≥20%, arginine promotes active intestinal absorption; added to middle-aged and elderly calcium tablets/milk powder (containing 200mg calcium per 100g), it enhances bone mineral density (increases by 5%), improves joint flexibility, and is suitable for osteoporosis prevention.

(31) Arginine Chelated Zinc (Food/Healthcare Product-specific): Zinc content ≥18%, bioavailability is 30% higher than that of zinc sulfate; children's chewable tablets (containing 5mg zinc per tablet, with fruit flavor) prevent growth retardation; adult capsules improve male reproductive health (sperm motility increases by 20%) and enhance immunity.

(32) Arginine Chelated Magnesium (Food/Healthcare Product-specific): Magnesium content ≥8%; added to sports nutrition products (containing 100mg magnesium per 100g), it relieves muscle spasms; middle-aged and elderly health products improve sleep (sleep onset time shortens by 15 minutes) and assist in blood pressure regulation (systolic blood pressure decreases by 5-10mmHg).

(33) Arginine Chelated Chromium (Food/Healthcare Product-specific): Chromium content ≥0.2%; added to sugar-controlled foods/healthcare products (containing 100μg chromium per 100g), it assists in blood glucose regulation (postprandial blood glucose peak decreases by 10%-15%), improves insulin sensitivity, and is suitable for people in the pre-diabetic stage.

(34) Arginine Chelated Selenium (Food-specific): Selenium content ≥0.1%; added to selenium-rich foods (such as selenium tablets and grains), it assists in improving immunity (lymphocyte activity increases by 20%) and thyroid function, suitable for people in selenium-deficient areas.

(35) Arginine Chelated Molybdenum (Food-specific): Molybdenum content ≥5%; added to multivitamins (containing 50μg molybdenum per tablet); molybdenum participates in metabolism, and arginine protects blood vessels, which synergistically improves microcirculation and enhances immunity, suitable for middle-aged and elderly people.

(36) Arginine Chelated Zinc Oral Liquid (Children-specific): Contains 5mg zinc per 10mL, added with strawberry flavor, with a sweet taste and no irritation; children take 1 tube daily to prevent picky eating and growth retardation, and zinc absorption rate reaches 90%.

(37) Arginine Bicarbonate (Beverage-specific): Weakly alkaline (pH 7.5-8.0); added to sports drinks and plant-based beverages (0.5%-1%), it regulates pH value (avoids acid corrosion of teeth), provides amino acid nutrition, and relieves sports fatigue.

(38) Arginine-Natural Ingredient Compound Nutritional Supplement: Arginine (20%) + wolfberry polysaccharide (10%) + ginsenoside (5%); hard capsules (0.5g per capsule), 2 capsules daily, which improves immunity (cold incidence reduces by 25%), resists fatigue (energy recovery speed increases by 30%), and is suitable for high-intensity workers and athletes.

(39) Arginine Chelated Strontium (Food/Healthcare Product-specific): Strontium content ≥15%; added to bone health milk powder (containing 50mg strontium per 100g), it promotes bone formation and inhibits bone resorption, suitable for middle-aged and elderly people with osteoporosis.

(40) Arginine Chelated Potassium (Food-specific): Potassium content ≥12%; added to low-sodium salt/sports drinks (containing 300mg potassium per 100g), it supplements electrolytes, maintains stable blood pressure, and is suitable for people with hypertension and athletes.

IV. Pharmaceutical Field (R&D/Therapeutic Assistance)

(41) Arginine Chelated Calcium (Pharmaceutical-specific): High-purity grade (≥99%); used as an auxiliary clinical treatment for osteoporosis (supplementing 500mg calcium daily), it must be used under medical advice; gastrointestinal irritation is 40% lower than that of calcium carbonate, suitable for patients with insufficient gastric acid secretion.

(42) Pharmaceutical-grade Derivative - N-Nitro-L-arginine: A reagent for cardiovascular disease research; it inhibits nitric oxide synthesis and is used in hypertension and myocardial ischemia model research, requiring laboratory control.

(43) Pharmaceutical-grade Derivative - L-Arginine Phosphate: A raw material for injection R&D; it improves drug water solubility and bioavailability, and is used in amino acid transfusion and cardiovascular drug R&D, suitable for clinical nutritional support.

(44) Arginine N-Hydroxysuccinimide Ester (CAS: 17896-24-7): A reagent for protein chemical modification and an intermediate for antibody-drug conjugate (ADC) synthesis; it activates arginine amino groups, improves drug targeting, and has clear demand in the pharmaceutical R&D field.

(45) Arginine Chelated Iron (Pharmaceutical-grade): Iron content ≥15%, purity ≥99.5%; a raw material for chronic iron-deficiency anemia treatment preparations (sustained-release tablets), which releases slowly for 12 hours to avoid sudden increase in blood iron, suitable for people who need long-term iron supplementation.

(46) Arginine Chelated Cobalt (Pharmaceutical-grade): Cobalt content ≥10%; a precursor for vitamin B_{12} synthesis, used as an auxiliary raw material for the treatment of megaloblastic anemia, suitable for patients with absorption disorders (such as gastrointestinal diseases).

V. Daily Chemical Field (Care + Additives)

(47) Daily Chemical/Food-grade Derivative - Hydroxypropyl Arginine Lauryl Ether Hydrochloride: A raw material for hair conditioners (addition amount 2%-5%); it repairs hair cores (hair scale closure rate increases by 30%), enhances smoothness, and is suitable for damaged hair care.

(48) Daily Chemical/Food-grade Derivative - L-Arginine Hydrochloride: A raw material for sports nutrition products (addition amount 5%-10%); it promotes nitric oxide synthesis and improves exercise endurance; it can also be used as a pH regulator in cosmetics (suitable for weakly acidic formulations).

(49) N-Acetyl-L-arginine: Good water solubility, skin irritation score 0; a humectant in skincare products (added 3%-5% to face creams/serums), it relieves skin dryness (moisture content increases by 25%), enhances skin barrier function, and is suitable for sensitive skin.

(50) Cosmetic-grade Arginine Compound Conditioner: Arginine(5%) + Hyaluronic Acid (2%) + Ceramide (1%); pH value 5.5-6.5 (close to skin pH); added to sensitive skin care products, it soothes redness (red blood streaks reduce by

20%) and repairs the skin barrier, suitable for the sensitive period of seasonal changes.

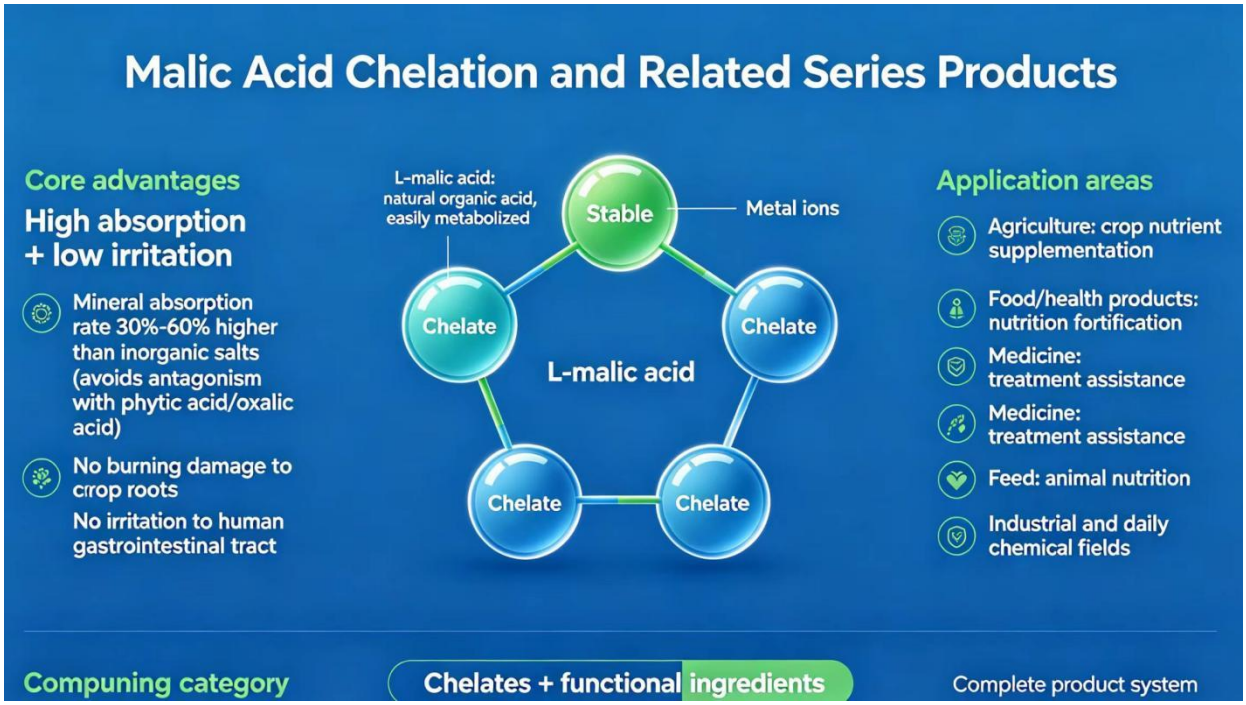
(51) Arginine Chelated Zinc (Daily Chemical Grade): Zinc content ≥15%; added 1%-2% to oil-controlling facial cleansers/toners, it inhibits Propionibacterium acnes (bacterial count reduces by 60%) and decreases sebum secretion (sebum amount reduces by 25%), suitable for oily and sensitive skin.

(52) Arginine Compound Antioxidant Serum: Arginine (5%) + Vitamin C (3%) + Ergothioneine (2%); added to eye creams/facial serums, it fades fine lines (depth reduces by 15%) and resists blue light damage, suitable for people who stay up late or face electronic screens for a long time.

(53) Arginine Chelated Magnesium (Daily Chemical Grade): Magnesium content ≥8%; added 0.5%-1% to body lotions/hand creams, it soothes skin sensitivity (itching sensation reduces by 30%) and enhances moisture retention, suitable for dry skin.

(54) Arginine-based Surfactant: A mild surfactant (Cocoyl Arginine Ethyl Ester Hydrochloride); added 5%-8% to facial cleansing mousses/baby body washes, it has strong cleansing power without damaging the skin barrier, suitable for infants and sensitive skin.

(55) Arginine Compound Hair Care Essential Oil: Arginine (3%) + Jojoba Oil (80%) + Vitamin E (5%); applied to hair when it is half-dry, it repairs frizz (smoothness increases by 40%) and reduces split ends, suitable for chemically damaged hair (dyed or permed).



(XI) Malic Acid Chelated and Associated Product Series

Based on L-malic acid, it forms stable five-membered ring chelates with metal ions. It features good biocompatibility and mild physical and chemical properties. It is applied in agricultural trace element supplementation, food nutrition blending, feed preparation, pharmaceutical accessories, daily chemical and industrial complexing processing.

I. Agricultural Field (Crop Nutrient Supplementation + Quality Improvement & Stress Resistance)

(1) Malic Acid Chelated Calcium (Fertilizer Grade): Calcium content ≥18%, slightly soluble in water (solubility increases to 15g/100mL at pH 5); sprayed on fruits and vegetables during the fruit expansion period (e.g., tomatoes, grapes), it prevents fruit cracking (cracking rate reduces by 30%) and blossom-end rot, and increases fruit firmness by 20%; when applied as a base fertilizer in acidic soils, it improves soil structure, suitable for red soils in southern China.

(2) Malic Acid Chelated Magnesium (Fertilizer Grade): Magnesium content ≥ 10%, fully water-soluble; sprayed on bananas and citrus with magnesium-deficiency chlorosis (diluted 500 times), it achieves a leaf greening rate of 90%, increases photosynthetic efficiency by 18%, and enhances fruit sweetness by 1-2 degrees; when compounded with potassium fertilizer, it promotes the accumulation of photosynthates.

(3) Malic Acid Chelated Zinc (Fertilizer Grade): Zinc content ≥15%, alkali-resistant (no precipitation at pH 8-9); sprayed on corn and rice at the seedling stage (diluted 800 times), it prevents and treats little leaf disease and white seedling disease, and increases the number of tillers by 15%; when compounded with boron fertilizer, it improves the fruit setting rate.

(4) Malic Acid Chelated Iron (Fertilizer Grade): Iron content ≥12%, suitable for alkaline soils; sprayed on wheat and roses with iron-deficiency chlorosis (diluted 600 times), leaves turn green in 7 days, chlorophyll content increases by 25%, and the formation of iron hydroxide precipitation is avoided.

(5) Malic Acid Chelated Copper (Fertilizer Grade): Copper content ≥18%; sprayed on citrus and grapes during the flowering period (diluted 1000 times), it enhances cold/drought resistance, and prevents leaf wilting and small fruits caused by copper deficiency (fruit expansion rate increases by 20%); when compounded with phosphorus and potassium fertilizers, it improves the seed setting rate.

(6) Malic Acid Chelated Manganese (Fertilizer Grade): Manganese content ≥ 14%; sprayed on corn and soybeans (diluted 800 times), it resolves interveinal chlorosis, increases enzyme activity by 30% (e.g., nitrate reductase), and improves 1000-grain weight by 5g; suitable for rainy and high-humidity areas to reduce manganese loss.

(7) Malic Acid Chelated Cobalt (Fertilizer Grade): Cobalt content ≥10%;

applied to the rhizosphere of leguminous crops (soybeans, peanuts), it promotes nitrogen fixation by rhizobia (nitrogen fixation amount increases by 25%) and reduces dependence on nitrogen fertilizers; when compounded with molybdenum fertilizer, it increases yield by 10%.

(8) Malic Acid Chelated Molybdenum (Fertilizer Grade): Molybdenum content ≥ 5%; sprayed on soybeans and rapeseed during the flowering period (diluted 1000 times), it corrects poor pod formation caused by molybdenum deficiency and reduces nitrate content (nitrate in cabbage reduces by 18%); suitable for acidic soils to prevent molybdenum fixation.

(9) Malic Acid Chelated Potassium (Fertilizer Grade): Potassium content ≥ 20%; applied via drip irrigation to fruits and vegetables during the fruit expansion period (e.g., strawberries, watermelons), it promotes stem thickening and lodging resistance, increases fruit sugar content by 2 degrees, and boosts yield by 15%; when compounded with calcium fertilizer, it avoids fruit cracking.

(10) Malic Acid Chelated Selenium (Fertilizer Grade): Selenium content ≥ 0.5%; sprayed on tea and rice during the filling stage (diluted 1000 times), it produces selenium-rich agricultural products (selenium content in selenium-rich rice is 0.15mg/kg), enhances antioxidant capacity, and extends the fresh-keeping period.

(11) Malic Acid Chelated Boron (Fertilizer Grade): Boron content ≥8%; sprayed on rapeseed and citrus during the flowering period (diluted 800 times), it promotes pollen germination and pollen tube elongation (fruit setting rate increases by 20%), and solves problems of "flowering without fruiting" and "deformed fruit surfaces", suitable for fruit trees and cruciferous crops.

(12) Malic Acid Chelated Silicon (Fertilizer Grade): Silicon content ≥20%; sprayed on rice and wheat during the jointing stage (diluted 500 times), it enhances stem toughness (lodging resistance rate increases by 30%) and leaf cuticle (improves disease and pest resistance, rice planthopper incidence reduces by 25%); when sprayed on fruits and vegetables, it improves fruit surface brightness and extends shelf life by 2-3 days.

(13) Malic Acid Chelated Nickel (Fertilizer Grade): Nickel content ≥5%; sprayed on legumes and cruciferous crops (e.g., cabbage) (diluted 1000 times), it assists in promoting metabolic enzyme activity and enhances stress resistance (salt-alkali resistance), suitable for agricultural segmented scenarios and scientific research.

(14) Malic Acid Chelated Multi-element Water-soluble Fertilizer: Chelated calcium (10%), magnesium (8%), zinc (5%), manganese (4%), compounded with mineral source fulvic acid (5%) and small molecule peptides (3%); fully water-soluble, suitable for drip irrigation/spraying, avoiding element antagonism, activating soil (organic matter increases by 10%), reducing the malformed fruit rate of fruits and vegetables by 25%, and increasing

sweetness by 1-2 degrees.

(15) Malic Acid Chelated Trace Element - Ammonium Polyphosphate Compound Fertilizer: Chelated zinc (5%), copper (3%) + ammonium polyphosphate (30%); slow-release phosphorus source (release cycle of 30 days) + efficient absorption of trace elements, suitable for integrated water and fertilizer systems, reducing soil fixation (phosphorus utilization rate increases by 40%), and suitable for cash crops such as strawberries and kiwifruits.

(16) Malic Acid Active Peptide Compound Preparation (Agricultural Grade): Malic acid chelated zinc (5%) + active peptides (2%); applied via root irrigation to crops such as lotus roots and asparagus, it promotes root development (fresh root weight increases by 30%) and improves pesticide efficacy (utilization rate increases by 20%); suitable for aquatic crops and protected agriculture.

(17) Malic Acid Chelated Titanium (Fertilizer Grade): Titanium content ≥ 0.1%; sprayed on fruits and vegetables (diluted 1000 times), it promotes chlorophyll synthesis (photosynthetic efficiency increases by 20%) and improves fruit coloration (apple color uniformity increases by 25%), suitable for areas with insufficient sunlight.

(18) Malic Acid Chelated Vanadium (Fertilizer Grade): Focuses on improving salt tolerance of crops in saline-alkali soils (e.g., cotton); currently in the research stage, and further verification of safety and practicality is required.

II. Food/Healthcare Product Field (Nutritional Fortification)

(19) Malic Acid Complexed Calcium (Food Grade): Calcium content ≥15%, soluble in acid (solubility reaches 20g/100mL in gastric acid environment); added to milk and calcium tablets, its absorption rate is 40% higher than that of calcium carbonate, with no constipation side effects; suitable for infants, the elderly, and people with sensitive gastrointestinal tracts.

(20) Malic Acid Chelated Magnesium (Food Grade): Magnesium content ≥8%; made into chewable tablets and effervescent tablets (containing 100mg magnesium per tablet), it relieves post-exercise muscle soreness (lactic acid metabolism rate increases by 30%) and improves constipation in sedentary people; suitable for fitness enthusiasts and office workers.

(21) Malic Acid Chelated Zinc (Food Grade): Zinc content ≥18%, bioavailability is 30% higher than that of zinc oxide; added to children's milk powder (containing 5-8mg zinc per 100g) and supplementary food, it has low gastrointestinal irritation and prevents growth retardation caused by zinc deficiency; added to health products for pregnant women to enhance immunity.

(22) Malic Acid Chelated Sodium (Food Grade): Strong chelating ability (chelating capacity of 350mg $CaCO_3$ /g); added to canned foods and meat products (0.1%-0.3%) to prevent oxidative discoloration; added to beverages and sauces to prevent flavor deterioration caused by metal ions (e.g., iron,

copper) and extend shelf life.

(23) Ferrous Malate (Food Grade): Iron content ≥30%, no iron odor; added to iron-supplementing oral liquids and nutritional cereals (containing 10mg Fe^{2+} per 100g) to prevent iron-deficiency anemia; suitable for the elderly and children with sensitive constitutions, with an absorption rate 50% higher than that of ferrous sulfate.

(24) Ammonium Ferric Malate Chelate (Food Grade): Iron content ≥12%, brown-yellow powder; used as a fortifier in flour and milk powder (adding 8-10mg iron per 100g), and can also be used as a food colorant (e.g., substitute for caramel color); suitable for grain processing and dairy products.

(25) Malic Acid Chelated Strontium (Food Grade): Strontium content ≥15%; added to bone health milk powder (containing 50mg strontium per 100g) and health products, it assists in increasing bone mineral density (increases by 5%); suitable for menopausal women and the elderly with osteoporosis.

(26) Malic Acid Chelated Chromium (Food Grade): Chromium content ≥0.2%; added to blood sugar-lowering health foods (containing 100μg chromium per 100g), it enhances chromium activity and assists in improving glucose metabolism (postprandial blood glucose peak reduces by 15%) and lipid metabolism; suitable for people in the pre-diabetic stage.

(27) Malic Acid Chelated Selenium (Food Grade): Selenium content ≥0.1%; added to protein powder and nutritional cereals (containing 50μg selenium per 100g) to prevent selenium deficiency (e.g., Keshan disease); suitable for people in selenium-deficient areas, with an absorption rate 80% higher than that of sodium selenite.

(28) Malic Acid Calcium - Vitamin D3 - Multi-element Compound Preparation (Food Grade): Malic acid calcium (20%) + vitamin D3 (0.01%) + magnesium (5%) + zinc (3%) + vitamin K (0.005%); provides full-chain bone health protection (vitamin D3 promotes absorption, vitamin K locks calcium into bones); the elderly take 1 tablet daily (containing 500mg calcium) to prevent osteoporosis; the children's version adjusts the calcium-zinc ratio to promote bone development.

(29) Malic Acid Chelated Iron - Vitamin C Compound Preparation (Food Grade): Malic acid chelated iron (10%) + vitamin C (20%); vitamin C promotes the conversion of Fe^{3+} to Fe^{2+}, further increasing iron absorption rate by 20%; made into oral liquid (containing 15mg iron per 100mL), it has no iron odor and a mild taste; suitable for pregnant and lactating women.

(30) Malic Acid Calcium Diglycinate (Food Grade): Unique diglycine chelated structure, containing 200mg calcium per capsule; easy to absorb and gentle on the gastrointestinal tract; in addition to calcium supplementation, it assists in relieving stress (regulating neurotransmitters) and improving mood; suitable for people under high pressure.

(31) Malic Acid Chelated Potassium (Food Grade): Potassium content ≥12%; added to sports drinks (containing 100mg potassium per 100mL) to prevent

hypokalemia (maintaining heart rate and muscle function); added to low-sodium salt (replacing 20% sodium chloride); suitable for people with hypertension.

(32) Malic Acid Chelated Manganese (Food Grade): Manganese content ≥12%; added to multivitamins (containing 1mg manganese per tablet) to maintain nerve function and bone health; suitable for vegetarians (low absorption rate of manganese from plant-based foods).

III. Pharmaceutical Field (Therapeutic Assistance + R&D)

(33) Malic Acid Complexed Calcium (Pharmaceutical Grade): Purity ≥98%; used as an auxiliary clinical treatment for osteoporosis (supplementing 600mg calcium daily), it must be used under medical advice; gastrointestinal irritation is 40% lower than that of calcium carbonate; suitable for patients with insufficient gastric acid secretion.

(34) Ferrous Malate (Pharmaceutical Grade): Purity ≥99%; raw material for oral iron-supplementing preparations (e.g., sustained-release tablets) to treat iron-deficiency anemia, avoiding sudden increase in blood iron (reducing oxidative stress); suitable for patients with chronic anemia.

(35) Malic Acid Chelated Cobalt (Pharmaceutical Grade): Cobalt content ≥ 10%; precursor for vitamin B_{12} synthesis, used as an auxiliary treatment for megaloblastic anemia; suitable for people with absorption disorders (e.g., patients with gastrointestinal diseases), and must be used under medical advice.

(36) Malic Acid Chelated Lithium (Pharmaceutical Grade): Lithium content ≥ 8%; auxiliary preparation for mental illnesses, regulating neurotransmitters (e.g., serotonin); explored for improving depression and mania; must be used under professional medical guidance to avoid lithium poisoning.

(37) Malic Acid Chelated Vanadium (Pharmaceutical Grade): Focuses on auxiliary regulation of type 2 diabetes (improving insulin sensitivity); currently in the clinical trial stage, not yet approved as a regular pharmaceutical ingredient; must be used on a trial basis strictly under medical advice.

(38) Ammonium Ferric Malate Chelate (Pharmaceutical Grade): Purity ≥99%; auxiliary raw material for treating iron-deficiency anemia (e.g., syrups); brown-yellow color for easy identification; suitable for children's oral preparations to mask iron odor.

(39) Malic Acid Chelated Magnesium (Pharmaceutical Grade): Magnesium content ≥10%; raw material for mild laxatives (e.g., emulsions) to relieve constipation; gently stimulates intestinal peristalsis; suitable for elderly patients with constipation to avoid intestinal damage.

IV. Feed Field (Animal Nutrition Supplementation)

(40) Malic Acid Complexed Calcium (Feed Grade): Calcium content ≥15%; added to layer feed (200mg per kg), it increases eggshell hardness by 25% and reduces breakage rate by 18%; added to piglet feed, it promotes bone

development and reduces the incidence of rickets.

(41) Malic Acid Chelated Zinc (Feed Grade): Zinc content ≥18%; added to broiler and fattening pig feed (80-120mg per kg), zinc absorption rate is 40% higher than that of zinc sulfate, reducing skin inflammation (piglet skin keratinization) and improving feed utilization rate by 15%.

(42) Malic Acid Chelated Iron (Feed Grade): Iron content ≥12%; added to piglet and chick feed (60-100mg per kg), it prevents iron-deficiency anemia (hemoglobin increases by 20%), reduces weight loss, and improves survival rate by 12%.

(43) Malic Acid Chelated Manganese (Feed Grade): Manganese content ≥14%; added to breeder chicken feed (50-80mg per kg), it prevents perosis and improves breeder egg fertilization rate by 20%; added to beef cattle feed, it promotes bone development and reduces joint diseases.

(44) Malic Acid Chelated Copper (Feed Grade): Copper content ≥18%; added to piglet feed (10-15mg per kg), it promotes growth (daily weight gain increases by 15%), enhances immunity, and reduces diarrhea rate; added to aquaculture feed, it reduces copper accumulation toxicity.

(45) Malic Acid Chelated Cobalt (Feed Grade): Cobalt content ≥10%; added to ruminant (cattle/sheep) feed (0.1-0.3mg per kg), it promotes vitamin B_{12} synthesis by rumen microorganisms, improves digestive function (crude fiber digestion rate increases by 15%), and prevents anemia.

(46) Malic Acid Chelated Selenium (Feed Grade): Selenium content ≥0.1%; added to layer feed (0.3-0.5mg per kg), it produces selenium-rich eggs (selenium content is 0.3mg/kg); added to broiler feed, it enhances stress resistance (transport mortality reduces by 10%).

(47) Malic Acid Active Peptide Compound Preparation (Feed Grade): Contains malic acid chelated zinc (5%) + active peptides (2%); when added to livestock and poultry feed, it enhances intestinal absorption capacity (nutrient utilization rate increases by 20%) and assists in improving immunity (disease incidence reduces by 18%); suitable for the weaning period of piglets and the fattening period of broilers.

(48) Malic Acid Chelated Potassium (Feed Grade): Potassium content ≥12%; added to layer feed (100-150mg per kg) in high-temperature seasons, it maintains electrolyte balance and reduces the decline in egg production rate caused by heat stress.

(49) Malic Acid Chelated Magnesium (Feed Grade): Magnesium content ≥8%; added to dairy cow feed (100mg per kg), it increases milk production (by 8%) and improves milk quality (milk protein content increases by 0.5 percentage points).

V. Other Segmented Categories (Improving Product Matrix)

(50) Malic Acid Chelated Silicon (Daily Chemical Grade): Silicon content ≥ 20%; added to skincare products (3%-5%), it enhances the skin barrier

(transepidermal water loss reduces by 20%) and improves the smoothness of emulsions; suitable for face creams and serums.

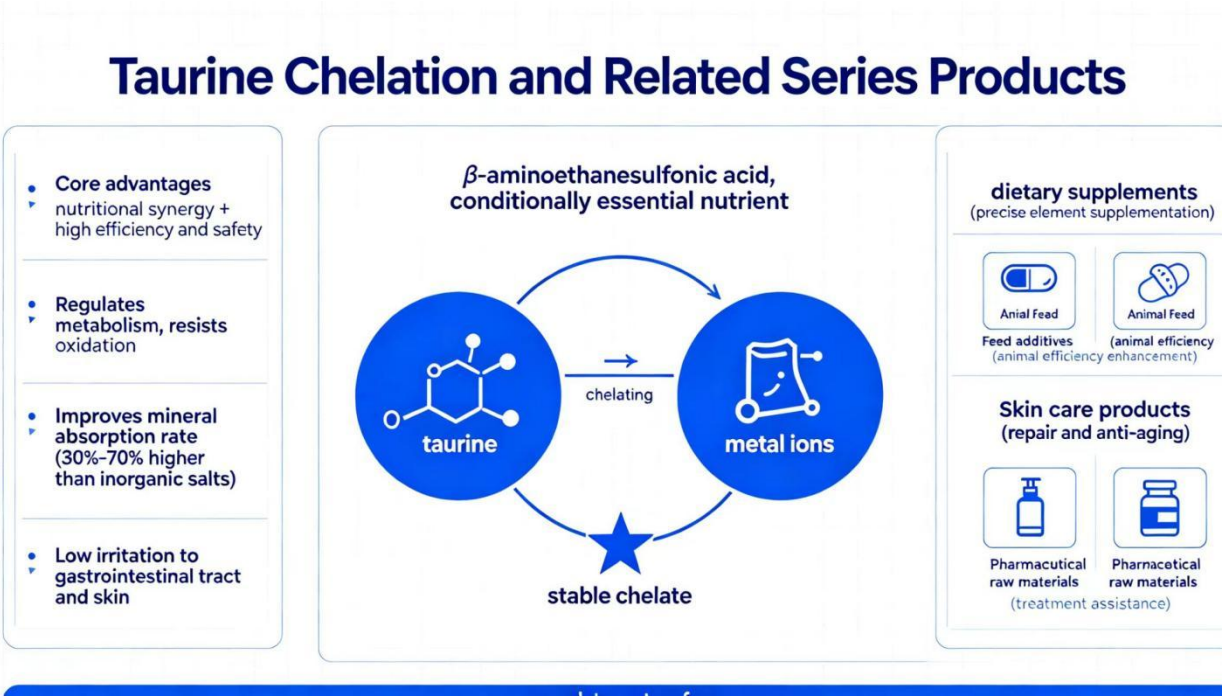
(51) Malic Acid Chelated Copper (Industrial Grade): Copper content ≥18%; used as a coating catalyst (increasing paint film curing speed by 20%) and electroplating additive (improving coating uniformity); suitable for the chemical and electronics industries.

(52) Malic Acid Chelated Manganese (Industrial Grade): Manganese content ≥ 14%; applied in metal surface treatment (steel phosphating, increasing corrosion resistance by 30%) and chemical oxidants (phenol production via benzene oxidation, increasing efficiency by 15%).

(53) Malic Acid-based Water Treatment Agent (Industrial Grade): Contains malic acid chelated calcium/magnesium (10%) + corrosion inhibitor (5%); used in industrial circulating water treatment to chelate calcium and magnesium ions (scale inhibition rate of 95%) and reduce scale; suitable for power plants and chemical plants.

(54) Malic Acid Chelated Tungsten (Industrial Grade): Tungsten content ≥ 30%; used in hard alloy preparation (hardness reaches HRC 65); suitable for the production of cutting tools and molds; currently in the stage of small-scale application.

(55) Malic Acid Chelated Strontium (Daily Chemical Grade): Strontium content ≥15%; added to toothpaste (0.5%-1%), it enhances enamel strength (reducing the risk of dental caries); suitable for anti-sensitive toothpaste to relieve tooth sensitivity.



(XII) Taurine Chelated and Associated Product Series

The core of the taurine series lies in stable chelates formed by taurine (β-aminoethanesulfonic acid, a conditionally essential nutrient for humans) and metal ions. Its core advantage is "nutritional synergy + high efficiency and safety" — it not only regulates metabolism and resists oxidation through taurine, but also increases mineral absorption rate (30%-70% higher than that of inorganic acid salts), with low irritation to the gastrointestinal tract and skin. It covers four major fields: dietary supplements (precision nutrient supplementation), feed additives (animal efficiency enhancement), skincare products (repair and anti-aging), and pharmaceutical raw materials (therapeutic assistance), forming a complete system from basic raw materials to end products.

I. Dietary Supplement Field (Precision Nutrient Supplementation + Metabolism Regulation)

(1) Taurine Chelated Magnesium (CAS: 334824-43-0): Magnesium content ≥10%, with bioavailability 40% higher than that of magnesium oxide. It participates in energy metabolism and neuromuscular regulation, and is made into chewable tablets (containing 100mg magnesium per tablet). It helps improve sleep (shortening sleep onset time by 15 minutes) and relieve post-exercise fatigue, suitable for people who stay up late and fitness enthusiasts.

(2) Taurine Chelated Calcium: Calcium content ≥18%, resistant to interference from oxalic acid and phytic acid. Its absorption rate is 50% higher than that of calcium carbonate. Added to calcium tablets for the middle-aged and elderly and children's growth milk powder (containing 200mg calcium per 100g), it supports bone and teeth health without constipation

side effects, suitable for calcium-deficient people of all ages.

(3) Taurine Chelated Zinc: Zinc content ≥15%, with absorption efficiency 30% higher than that of zinc sulfate. It participates in immune regulation and growth and development, and is made into children's oral liquid (containing 5mg zinc per 100mL) and capsules for pregnant women. It prevents poor appetite and decreased immunity caused by zinc deficiency, suitable for children, pregnant women and vegetarians.

(4) Taurine Chelated Iron: Iron content ≥12%, with good water solubility (solubility up to 15g/100mL at 25℃). Without the constipation side effect of traditional iron supplements, it is made into iron-supplementing granules (containing 15mg iron per sachet). It maintains calcium-iron balance in liver cells and prevents iron-deficiency anemia, suitable for the elderly and people with sensitive gastrointestinal tracts.

(5) Taurine Chelated Ferrous Iron: Divalent iron content ≥14%, with bioavailability 25% higher than that of trivalent chelated iron. It also has the antioxidant property of taurine. Added to infant supplementary food and nutritional cereals, it enables efficient iron supplementation, suitable for sensitive people and food nutritional fortification.

(6) Taurine Chelated Selenium: Selenium content ≥0.1% with strong stability. Made into selenium tablets (containing 50μg selenium per tablet) and selenium-rich protein powder, it enhances immunity (increasing lymphocyte activity by 20%), suitable for people in selenium-deficient areas and those with low immunity.

(7) Taurine Chelated Copper (CAS: 14025-15-1): Copper content ≥18%, avoiding rapid metabolic loss. It participates in iron metabolism and neurotransmitter synthesis. Added to multivitamins (containing 1mg copper per tablet), it helps improve neurological abnormalities caused by copper deficiency, suitable for vegetarians and patients with absorption disorders.

(8) Taurine Chelated Cobalt: Cobalt content ≥10%, a precursor for vitamin B_{12} synthesis. Made into special dietary supplements (containing 0.5mg cobalt per capsule), it maintains hematopoietic function and nervous system metabolism, suitable for ruminant breeders and scientific research experiments.

(9) Taurine Chelated Nickel: Nickel content ≥5%, participating in the regulation of enzyme activity. Used for trace fortification of special formula foods (adding 0.1mg per 100g), it reduces the irritation of single nutrient supplementation, suitable for scientific research and precision nutrition needs.

(10) Taurine Chelated Chromium: Trivalent chromium content ≥0.2%, which is the active center of glucose and lipid metabolism regulator (GTF). Made into sugar-controlling capsules (containing 100μg chromium per capsule), it synergistically regulates blood glucose (reducing postprandial blood glucose peak by 10%) and improves blood lipids, suitable for people in pre-diabetic

stage and obese people.

(11) Taurine Chelated Sodium: Sodium content ≥12%, with better stability than ordinary sodium salts. Added to sports drinks (containing 50mg sodium per 100mL), it quickly supplements electrolytes and reduces post-exercise fatigue, suitable for athletes and people working in high-temperature environments.

(12) Taurine Chelated Potassium: Potassium content ≥15%, with low irritation to the gastrointestinal tract. Made into electrolyte effervescent tablets (containing 200mg potassium per tablet), it maintains neuromuscular excitability and helps improve hypokalemia, suitable for post-exercise recovery and people with hypertension.

(13) Taurine Chelated Manganese: Manganese content ≥14%, improving absorption and utilization rate and reducing element antagonism. Added to compound nutrients (containing 1mg manganese per tablet), it participates in antioxidant enzyme synthesis and energy metabolism, suitable for vegetarians and adolescents in the growth and development stage.

(14) Taurine Chelated Molybdenum: Molybdenum content ≥5%, enhancing biological activity. Made into precision nutrient-supplementing capsules (containing 50μg molybdenum per capsule), it participates in purine metabolism and prevents metabolic abnormalities caused by molybdenum deficiency, suitable for people with special nutritional needs.

(15) Taurine Chelated Fluoride: Fluoride content ≥0.5%, with better bioavailability than traditional fluorides. Added to dietary supplements (containing 0.5mg fluoride per tablet), it helps strengthen bones and teeth, suitable for people with high risk of dental caries and osteoporosis patients.

(16) Taurine Compound Amino Acid Chelate: Contains 20% taurine, 15% lysine and 10% leucine, which synergistically improve absorption efficiency. Made into high-end nutritional supplements, it enhances the physiological functions of the body, suitable for post-operative recovery and people who exercise to build muscle.

(17) Taurine Compound Trace Element Chelate: Chelated zinc (8%), iron (6%), magnesium (5%) and copper (3%), avoiding element antagonism. Added to formula milk powder and compound nutrients, it meets the daily nutritional needs of people of all ages, suitable for infants and people with unbalanced nutrition.

(18) Acetyl Taurine Magnesium (CAS: 75350-40-2): Magnesium content ≥8%, with gastrointestinal irritation 60% lower than that of ordinary magnesium salts. Made into sleep-aiding capsules (containing 80mg magnesium per capsule), it has both neuroprotective and cardiovascular care effects, helping improve insomnia and relieve fatigue, suitable for people under high pressure.

(19) Acetyl Homotaurine Calcium (CAS: 77337-73-6): Calcium content ≥12%.

Made into special dietary supplements, it regulates brain neurotransmitters, helps reduce alcohol withdrawal symptoms, and supplements calcium at the same time, suitable for people in alcohol dependence recovery period and the elderly with bone loss.

(20) Guanidinoacetic Acid (CAS: 543-18-0): With strong biological activity. Added to sports nutrition powder (adding 5g per 100g), it helps regulate metabolism and accelerate recovery, suitable for people engaged in high-intensity sports.

(21) Homotaurine (CAS: 3687-18-1): Can cross the blood-brain barrier. Made into brain-nourishing capsules (containing 100mg per capsule), it reduces the toxicity of β-amyloid protein and slows down memory decline, suitable for the elderly to prevent cognitive decline and student groups.

(22) Taurine Small Molecule Peptide: Molecular weight ≤1000Da, with excellent water solubility. Made into oral liquid (containing 5g peptide per 10mL), it enhances immunity, improves memory and protects the cardiovascular system, suitable for sub-healthy people and middle-aged and elderly health care.

(23) Taurine Tablets: Each tablet contains 500mg taurine, which can be taken with B vitamins. It regulates the nervous system and fat metabolism, suitable for daily supplementation and sub-health conditioning of people who work overtime and stay up late.

(24) Multivitamin Taurine Mineral Tablets: Each tablet contains 200mg taurine, combined with 12 kinds of vitamins and 8 kinds of minerals. It meets the daily nutritional needs of the human body, suitable for athletes and people with irregular diets.

(25) Oyster Taurine Vitamin C Capsules: Contain 30% oyster extract, 20% taurine and 10% vitamin C. The three synergistically enhance immunity and resist oxidation, suitable for people in need of multi-dimensional nutritional supplementation and those with weak physique.

(26) Taurine Coffee Buccal Tablets: Each tablet contains 100mg taurine and 50mg coffee extract. It quickly refreshes the mind and supplements energy, suitable for scenarios that require immediate energy recovery such as overtime work and long-distance driving.

(27) Taurine Probiotic Compound Preparation: 10% taurine + Bifidobacterium (10^9CFU/g) + 5% fructooligosaccharides. It regulates intestinal flora (increasing the number of lactic acid bacteria by 2 times) and enhances nutrient absorption, suitable for people with gastrointestinal disorders and constipation.

(28) Taurine Lutein Ester Chewable Tablets: 15% taurine + 5% lutein ester. They synergistically protect the retina and relieve eye fatigue, suitable for people who use electronic devices for a long time and adolescents to prevent myopia.

II. Feed Additive Field (Animal Efficiency Enhancement + Health Maintenance)

(29) Taurine Chelated Zinc (Feed Grade): Zinc content ≥18%. When added to broiler and fattening pig feed (80-120mg per kg), it increases daily weight gain by 15%, improves feed utilization rate by 10%, and reduces skin inflammation, suitable for large-scale breeding.

(30) Taurine Chelated Iron (Feed Grade): Iron content ≥12%. When added to piglet and chick feed (60-100mg per kg), it prevents iron-deficiency anemia (increasing hemoglobin by 20%), improves survival rate by 12%, and has no intestinal irritation.

(31) Taurine Chelated Selenium (Feed Grade): Selenium content ≥0.1%. When added to layer feed (0.3-0.5mg per kg), it produces selenium-rich eggs (selenium content of 0.3mg/kg); when added to beef cattle feed, it enhances stress resistance and improves meat quality.

(32) Taurine Chelated Copper (Feed Grade): Copper content ≥18%. When added to piglet feed (10-15mg per kg), it promotes hematopoietic function and reduces diarrhea rate by 18%; when added to aquaculture feed, it reduces copper accumulation toxicity and improves the disease resistance of fish and shrimp.

(33) Taurine Chelated Manganese (Feed Grade): Manganese content ≥14%. When added to breeder chicken feed (50-80mg per kg), it prevents perosis and increases the fertilization rate of breeder eggs by 20%; when added to dairy cow feed, it increases milk production by 8%.

(34) Taurine Compound Trace Element Feed Premix: Chelated zinc (10%), iron (8%), selenium (0.1%) + 15% taurine. Customized according to animal species (formulas for early-stage piglets and peak-laying hens), it can be directly added to basic feed, simplifying the feeding process and ensuring balanced nutrition.

(35) Taurine Aquaculture-specific Additive: 20% taurine + 5% immune polysaccharides. When added to fish and shrimp feed (500mg per kg), it enhances stress resistance (increasing high-temperature survival rate by 20%), promotes growth and reduces water pollution.

(36) Taurine Ruminant-specific Supplement: 15% taurine + cobalt (0.1%) + B vitamins. When added to dairy cow feed (300mg per kg), it promotes rumen metabolism, increases milk production by 10% and improves milk quality.

III. Skincare Product Field (Repair & Anti-aging + Barrier Maintenance)

(37) Taurine Chelated Calcium (Daily Chemical Grade): Calcium content ≥15%. When used externally, it can penetrate the skin barrier and promote collagen production. Added to anti-aging face creams (concentration 3%-5%), it improves skin elasticity and reduces fine lines, suitable for mature skin.

(38) Water-Oil-Calcium Triple Luxury Care Youth-Enhancing Serum: Its core contains taurine chelated calcium (5%), combined with water-oil balance factors. It moisturizes, repairs the barrier and activates the anti-aging

pathway, suitable for comprehensive anti-aging of mature skin and improving skin sagging.

(39) Revitalizing Calcium Dual-Repair Serum: Taurine chelated calcium (4%) + amino acid chelated calcium (3%). It repairs the cuticle externally and elastic fibers internally, regulates water-oil balance, and prevents and reduces wrinkles, suitable for early-mature skin and relieving dry lines and fine lines.

(40) Revitalizing Calcium Repair Serum: Taurine chelated calcium (5%) + ceramide (1%). It accurately supplements calcium ions in the skin, promotes collagen production and firming, and quickly relieves sensitivity and dryness, suitable for skin with weak barriers and sensitive periods during seasonal changes.

(41) Wrinkle-Reducing Firming Microcrystalline Patch: Contains taurine chelated calcium (3%) + oligopeptide-1 (2%). It improves utilization rate through transdermal technology, penetrates the dermis, fades dry lines around the eyes and nasolabial folds on the face, and enhances skin elasticity, suitable for local anti-wrinkle needs.

(42) Taurine Chelated Zinc (Daily Chemical Grade): Zinc content ≥12%. Added to oil-controlling facial cleansers and acne-removing serums (concentration 1%-2%), it inhibits Propionibacterium acnes and reduces sebum secretion (reducing sebum amount by 25%), suitable for oily sensitive skin and acne-prone skin.

(43) Taurine Soothing Repair Mask: Taurine (5%) + panthenol (3%) + centella asiatica extract (2%). It soothes redness (reducing red blood streaks by 20%) and moisturizes, suitable for sensitive skin and post-medical aesthetic treatment repair.

(44) Taurine Anti-aging Eye Cream: Taurine chelated calcium (3%) + caffeine (2%). It fades dark circles, relieves eye puffiness, promotes collagen regeneration around the eyes and reduces fine lines, suitable for people who stay up late and those with early aging around the eyes.

(45) Taurine Ethyl Ester (CAS: 78723-71-4, Daily Chemical Grade): With enhanced fat solubility. Added to repair emulsions (concentration 2%-3%), it improves skin dryness and enhances tolerance, suitable for dry sensitive skin.

IV. Pharmaceutical Raw Material Field (Therapeutic Assistance + Intermediates)

(46) Tauroursodeoxycholic Acid (CAS: 14605-22-2): A bile acid compound. It has cholagogic and hepatoprotective effects, promotes bile secretion and excretion, and is used for auxiliary treatment of cholestatic liver disease and gallstones, which must be used under medical advice.

(47) Taurine Chelated Iron (Pharmaceutical Grade): Iron content ≥15% with purity ≥99%. As a raw material for oral iron-supplementing preparations

(such as sustained-release tablets), it treats iron-deficiency anemia and avoids oxidative stress caused by a sudden increase in blood iron, suitable for patients with chronic anemia.

(48) Taurine Chelated Chromium (Pharmaceutical Grade): Chromium content ≥ 0.2%. As a pharmaceutical excipient for auxiliary blood glucose regulation, it is used in auxiliary treatment preparations for diabetes, which requires strict dose control and must be used under medical advice.

(49) Acetyl Taurine Magnesium (Pharmaceutical Grade): Magnesium content ≥ 8%. As a raw material for neuroprotective drugs, it is used for auxiliary treatment of anxiety and insomnia to relieve nervous tension, which requires professional medical guidance.

(50) Taurine Ethyl Ester (Pharmaceutical Grade): An intermediate for antiarrhythmic drugs, which improves drug fat solubility and bioavailability, suitable for fine chemical synthesis scenarios.

(51) Taurine Chelated Lithium (Research Grade): Explored for auxiliary treatment of mental illnesses, it regulates neurotransmitters and improves symptoms of mania and depression. Currently in the clinical trial stage, it requires strict control.

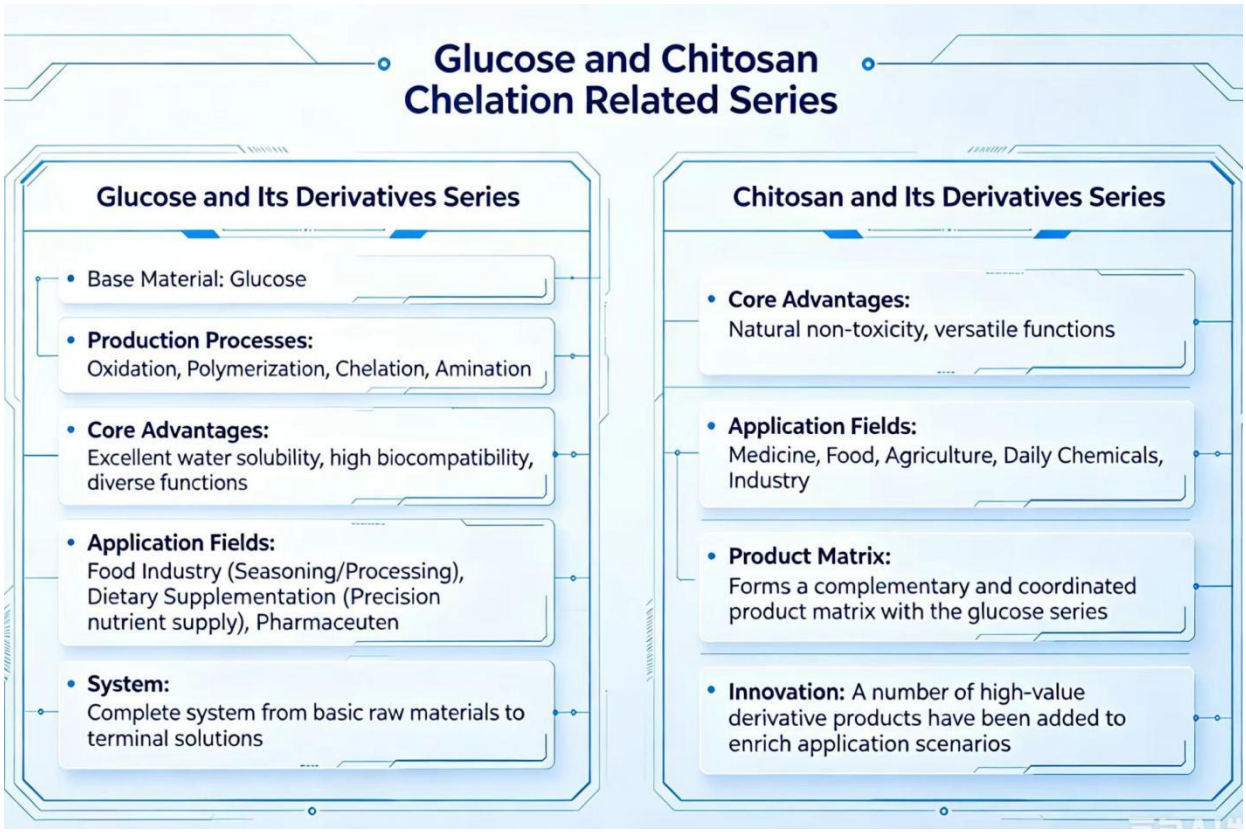
(52) Taurine-based Antiviral Raw Material (Research Grade): Taurine is coupled with antiviral components to enhance drug targeting. It is explored for auxiliary treatment of influenza and hepatitis virus infections and has not been commercialized yet.

V. Other Segmented Categories (Improving Product Matrix)

(53) Taurine Chelated Silicon (Industrial Grade): Silicon content ≥20%. Used as a coating additive, it improves the weather resistance and hardness of paint films; it can also be used as a rubber reinforcing agent to enhance product toughness, suitable for the chemical and material industries.

(54) Taurine Chelated Tungsten (Industrial Grade): Tungsten content ≥30%; it is a raw material for hard alloy preparation, which improves the hardness of the alloy (reaching HRC 65). It is suitable for the production of cutting tools and molds, and is applied on a small scale in the high-end manufacturing field.

(55) Taurine Compound Water Treatment Agent (Industrial Grade): Contains taurine chelated calcium/magnesium (10%) + corrosion inhibitor (5%); used in industrial circulating water treatment, it chelates calcium and magnesium ions (with a scale inhibition rate of 95%) to reduce scale, and is suitable for circulating water systems in power plants and chemical plants.



(XIII) Glucose and Chitosan Chelation-Related Series

The glucose and its derivatives series is derived from glucose as the basic raw material through oxidation, polymerization, chelation, amination and other processes. It boasts core advantages of excellent water solubility, high biocompatibility and diverse functions, covering five major fields: food industry (flavoring/processing), dietary supplements (precision nutrient supplementation), pharmaceutical carriers (therapeutic assistance), agricultural planting (crop quality improvement) and industrial applications (materials/treatment). It forms a complete system from basic raw materials to end-to-end solutions. The chitosan and its derivatives series, with natural non-toxic and multifunctional characteristics, are widely used in medicine, food, agriculture, daily chemicals, industry and other fields, forming a complementary and synergistic product matrix with the glucose series. Meanwhile, a number of high-value derivative products are added to enrich the coverage of application scenarios.

I. Glucose and Its Derivatives Series

(I) Basic Raw Materials and Salts

(1) Dextrose Monohydrate: White crystalline powder, purity ≥99.0%, solubility 80g/100mL at 25℃; food sweetener, pharmaceutical rehydration raw material, and basic substance for preparing glucose derivatives.

(2) Anhydrous Dextrose: Dehydrated crystalline product with strong stability, purity ≥99.5%; used for injectable preparations, oral rehydration salts and sweetener source for low-sugar foods.

(3) Glucose Syrup (High DE Value ≥90): Liquid mixture with high sweetness and fluidity, suitable for rapid forming of candies and beverages.

(4) Glucose Syrup (Medium DE Value 40-90): Balances sweetness and viscosity, used for flavoring and moisturizing in baking, jam and dairy products.

(5) Glucose Syrup (Low DE Value ≤40): High viscosity and low sweetness, suitable for anti-icing in ice cream and moisturizing/preserving pastries.

(6) Calcium Gluconate (Food Grade): Calcium content ≥9%, used for thickening dairy products, baking preservation and adding to infant milk powder.

(7) Calcium Gluconate (Pharmaceutical Grade): Purity ≥98%, core raw material for oral calcium tablets, maintaining bone health.

(8) Zinc Gluconate (Food Grade): Zinc content ≥10%, nutritional fortifier for children's complementary food and health products.

(9) Zinc Gluconate (Feed Grade): High absorption rate, used for zinc supplementation in livestock, poultry and aquatic products, reducing diarrhea rate.

(10) Ferrous Gluconate: Divalent iron content ≥11%, good water solubility, iron supplement for pregnant women and children without constipation side effects.

(11) Glucono-Delta-Lactone: Food coagulant (special for 内酯 tofu), acidulant, regulating intestinal flora.

(12) Sodium Gluconate (Industrial Grade): Metal corrosion inhibitor and concrete admixture, delaying setting time.

(13) Sodium Gluconate (Food Grade): Thickener and stabilizer, suitable for anti-stratification of beverages and condiments.

(14) Magnesium Gluconate: Magnesium content ≥7%, dietary supplement (chewable tablets/effervescent tablets), food moisturizing and stabilizing agent.

(15) Potassium Gluconate: Potassium content ≥13%, electrolyte supplement for sports drinks, and pharmaceutical grade for adjuvant improvement of hypokalemia.

(16) Copper Gluconate: Copper content ≥12%, added to multivitamins, and feed gradefor promoting hematopoiesis and fur development of livestock and poultry.

(17) Manganese Gluconate: Manganese content ≥11%, food nutritional fortifier, and agricultural grade foliar fertilizer to alleviate crop manganese deficiency chlorosis.

(18) Cobalt Gluconate: Cobalt content ≥10%, feed additive for ruminants, promoting vitamin B_{12} synthesis.

(19) Selenium Gluconate: Selenium content ≥0.1%, raw material for food-grade selenium-enriched nutritional powder, and agricultural grade foliar fertilizer for selenium-enriched planting.

(II) Chelate Series

(20) Calcium Gluconate Chelate (Pharmaceutical Grade): Chelation degree ≥ 95%, raw material for middle-aged and elderly calcium tablets, with absorption rate 25% higher than ordinary calcium gluconate.

(21) Calcium Gluconate Chelate (Agricultural Grade): Diluted 500 times for spraying, preventing fruit cracking and blossom-end rot of tomatoes andgrapes.

(22) Zinc Gluconate Chelate (Pharmaceutical Grade): High bioavailability, raw material for children's oral liquids, improving poor appetite caused by zinc deficiency.

(23) Zinc Gluconate Chelate (Agricultural Grade): Diluted 800 times for spraying, preventing little leaf disease and white seedling disease of corn and rice.

(24) Glucose Chelated Titanium: Titanium content ≥0.1%, agricultural growth promoter, increasing photosynthetic efficiency of apples and citrus by 20%, enhancing fruit coloring and sweetness.

(25) Sodium Glucoheptonate Chelate: Stable in alkaline environment, used for industrial metal surface degreasing and agricultural improvement of ion utilization rate in alkaline soils.

(26) Glucose Chelated Calcium-Magnesium-Boron Complex: Avoids element antagonism, diluted 600 times for spraying, alleviating crop chlorosis caused by nutrient deficiency.

(27) Glucose Chelated Iron-Zinc-Molybdenum Complex: Suitable for fruit trees and vegetables, improving fruit setting rate and quality.

(28) Glucose Chelated Silicon: Silicon content ≥15%, agricultural grade anti-lodging foliar fertilizer, and daily chemical grade skin care product barrier enhancer.

(29) Glucose Chelated Copper: Resistant to soil fixation, agricultural grade foliar fertilizer for preventing crop copper deficiency.

(30) Glucose Chelated Manganese: Efficient manganese supplementation, suitable for sensitive crops, improving stress resistance.

(31) Glucose Chelated Selenium-Molybdenum Complex: Dual effects of selenium and molybdenum enrichment, used for high-end agricultural product planting.

(III) Polymer and Functional Derivatives

(32) Polydextrose: Water-soluble dietary fiber, food thickener and stabilizer, filler for low-sugar/sugar-free foods.

(33) Glucosamine Sulfate: Purity about 65%, basic raw material for joint care, often compounded with chondroitin.

(34) Glucosamine Hydrochloride: Purity about 83%, low-sodium type, suitable for joint care of hypertensive patients.

(35) N-Acetylglucosamine: Small molecular weight and easy absorption, raw

material for joint care and skin moisturizing.

(36) Glucosamine Hydrochloride DC Grade (Carrier PVP K-30): Granulated grade, suitable for capsule and tablet production.

(37) Glucosamine Hydrochloride DC Grade (Carrier HPMC): Sustained-release type, raw material for long-acting preparations.

(38) Sodium Glucosamine Sulfate DC Grade (Carrier PVP K-30): Fast dissolution and high bioavailability.

(39) Sodium Glucosamine Sulfate DC Grade (Carrier HPMC): Sustained-release type, controlling release rate.

(40) Glucosamine + Chondroitin Sulfate Compound (3:2): Classic combination, promoting cartilage repair and regeneration.

(41) Glucosamine + MSM + Vitamin D3 Compound: Enhancing anti-inflammation and promoting calcium absorption, suitable for people with severe joint pain.

(42) Glucosamine + Calcium + Vitamin D Compound: Balancingcartilage repair and bone strengthening, suitable for people with osteoporosis combined with joint problems.

(43) Glucosamine + Type II Collagen + Hyaluronic Acid Compound: Improving joint flexibility and comprehensive care.

(44) Glucosamine Hydrochloride + Curcumin Compound Capsules: Enhancing anti-inflammation and relieving joint swelling, suitable for sports injuries.

(IV) Compound Preparations and Terminal Applications

(45) Amino Acid + Glucose Chelated Trace Element Water-soluble Fertilizer: Increasing crop yield by 15%, suitable for fruits, vegetables and field crops.

(46) Glucose Compound Thickener and Stabilizer (Special for Jelly): Rapid gelation, maintaining uniform texture.

(47) Glucose Compound Thickener and Stabilizer (Special for Baking): Improving moisture retention and taste of bread and cakes.

(48) Compound Sweetener (Including Glucose): High temperature and acid-base resistance, reducing food cost by 30%, suitable for ice cream and jam.

(49) Sodium Gluconate + Glucose Compound Concrete Admixture (3:1): Increasing compressive strength by 15%, suitable for bridges and dams.

(50) Glucose Compound Oral Rehydration Salt (Children's Type): Mild and easy to take, quickly replenishing water and electrolytes.

(51) Glucose Compound Oral Rehydration Salt (Adult Type): Suitable for dehydration caused by diarrhea and post-exercise.

(52) Glucose + Vitamin C + B Complex Compound Nutritional Powder: Quickly replenishing energy after exercise, enhancing oxidation resistance.

(53) Glucose + Probiotics + Fructooligosaccharides Compound Preparation: Regulating intestinal flora, suitable for children and the elderly with gastrointestinal disorders.

II. Chitosan and Its Derivatives Series

(I) Basic and Conventional Derivatives

(54) Chitooligosaccharides (Molecular Weight 1000-3000): High activity, raw material for pharmaceutical intermediates and functional foods.

(55) Chitooligosaccharides (Molecular Weight 3000-5000): Balancing activity and stability, biological pesticide and feed additive.

(56) Chitooligosaccharides (Molecular Weight 5000-10000): Industrial grade, raw material for cosmetic moisturizers and sewage treatment flocculants.

(57) High-Density Chitosan: Bulk density 0.6-0.85g/ml, raw material for health product capsules, weight loss and blood lipid reduction.

(58) Industrial Grade Chitosan (High Viscosity 2000-6000mpa.s): Suitable for thickening in textiles and coatings.

(59) Industrial Grade Chitosan (Medium Viscosity 500-2000mpa.s): Leather treatment and cigarette filter additive.

(60) Industrial Grade Chitosan (Low Viscosity ≤500mpa.s): Feed additive and agricultural plant protection.

(61) Food Grade Chitosan (Powder Type): Functional sweetener and fruit juice clarifier.

(62) Food Grade Chitosan (Flake Type): Fruit and vegetable preservative and enzyme immobilization carrier.

(63) Pharmaceutical Grade Chitosan (Deacetylation Degree ≥90%): Raw material for pharmaceutical preparations, reducing cholesterol and enhancing immunity.

(64) Pharmaceutical Grade Chitosan (Deacetylation Degree ≥95%): Raw material for high-end health products, preventing gout and gastric ulcers.

(II) Special Functional Derivatives

(65) Chitosan Lactate: Dual specifications of food grade and pharmaceutical grade, raw material for dressings and health foods.

(66) Carboxymethyl Chitosan (High Substitution Degree ≥90%): Drug sustained-release agent and heavy metal chelating agent.

(67) Carboxymethyl Chitosan (Medium Substitution Degree 70-90%): Cosmetic moisturizer and plant growth agent.

(68) Carboxymethyl Chitosan (Low Substitution Degree ≤70%): Industrial sewage treatment and papermaking auxiliary.

(69) Chitosan Hydrochloride: Raw material for wound dressings and health product capsules, food preservative.

(70) Chitosan Acetate: Cosmetic absorption enhancer, mild and non-irritating.

(71) Chitosan Sulfate: Esterification/etherification catalyst with high catalytic activity and no pollution.

(72) Chitosan Citrate: Food acidulant with health care functions.

(73) Hydroxypropyl Chitosan:Drug corrosion inhibitor and food preservative with excellent emulsifying property.

(74) Low Molecular Weight Chitosan (Molecular Weight 5000-20000): Cost-effective, suitable for mid-end functional needs.

(75) Low Molecular Weight Chitosan (Molecular Weight 20000-50000): Industrial grade, sewage treatment and feed additive.

(76) Chitin (Reagent Grade): Raw material for scientific research and high-end medicine with high purity.

(77) Chitin (Industrial Grade): Raw material for agricultural plant protection and textile printing and dyeing with controllable cost.

(78) Chitosan Oligosaccharide: High activity and low molecular weight, core raw material for functional foods and biological pesticides.

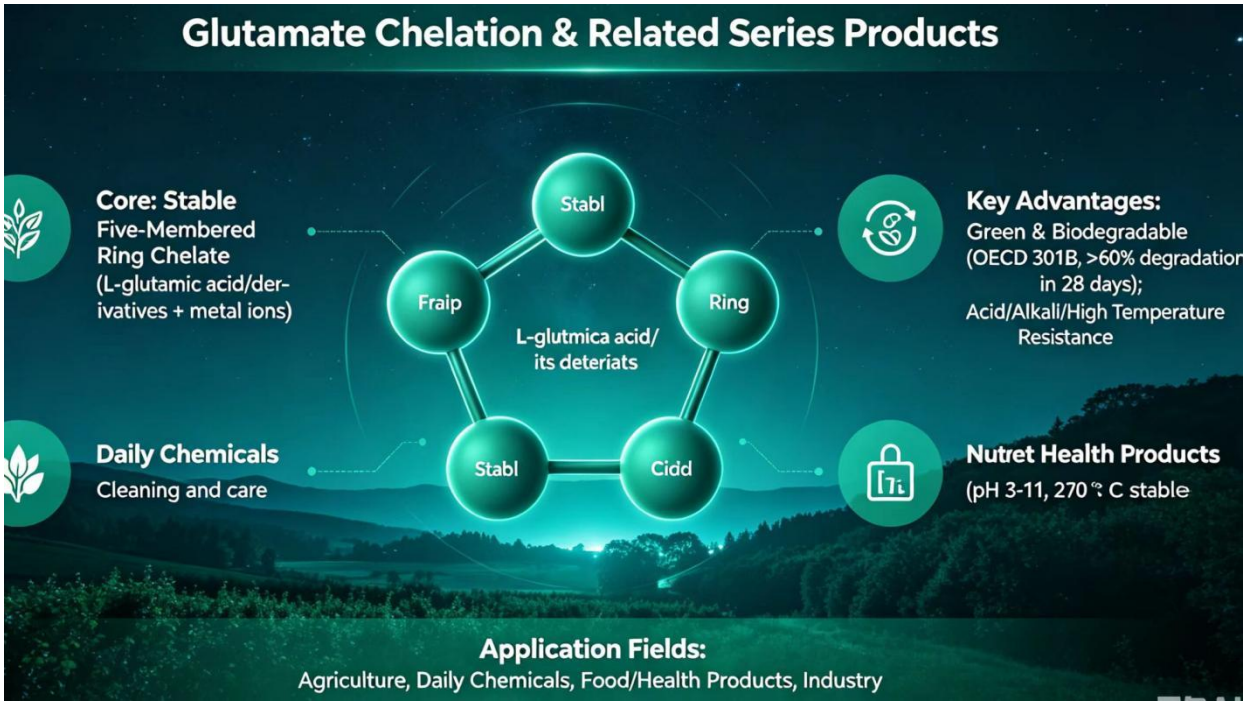
III. Fish Collagen Powder Series

(79) Fish Collagen Powder (Food Grade, Molecular Weight 5000Da): Easy absorption, raw material for nutritional health foods.

(80) Fish Collagen Powder (Food Grade, Molecular Weight 10000Da): Suitable for solid beverages and compressed candies.

(81) Fish Collagen Powder (Cosmetic Grade, Molecular Weight 3000Da): Moisturizing and locking water, added to high-end skin care products.

(82) Fish Collagen Powder (Pharmaceutical Grade, Molecular Weight 8000Da): Raw material for biomedical materials, assisting wound healing.



(XIV) Glutamate Chelation and Related Series Products

The core of glutamate chelation series adopts natural amino acid glutamate as ligand to form stable chelates with metal ions. It features environmental friendliness and high efficiency, with biodegradation rate over 98% within 28 days, heat resistance up to 170℃ and applicable pH range of 2-13.5. Its mineral utilization rate is 30%-80% higher than traditional inorganic salts. Widely applied in agriculture, food nutrition fortification, feed additive, industrial treatment and daily chemical care, it forms a complete product system from raw materials to terminal solutions.

(1) Tetrasodium Glutamate Diacetate GLDA-Na_4 : Replace EDTA, soil remediation, pesticide synergist, daily chemical scale inhibition, industrial water treatment, textile stabilizer, electroplating cleaning

(2) L-Glutamate Chelated Calcium: Prevent fruit cracking and blossom-end rot, strengthen eggshell and bone, food calcium supplement, skin moisturizing, shrimp and crab shell hardening

(3) L-Glutamate Chelated Zinc: Treat crop little leaf and stunted growth, promote animal growth, relieve skin inflammation, children zinc supplement, textile mordant, coating drier

(4) L-Glutamate Chelated Magnesium: Correct crop magnesium deficiency yellowing, boost photosynthesis, ease animal stress, relieve fatigue, skin emulsification, food preservation

(5) L-Glutamate Chelated Potassium: Promote fruit swelling, sweetening and coloring, resist lodging, balance electrolyte, food flavor adjustment, electroplating and resin synthesis

(6) L-Glutamate Chelated Copper: Prevent crop top blight, improve fruit setting, brighten animal hair, industrial anticorrosion and mildew proof

(7) L-Glutamate Chelated Manganese: Avoid chlorosis, enhance stress resistance and yield, prevent animal tendinopathy, improve breeding performance, food nutrition fortification, industrial catalysis and decolorization

(8) L-Glutamate Chelated Boron: Promote flowering and fruit setting, solve flower dropping and fruitless phenomenon, suitable for fruit trees and grain crops

(9) L-Glutamate Chelated Silicon: Strengthen crop stalk and resist lodging and pests, repair skin barrier

(10) L-Glutamate Chelated Selenium: Plant selenium-rich crops, improve livestock immunity, human health antioxidant

(11) L-Glutamate Chelated Molybdenum:

Boost nitrogen fixation of leguminous crops, regulate animal metabolism

(12) L-Glutamate Chelated Cobalt: Increase yield of leguminous crops, promote vitamin B12 synthesis and prevent anemia of ruminants

(13) L-Glutamate Chelated Titanium:

Improve photosynthesis, crop quality and color, enhance stress resistance, coating weather resistance modifier

(14) L-Glutamate Chelated Strontium:

Bone health maintenance, toothpaste anti-sensitivity and enamel repair

(15) L-Glutamate Chelated Nickel:

Enhance crop saline-alkali tolerance, fine chemical catalytic synthesis

(16) L-Glutamate Chelated Ferrous Iron:

Correct iron deficiency yellowing in alkaline soil, prevent young livestock anemia and protect intestinal tract

(17) Glutamate Chelated Ferric Ammonium:

Food iron supplement and colorant, improve iron deficiency anemia

(18) L-Pyroglutamic Acid Magnesium:

Health care magnesium supplement, high-grade formula chelating compatibility

(19) Glutamate Medium and Trace Element Foliar Fertilizer:

Correct crop nutrient deficiency yellowing, restore growth vigor, promote flowering and fruiting

(20) Compound Glutamate and Polyglutamic Acid Fertilizer:

Retain water and fertilizer, promote rooting, resist continuous cropping obstacle, improve

sandy soil, enhance fruit firmness

(21) Compound Glutamate Chelated Calcium Magnesium Fertilizer:

Relieve compound nutrient deficiency, boost fruit swelling and sweetness

(22) Compound Glutamate Chelated Zinc Boron Fertilizer:

Promote flowering and fruit setting, raise fruit setting rate, reduce flower and fruit dropping

(23) Compound Glutamate Selenium Potassium Fertilizer:

Improve fruit quality and sweetness, enhance stress resistance, cultivate selenium-rich agricultural products

(24) Compound Glutamate Calcium Zinc Feed Additive:

Promote young animal bone development, boost immunity, reduce disease incidence

(25) Compound Glutamate Iron Copper Manganese Feed Additive:

Supply balanced trace elements for livestock and aquatic products, promote hematopoiesis and growth

(26) Special Glutamate Chelator for Aquaculture: Accelerate shrimp and crab shelling, harden shell, purify water body and reduce ammonia nitrogen

(27) Livestock and Poultry Trace Element Premix: Standard trace element additive for pig, chicken, cattle, sheep and aquatic breeding

(28) GLDA&MGDA Environmental Composite Cleaning Agent: Industrial descaling, linen washing, strong acid and alkali resistance

(29) GLDA Heavy Metal Soil Remediation Agent:

Degrade farmland heavy metals, remediate contaminated soil without secondary pollution

(30) GLDA Industrial Composite Water Treatment Agent:

Scale inhibition for circulating water and boiler, stable water quality under high temperature

(31) GLDA Textile Bleaching Stabilizer: Protect textile fiber, improve fabric whiteness, save bleaching agent

(32) GLDA Daily Chemical Formula Stabilizer: Stabilize washing products, inhibit bacteria, fit sensitive skin

(33) GLDA Special Chelator for Electroplating: Homogenize coating layer, purify electroplating solution, reduce pollutant emission

(34) Oral Special Glutamate Chelated Magnesium: Anti-sensitivity and teeth strengthening for toothpaste and mouthwash, repair gingiva

(35) Glutamate Chitosan Chelated Iron: Long-acting iron supplement for alkaline soil, mild food nutrition fortification

(36) GLDA Bleaching Stabilizer: Protect fiber during textile washing and bleaching,

brighten fabric and avoid damage

(37) Daily Chemical Grade Glutamate Chelated Zinc:

Control skin oil, eliminate acne, relieve inflammation, repair oily skin

(38) Compound Glutamate Hyaluronic Acid Moisturizer: Long-term moisturizing, repair skin barrier, high-end skin care raw material

(39) Compound Glutamate Calcium Zinc Nutrient Tablet: Safe calcium and zinc supplement for children and pregnant women, easy absorption and mild property

(40) Glutamate Chelated Iron Oral Liquid: Human body iron supplement, improve anemia, mild taste without fishy smell

(41) Glutamate Selenium Nutritional Powder:

Human body antioxidant, boost immunity, middle-aged and elderly health care

(42) Industrial Grade Glutamate Chelated Potassium:

Auxiliary for electroplating, resin synthesis and battery electrolyte

(43) Industrial Grade Glutamate Chelated Zinc:

Textile mordant, chemical catalysis, coating drying agent

(44) Industrial Grade Glutamate Chelated Copper:

Wood anticorrosion, coating mildew proof, ink drying agent

(45) Industrial Grade Glutamate Chelated Manganese:

Chemical oxidation catalysis, glass decolorization processing

(46) Diethylene Glycol Diformate Diacyl Glutamic Acid:

Ultra-pure water chelating agent, fine chemical material, high-end pharmaceutical intermediate

(47) GLDA Precision Metal Cleaning Agent:

Remove oil and oxide from electronic machinery, no damage to base material, easy rinsing

(48) Research Grade Glutamate Chelated Lithium: Neuroscience research, battery material modification and development

(49) Dual-purpose Glutamate Chelated Silicon for Agriculture and Daily Chemical: Enhance crop lodging and pest resistance, improve skin feeling in skin care products

(50) Dual-purpose Glutamate Chelated Nickel for Agriculture and Industry: Improve crop saline-alkali resistance, fine chemical catalytic intermediate

(51) Compound Glutamate Potassium Water-soluble Fertilizer: Supply nutrients in whole growth period, strengthen seedling, increase yield and quality

(52) GLDA Cosmetic Antiseptic Compound Agent: Mild bacteriostasis and formula stabilization, suitable for sensitive skin and pregnant women

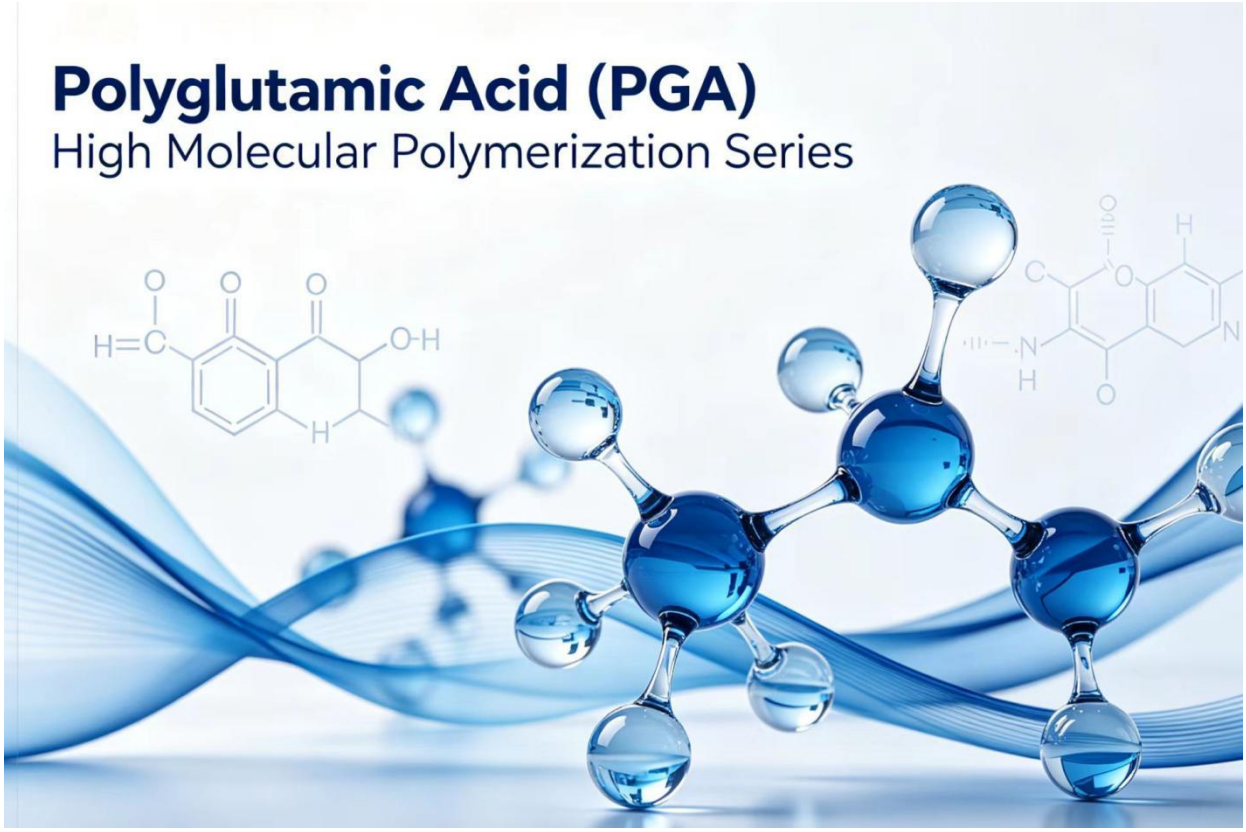
(53) Feed Special Glutamate Chelated Selenium： Improve livestock antioxidant capacity and disease resistance, produce selenium-rich livestock products

(54) Feed Special Glutamate Chelated Molybdenum： Regulate metabolism of ruminants, relieve diarrhea

(55) Feed Special Glutamate Chelated Cobalt：

Promote growth of ruminants, accelerate vitamin B12 synthesis

(56) GLDA Compound Bactericidal Synergist： Synergize pesticide effect, extend efficacy duration, stabilize liquid medicine property



(XV) Polyglutamic Acid Macromolecular Polymer Series Products

The polyglutamic acid chelated series is mainly formed by combining polyglutamic acid (γ-PGA) as a chelating agent with different metal ions. With the advantages of good biocompatibility, degradability, and precise efficacy, it is widely used in agriculture, food, medicine, daily chemicals and other fields. The common types are as follows:

(1) Polyglutamic Acid-Calcium: Prevents fruit cracking and blossom-end rot in fruits and vegetables (such as tomatoes and grapes) caused by calcium deficiency, enhances peel toughness, and improves fruit marketability; suitable for foliar spraying and flushing application, with higher absorption efficiency than traditional calcium fertilizers.

(2) Polyglutamic Acid-Magnesium: Controls leaf chlorosis in field crops (such as rice and wheat) and fruits/vegetables due to magnesium deficiency, promotes chlorophyll synthesis, and improves photosynthesis efficiency, especially suitable for alkaline soils.

(3) Polyglutamic Acid-Zinc: Alleviates zinc-deficiency-induced little leaf disease in fruit trees (such as apples and citrus) and seedling stunting in field crops, promotes flower bud differentiation and root development, suitable for fertilization from the seedling stage to the flowering stage of crops.

(4) Polyglutamic Acid-Iron: Solves iron-deficiency chlorosis in crops (such as strawberries and roses) in alkaline soils, improves the stability of iron elements, and reduces the impact of soil pH on absorption.

(5) Polyglutamic Acid-Potassium: Enhances the drought and cold resistance of crops (such as watermelons and sugar beets), promotes fruit expansion and sugar accumulation, suitable for flushing or foliar spraying during the fruit expansion period.

(6) Polyglutamic Acid-Boron: Suitable for rapeseed, fruit trees and leguminous crops, promotes pollen germination and fertilization, prevents "flowering without fruiting", and improvesfruit setting rate.

(7) Polyglutamic Acid-Chelated Calcium-Magnesium: Synergizes with elements such as boron and zinc, with high total content of calcium and magnesium, fully water-soluble and easy to absorb, reduces chlorosis and fruit cracking of fruits and vegetables, suitable for the growth period of high-value crops (such as blueberries and cherries).

(8) Polyglutamic Acid-Chelated Trace Elements: Contains zinc, manganese, iron, boron, copper, molybdenum, etc., used as foliar fertilizer or for flushing application, prevents multiple nutrient deficiency symptoms in crops, and increases nutrient absorption and utilization rate by more than 30%.

(9) Polyglutamic Acid Compound Fertilizer: Polyglutamic acid is added to traditional compound fertilizers to improve particle integrity and fertilizer utilization rate, suitable for the whole growth cycle fertilization of field crops (corn and cotton), and reduces the loss of nitrogen, phosphorus and potassium.

(10) Polyglutamic Acid Solid Fertilizer: Made by drying liquid fertilizer, easy for long-distance transportation and storage, with the functions of water and fertilizer retention and soil pH adjustment, suitable for crops (such as sunflowers and sorghum) in arid or saline-alkali areas.

(11) Polyglutamic Acid Liquid Fertilizer: Made by liquid fermentation of sodium glutamate and Bacillus subtilis, containing γ-polyglutamic acid, glucose, protein, etc., natural and environmentally friendly with no chemical residues, complying with EU organic agriculture standards, suitable for irrigation/foliar spraying of organic fruits and vegetables (such as organic lettuce and grapes).

(12) Polyglutamic Acid Microbial Inoculant: Added with compound Bacillus subtilis, high-concentration polyglutamic acid and biochemical fulvic acid, it synergistically improves soil quality, inhibits soil-borne diseases (such as root rot), and has a significant effect on resisting continuous cropping. Suitable for continuous cropping fields of protected vegetables (tomatoes and cucumbers); its application in Heilongjiang soybean fields can increase the yield by about 1500 kg per hectare.

(13) Polyglutamic Acid-Chelated Fish Protein: A liquid fertilizer containing amino acids and trace elements such as copper and iron, promotes crop photosynthesis and nutritional balance, and improves stress resistance (resistance to low temperature, diseases and pests), suitable for economic

crops such as fruit trees and flowers.

(14) Polypeptide-Polyglutamic Acid-Chelated Nutrient Solution: A fully water-soluble and fully chelated formula that combines the advantages of quick-acting chemical fertilizers, long-acting organic fertilizers and efficient functional fertilizers to achieve "three effects in one", suitable for fruits and vegetables (strawberries and kiwifruits) pursuing high yield and quality.

(15) Polypeptide Enzyme-Polyglutamic Acid: An upgraded version of polyglutamic acid, its network molecular structure improves water retention and chelation stability, can be compounded with compound fertilizers and foliar fertilizers, enhances soil acid-base adjustment ability, and is suitable for crops in various saline-alkali or barren soils.

(16) Polyglutamic Acid-Chelated Medium Element Water-Soluble Fertilizer: Chelates calcium, magnesium, boron, zinc, etc., quickly promotes root growth and nourishes roots, repairs physiological diseases caused by nutrient deficiency (such as tomato blossom-end rot and grape berry size inconsistency), and improves soil aggregate structure.

(17) Organic Ecological Polyglutamic Acid Fertilizer: Has dual effects of nutrient supply and soil maintenance, can improve crop stress resistance, suitable for ecological agricultural planting (such as organic rice and ecological tea gardens), and meets the strict standards of green agriculture.

(18) Organic Chelated Slow-Release Liquid Nitrogen Fertilizer: Contains nitrate nitrogen, ammonium nitrogen, amide nitrogen and polyglutamic acid, with both quick-acting nitrogen supplementation and long-acting slow-release effects, reducing nitrogen loss, suitable for the growth period of field crops such as wheat and corn.

(19) Compound Microbial Inoculant + Polyglutamic Acid: Added with Bacillus subtilis and Trichoderma harzianum, it synergizes with polyglutamic acid to inhibit diseases and activate soil nutrients, suitable for green agricultural bases (such as green vegetable greenhouses) and reduces the input of chemical fertilizers.

(20) γ-Polyglutamic Acid Fertilizer Synergist: Can be compounded with compound fertilizers and foliar fertilizers, increases fertilizer utilization rate by 20%-40%, and promotes crop yield increase by 4.7%-15.9%, conforming to the global green agriculture development trend, and serving more than 100 million mu of farmland nationwide every year.

(21) Polyglutamic Acid Fermentation Broth: Contains polyglutamic acid and fermentation by-products (amino acids, small molecule peptides), can be directly used for crop irrigation/foliar spraying, and can also be further processed as a raw material for fertilizers and cosmetics, with significant cost advantages, and is a basic raw material for large-scale production.

(22) Polyglutamic Acid Microparticles: Granular products made from fermentation broth, easy to use and stable in storage, suitable for

mechanized fertilization scenarios (such as mechanized sowing and fertilization of field crops), and can reduce manual fertilization costs.

(23) Polyglutamic Acid Powder: High polymerization degree and high content, covering different molecular weight specifications, can be used as a raw material for fertilizers and feed additives, suitable for industrial production needs, and is also one of the important forms of cosmetic raw materials.

(24) γ-Polyglutamic Acid (CAS: 25513-46-6): A water-soluble macromolecular polymer with good biocompatibility and outstanding long-acting moisturizing ability, can be used as a basic moisturizer added to face creams and serums, complying with EU cosmetic ingredient regulations (EC No. 1223/2009).

(25) High-Molecular-Weight Polyglutamic Acid (PGA-HMW): Rich in hydrophilic groups on the side chain, with better moisturizing effect than sodium hyaluronate and collagen, smooth and non-greasy skin feel, can improve the user experience of hyaluronic acid-based products, suitable for moisturizing masks and emulsions.

(26) Low-Molecular-Weight Polyglutamic Acid (PGA-LMW): Mildly inhibits tyrosinase activity to achieve healthy skin brightening; at the same time, reduces thedecomposition of skin HA enzyme and prolongs the moisturizing time of hyaluronic acid, suitable for whitening serums and repair creams.

(27) Oligo-Polyglutamic Acid (PGA-Oligo): Low molecular weight, easy to penetrate into the skin base, promotes the production of natural moisturizing factors (NMF), and improves skin water retention capacity, suitable for essence lotions and anti-aging serums, and has passed the US FDA cosmetic ingredient registration (INCI: Polyglutamic Acid).

(28) Sodium Polyglutamate (CAS: 26247-79-0): Has both moisturizing and conditioning effects, locks in moisture for a long time, enhances skin elasticity, and reduces dry lines, suitable for basic care products such as moisturizing face creams and body lotions.

(29) Sodium Polyglutamate (CAS: 28829-38-1): While providing strong moisturizing, it helps tighten the skin and refine pores, with a refreshing skin feel, suitable for oil-controlling moisturizing serums and men's skincare products, complying with Japanese and Korean cosmetic ingredient standards.

(30) Methyl Polyglutamate (CAS: 25086-16-2): Used as a drug carrier in the pharmaceutical field to achieve long-acting targeted drug release (such as antibiotics and anti-tumor drugs); in materials science, it can be used to prepare biocompatible films and medical consumable coatings (such as surgical suture coatings), suitable for biomedical R&D needs in Europe and America.

(31) Paclitaxel-Polyglutamic Acid (CAS: 263351-82-2): A targeted chemotherapy drug combining paclitaxel and polyglutamic acid, which acts precisely on cancer cells such as breast cancer and non-small cell lung cancer, reduces the side effects of free paclitaxel (such as neurotoxicity

and myelosuppression), and improves medication safety, has entered clinical research stages in many countries.

(32) Poly-L-Glutamic Acid-γ-Benzyl Ester (CAS: 25014-27-1): Used as a drug carrier precursor in the pharmaceutical field, which can be adapted to different drug loading through chemical modification; it can also be used to prepare biodegradable microspheres and tissue engineering scaffolds; at the same time, it is a macromolecular synthesis intermediate, which can be converted into other polyglutamic acid derivatives through debenzylation, supporting innovative biomedical R&D.

(33) Food-Grade Polyglutamic Acid: A natural macromolecular polymer that can replace traditional emulsifiers, improve dough extensibility (suitable for baked goods such as bread and cakes), enhance sauce adhesion and achieve salt reduction and flavor enhancement, and can also inhibit dehydration of frozen foods (such as meat and seafood) to maintain food moisture and taste.

(34) Polyglutamic Acid-Chelated Selenium: For the cultivation of selenium-rich agricultural products (such as selenium-rich rice and selenium-rich bean sprouts), it improves the stability and absorption rate of selenium through chelation, helps crops accumulate organic selenium, and meets the human demand for selenium supplementation, suitable for ecological planting bases.

(35) Polyglutamic Acid Stress-Resistant Foliar Fertilizer: Specifically designed for extreme environments (high temperature, flood, frost), integrates polyglutamic acid and stress-resistant factors, can quickly repair damaged crop tissues and improve stress resistance, suitable for various crops in disaster-prone areas.

(36) Polyglutamic Acid Moisturizing and Repairing Mask Essence: With low-molecular-weight polyglutamic acid as the core ingredient, combined with ceramide and vitamin B5, it can quickly penetrate to replenish moisture and repair the skin barrier, suitable for daily care of sensitive and dehydrated skin, conforming to the trend of mild cosmetic formulas.

(37) Polyglutamic Acid Pharmaceutical Microspheres: Using polyglutamic acid derivatives as carriers, they can encapsulate drugs such as antibiotics and hormones to achieve long-acting slow release and targeted delivery, reduce medication frequency and side effects, suitable for clinical treatment of chronic diseases (such as rheumatoid arthritis).

(38) Polyglutamic Acid Aquafeed Additive: Can be used as a feed binder to enhance particle stability, reduce feed waste in aquaculture (such as fish and shrimp), and at the same time chelate harmful heavy metal ions in the intestines, promote calcium and magnesium absorption, and inhibit the reproduction of harmful bacteria, reducing the incidence of fish diseases and the use of antibiotics, suitable for various aquaculture scenarios.

(39) Polyglutamic Acid Aquaculture Water Quality Improver: Can adsorb suspended solids, ammonia nitrogen and heavy metals such as lead and cadmium in water, clarify water quality and adjust water pH, and can also complex

nitrogen and phosphorus elements to inhibit excessive algae reproduction, maintain the ecological balance of aquaculture, and meet the needs of green aquaculture.

(40) Polyglutamic Acid Seed Coating Agent: Sprayed on the surface of crop seeds such as wheat, corn and rice to form a protective film, improves the water and fertilizer retention capacity of seeds, promotes germination and seedling root development, and increases seedling survival rate, suitable for large-scale seedling raising scenarios.

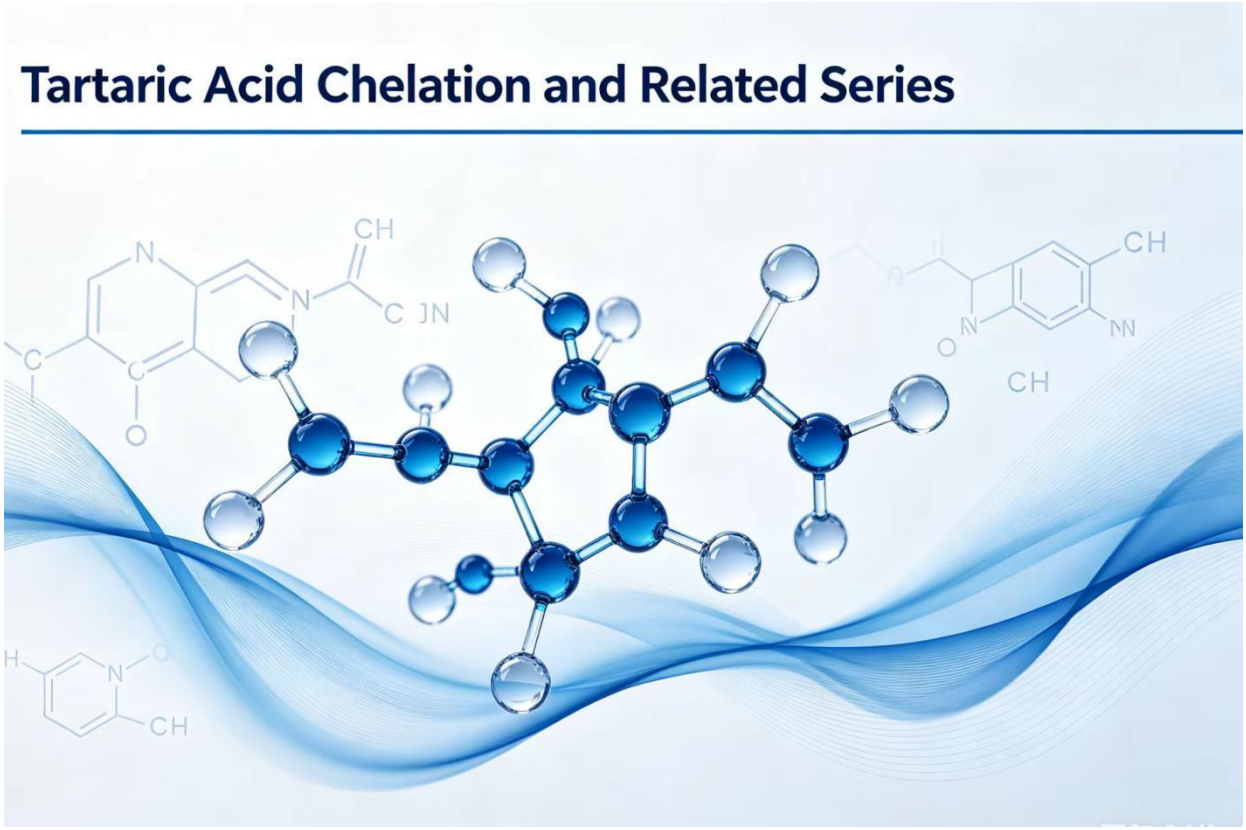
(41) Polyglutamic Acid Slow-Controlled Release Compound Fertilizer: Uses a macromolecular network structure to wrap nutrients, extending the fertilizer effect period from 30-45 days of traditional fertilizers to 60-90 days, reducing the volatilization and leaching of nitrogen, phosphorus and potassium, suitable for one-time base application of field crops (such as corn and cotton), and reducing topdressing costs.

(42) Polyglutamic Acid Seedling Substrate Additive: Added to seedling soil or substrate, it can enhance water and fertilizer retention capacity, reduce the frequency of watering and fertilization during the seedling stage, and improve the stress resistance and survival rate of seedlings of vegetables and flowers, suitable for greenhouse seedling raising and greenhouse planting.

(43) γ-D-Polyglutamic Acid Special Fertilizer: Made of high-purity D-type polyglutamic acid (content up to 90% or more), compared with ordinary polyglutamic acid fertilizers, it has more advantages in water retention, chelation, root promotion and efficiency enhancement, suitable for organic agriculture with strict quality requirements (such as high-end fruit and vegetable cultivation).

(44) Polyglutamic Acid Soil Heavy Metal Remediator: With strong adsorption capacity for heavy metal ions such as lead, copper and cadmium, it can remediate soil with excessive heavy metals caused by industrial pollution or excessive agricultural fertilization, and provide a safe environment for subsequent crop cultivation, suitable for ecological remediation projects.

(45) Polyglutamic Acid Full-Nutrition Water-Soluble Fertilizer: Chelates the nutrients required by crops throughout the growth cycle, one bottle can meet the dosage of 10 mu of land, quickly supplements nutrients, suitable for drip irrigation and sprinkler irrigation needs of various crops such as fruit trees, melons, vegetables and root crops (such as potatoes and ginger).



(XVI) Tartaric Acid Chelated and Associated Product Series

The tartaric acid chelated series and its derivatives are made from grape fermentation by-products. They can form stable chelates with metal ions such as calcium and iron, featuring high bioavailability and environmental friendliness. Covering categories including chelated salts, tartrates, and tartaric acid esters, they are widely used in food, medicine, daily chemicals, and industrial cleaning fields, combining natural properties and functionality.

(1) Tartaric Acid Chelated Calcium: The food-grade is used in calcium supplements, with an absorption rate 40% higher than that of calcium carbonate, suitable for children and the elderly; the agricultural-grade can prevent fruit cracking caused by calcium deficiency in crops and is used in foliar fertilizers.

(2) Tartaric Acid Chelated Iron: The pharmaceutical-grade is used for auxiliary treatment of iron-deficiency anemia without gastrointestinal irritation; the food-grade is added to infant supplementary food to prevent oxidation and discoloration of iron ions.

(3) Tartaric Acid Chelated Magnesium: The health product-grade relieves fatigue and improves sleep, suitable for people who stay up late; the agricultural-grade prevents and treats magnesium-deficiency chlorosis in crops, suitable for fruit trees and vegetables.

(4) Tartaric Acid Chelated Zinc: The food-grade is added to milk powder and beverages to improve zinc absorption rate; the feed-grade is used for zinc

supplementation in livestock and poultry, reducing diarrhea and promoting growth.

(5) Tartaric Acid Chelated Copper: The agricultural-grade is used as a trace element fertilizer to prevent poor grain setting in crops due to copper deficiency; the industrial-grade is used in electroplating solutions to improve coating uniformity.

(6) Tartaric Acid Chelated Manganese: The feed-grade promotes bone development of livestock and poultry and reduces leg weakness; the agricultural-grade is used for wheat and corn to improve lodging resistance.

(7) Tartaric Acid Chelated Potassium: The agricultural-grade is used in the fruit expansion period of fruits and vegetables to promote sugar accumulation and reduce fruit cracking; the industrial-grade is used in detergents to enhance decontamination and hard water resistance.

(8) Tartaric Acid Chelated Compound Trace Elements: Contains 5 elements including iron, zinc, and manganese, used in foliar fertilizers or food nutritional fortification, suitable for multiple scenarios.

(9) L-Potassium Tartrate (CAS: 921-53-9): Mostly white crystals or crystalline powder, it is a chiral potassium tartrate salt, easily soluble in water. It is mainly used in the food industry (e.g., acidulants, stabilizers) and pharmaceutical field (e.g., preparation of pharmaceutical excipients), and can also be used as a basic raw material in chiral synthesis.

(10) Potassium Sodium Tartrate (CAS: 304-59-6): It is mainly used as a complexing agent, often forming stable complexes with metal ions (such as copper and iron), and is widely used in electroplating, food additives, and chemical analysis fields. It can also be used as a pharmaceutical excipient to adjust the pH value of drugs, or as a mordant in the textile industry to improve the dyeing effect and stability of dyes.

(11) Potassium Antimonyl Tartrate (CAS: 11071-15-1): Usually colorless transparent crystals or white powder, easily soluble in water, it is an antimony-containing tartrate compound. It is mainly used as a mordant in the textile industry, a tanning agent in the leather industry, and also as an analytical reagent in certain specific fields. It should be noted that it has certain toxicity and requires standardized operation during use.

(12) Antimony Potassium Tartrate (CAS: 6535-15-5): An organometallic salt, usually colorless transparent crystals or white powder, with a sweet and metallic taste, and easy to weather in the air. It is mainly used as a mordant for fabrics and leather, an insecticide, and can also be used in the pharmaceutical industry.

(13) L-Potassium Sodium Tartrate: The food-grade is used as an acid regulator and stabilizer, suitable for fruit juices and jellies; the industrial-grade is used in electroplating and water quality testing.

(14) Potassium Hydrogen Tartrate (CAS: 868-14-4): The food-grade is a

leavening agent (cream of tartar) used in cakes and biscuits; the pharmaceutical-grade relieves excessive gastric acid as an antacid excipient.

(15) Potassium Tartrate: The food-grade is used for acid adjustment in wine to improve flavor; the pharmaceutical-grade is used as a laxative excipient to regulate intestinal peristalsis.

(16) DL-Tartaric Acid Chelated Potassium: Used as a food additive, it is mainly used to adjust food acidity, improve taste, and can also be used as a leavening agent to assist in the formation of baked foods, commonly found in beverages, candies, and pastries. It also has applications in the industrial field, serving as a complexing agent to remove metal ion impurities or stabilize the composition of plating solutions in electroplating, suitable for food processing and industrial production scenarios.

(17) Calcium Tartrate: The food-grade is used in calcium-supplementing chewable tablets with a mild taste; the feed-grade increases the bone calcium content of livestock and poultry and reduces rickets.

(18) Iron Tartrate: The pharmaceutical-grade is used for the treatment of iron-deficiency anemia and is easily soluble in water; the food-grade is added to sports drinks to supplement iron.

(19) Magnesium Tartrate: The health product-grade relieves muscle spasms, suitable for athletes; the food-grade is used as a stabilizer in plant protein beverages.

(20) Zinc Tartrate: The pharmaceutical-grade is used for the treatment of oral ulcers to promote mucosal repair; the food-grade is added to cereals to increase zinc content.

(21) Bismuth Potassium Tartrate: The pharmaceutical-grade is used for the treatment of gastric ulcers and gastritis to protect the gastric mucosa; there is no food-grade application, and strict control is required.

(22) Antimony Potassium Tartrate: The industrial-grade is used as a mordant in printing and dyeing and tanning in the leather industry; the pharmaceutical-grade (specific specifications) is used for anti-schistosomiasis and must be used under medical advice.

(23) DL-Sodium Tartrate: The food-grade is used as a preservative to extend the shelf life of sauces; the industrial-grade is used for metal cleaning to remove oxide layers.

(24) Ammonium Tartrate: The industrial-grade is used for preparing catalysts and cleaning agents for electronic components; the agricultural-grade is used in small amounts as a fertilizer for flowers to promote blooming.

(25) Lithium Tartrate: The pharmaceutical-grade is used for auxiliary treatment of mania and depression; the industrial-grade is used as an electrolyte additive in lithium batteries to improve conductivity.

(26) Tartaric Acid Monoglyceride (TMG): The food-grade is used as an emulsifier, suitable for bread and pastries to delay aging; the daily

chemical-grade is used in face creams to enhance skin feel.

(27) Diacetyl Tartaric Acid Ester of Monoglycerides (DATEM): A core food-grade emulsifier, used in steamed buns and instant noodles to improve dough gluten.

(28) L-Tartaric Acid: Industrially used as a chelating agent in detergents, metal cleaners, and gold plating processes; in the food field, it is used as an acidulant and pH regulator, suitable for beverages, baked foods, etc.; in the pharmaceutical field, it can assist in adjusting the pH of liquid medicines.

(29) DL-Tartaric Acid: The industrial-grade can be used as an electroplating complexing agent and cement retarder; the food-grade has the functions of a chelating agent, acid regulator, and antioxidant, which can stabilize metal ions in food and optimize taste, suitable for processed foods such as canned foods and jams.

(30) D-Tartaric Acid: A natural optical isomer (containing two chiral carbons), extracted from grape brewing by-products or prepared by biological fermentation; used as an acidulant in food, a chiral resolving agent in medicine, and a chelating agent in industry, and can be used in asymmetric synthesis due to its optical activity.

(31) MESO-Tartaric Acid (Meso-Tartaric Acid): With zero optical activity, its chemical properties are different from D/L-tartaric acid. It is mainly used in specific chemical synthesis reactions (e.g., fine chemical intermediates) and scientific research fields, with little large-scale industrial application.

(32) Sodium Tartrate: Used as a stabilizer, pH regulator, and flavoring agent in food; in industry, it can chelate metal ions, suitable for beverages, dairy products, and metal surface treatment processes.

(33) L-Sodium Tartrate Dihydrate (CAS: 868-18-8): Commonly used as a food additive to adjust acidity and stabilize properties, and can also be used in biochemical research and analytical determination. Lin'an is mostly a production or operation site for related products.

(34) Potassium Tartrate: With chelating ability, it is used as an acid regulator in food (e.g., baked foods, carbonated drinks); in medicine, it can assist in adjusting the electrolyte balance of body fluids, suitable for oral rehydration preparations.

(35) Ammonium Tartrate: Mainly used in specific chemical reactions (e.g., organic synthesis intermediates) and analytical reagents (e.g., metal ion detection), with weak chelating properties, suitable for laboratory research and fine chemical scenarios.

(36) Calcium Tartrate: An organic calcium supplement that combines with intestinal ions to form soluble calcium salts after entering the human body, with high absorption rate, suitable for people in need of calcium

supplementation such as the elderly, pregnant women, and children, and commonly used in calcium tablets and nutritional health products.

(37) Magnesium Tartrate: A magnesium supplement, used in the pharmaceutical/health product field. Its chelated structure improves the bioavailability of magnesium, suitable for people with neurological and muscular dysfunction caused by magnesium deficiency.

(38) Lithium Tartrate: Mainly used in specific pharmaceutical fields (e.g., research on auxiliary treatment of certain mental diseases) and as a scientific research reagent. Due to the characteristics of lithium ions, the dosage must be strictly controlled.

(39) Manganese Tartrate: Light pink to white powder/granule/solution, easily soluble in water; used as a manganese nutritional fortifier in food, a metal preservative and water treatment agent in industry, a catalyst/intermediate in chemical industry, and a fiber treatment aid in textile industry.

(40) Iron Tartrate: Used as an iron nutritional fortifier in food (supplementing iron and preventing iron-deficiency anemia); in industry, it can be used as a catalyst and complexing agent, suitable for food additives and fine chemical scenarios.

(41) Copper Tartrate: Used as a catalyst/intermediate in organic synthesis, and improves the uniformity and compactness of coatings in electroplating processes; attention should be paid to its potential toxicity to aquatic organisms, and compliance with regulations is required during use.

(42) Zinc Tartrate: Used as a zinc supplement in medicine/health products. Its chelated structure is more easily absorbed than ordinary zinc salts (e.g., zinc sulfate), suitable for zinc-deficient people such as children and pregnant women, and can also be used in cosmetics to adjust skin zinc content.

(43) Chromium Tartrate: Added to nutritional supplements to assist in regulating blood glucose and lipid metabolism, suitable for people in need of blood glucose control (e.g., people in the pre-diabetic stage), and must comply with the limit standards for health product ingredients.

(44) Cobalt Tartrate: Used as a catalyst for specific reactions in organic synthesis, and there are research and exploration on cobalt supplements in the pharmaceutical field; due to the potential toxicity of cobalt, strict control of residues is required in industrial applications.

(45) Nickel Tartrate: A core additive in the electroplating industry, improving the quality of nickel plating layers (reducing pinholes and enhancing adhesion), suitable for nickel plating processes of electronic components and hardware.

(46) Zirconium Tartrate: Improves the strength and toughness of products in the ceramic field, and enhances weather resistance and adhesion in coatings, suitable for the research and development of special ceramics (e.g., high-

temperature resistant ceramics for aerospace) and high-end coatings.

(47) Tin Tartrate: Used as a mordant in textile printing and dyeing, promoting the combination of dyes and fabrics (especially natural fibers such as cotton and linen), and improving dyeing fastness and uniformity.

(48) Antimony Tartrate: Once used as an emetic in traditional medicine, its pharmaceutical application has now decreased; in industry, it can be used as a reagent for specific reactions. Attention should be paid to the toxicity of antimony, and compliance with environmental protection and safety standards is required during use.

(49) Potassium Antimonyl Tartrate (Tartar Emetic): Once used for the treatment of schistosomiasis, its pharmaceutical application is now limited; used as a reagent in chemical analysis, and can be used in processes such as leather tanning in industry, with strict control of application scenarios required.

(50) Lanthanum Tartrate: Used as a catalyst in catalytic reactions, and can treat fluorine-containing wastewater in the environmental protection field (forming stable precipitates with fluoride ions), suitable for industrial wastewater treatment and fine catalytic scenarios.

(51) Cerium Tartrate: Mainly used in scientific research fields, such as catalytic reaction research and the preparation of functional materials (e.g., rare earth luminescent materials), with little industrial application and niche demand.

(52) Palladium Tartrate: A precious metal catalyst used in hydrogenation reactions and coupling reactions in organic synthesis (e.g., synthesis of pharmaceutical intermediates), with high catalytic activity but high cost, suitable for fine chemical industry and pharmaceutical research and development.

(53) Iridium Tartrate: An ultra-high activity catalyst used in extremely fine organic synthesis (e.g., chiral synthesis of high-end pharmaceutical intermediates), with strict application scenarios and extremely high cost, only suitable for niche high-end research and development needs.

(54) Tantalum Tartrate: A precursor of tantalum-based thin film materials and high-temperature ceramics, suitable for the preparation of special materials in aerospace (e.g., high-temperature resistant components of engines) and microelectronics (e.g., chip packaging materials) fields.

(55) Dysprosium Tartrate: Relying on the strong magnetic properties of dysprosium, it is used in scientific research and exploration of rare earth permanent magnet materials and magnetostrictive materials, with only experimental applications in niche special material fields.

(56) Tungsten Tartrate: Tungsten tartrate: a raw material for the preparation of tungstate functional materials in the laboratory, or as an auxiliary component for high-temperature coatings, with very few industrial scale

applications. It is mainly suitable for scientific research and the development of special coatings.

(57) Holmium Tartrate: A cutting-edge scientific research raw material for special optical crystals and laser materials (e.g., infrared laser devices), with highly segmented application scenarios and only a small amount of experimental use in high-end optical fields.

(58) Ferrous Tartrate: Blue-green powder/crystals, used as a colorant in food (e.g., coloring candies and beverages), and as a reducing agent/indicator in chemical analysis. Attention should be paid to its easy oxidation property, and it should be stored in a dark and sealed manner.

(59) Sodium Ferrous Tartrate: A specific chemical analysis reagent(e.g., detecting certain oxidants) or a niche industrial auxiliary (e.g., reducing agent in printing and dyeing), with relatively specific application scenarios.

(60) Ammonium Ferrous Tartrate: Used as a reducing agent in chemical analysis (e.g., titration experiments), assisting in reduction reactions in chemical production, and can also be used as a developer raw material in the photography industry.

(61) Ammonium Ferrous Tartrate Double Salt: A composite salt with different crystal forms, suitable for specific industrial reduction processes and laboratory precise analysis, and the specification should be selected according to specific reaction requirements.

(62) Barium Tartrate: Mainly used in specific chemical analysis (e.g., detecting sulfate ions) and material preparation (e.g., auxiliary raw material for barium-based ceramics). Due to the toxicity of barium ions, contact with water bodies and biological environments should be avoided.

(63) Ammonium Cobalt Tartrate: A ternary chelate, a catalyst for specific chemical catalytic reactions (e.g., ammonia oxidation reaction), and can also be used in special electroplating processes (e.g., alloy coating preparation), with relatively segmented application scenarios.

(64) Ammonium Copper Tartrate: A reagent for detecting certain metal ions (e.g., potassium ions) in chemical analysis, and a corrosion inhibitor in metal processing, suitable for laboratory analysis and metal surface protection scenarios.

(65) Sodium Copper Tartrate: An additive in specific electroplating processes (e.g., copper alloy plating), and a catalyst in chemical synthesis, suitable for copper plating of electronic components and fine organic synthesis scenarios.

(66) Ammonium Iron Tartrate: Used as a color developer/indicator in chemical analysis (e.g., detecting sulfides), and can also be used in special fertilizers (e.g., special fertilizers for ornamental plants) that need to supplement both iron and nitrogen elements, with the iron ion concentration

requiring control.

(67) Copper Tartrate Complex: With a more complex structure than ordinary copper tartrate, it is used in the production of printed circuit boards in the electronics industry (controlling the deposition rate and uniformity of copper ions), suitable for the fine processing process of PCBs (printed circuit boards).

(68) L-Potassium Hydrogen Tartrate (Potassium Bitartrate): Used as a pH regulator in food (e.g., controlling acidity in baked foods to prevent excessive fermentation), and as a laxative component in medicine (stimulating intestinal peristalsis), and can also be used as a raw material for preparing potassium carbonate.

(67) Copper Tartrate Complex: With a more complex structure than ordinary copper tartrate, it is used in the production of printed circuit boards (PCBs) in the electronics industry to control the deposition rate and uniformity of copper ions, making it suitable for the fine processing of PCBs.

(68) L-Potassium Hydrogen Tartrate (Potassium Bitartrate): In the food industry, it serves as a pH regulator (e.g., controlling acidity in baked goods to prevent over-fermentation); in medicine, it acts as a laxative component (stimulating intestinal peristalsis); it can also be used as a raw material for potassium carbonate production.

(69) Potassium Sodium Tartrate (Rochelle Salt / Sodium Potassium Tartrate): In electroplating, it functions as a complexing agent (stabilizing metal ions to improve coating quality); in food, it is used as an antioxidant aid and a baking powder ingredient; in laboratories, it is used to prepare Fehling's solution (for detecting reducing sugars) and Biuret reagent (for detecting proteins); in telecommunications equipment, it is used to manufacture crystal speakers/microphones (utilizing its piezoelectric properties).

(70) Metatartaric Acid: A polymer of tartaric acid with strong complexing ability. In wine/fruit wine, it inhibits the crystallization of potassium tartrate (maintaining wine clarity and extending shelf life); in fruit juice beverages, it acts as a stabilizer (preventing turbidity caused by metal ions). Note its stability under acidic conditions.

(71) Varenicline Tartrate (CAS: 375815-87-5): A smoking cessation drug that blocks nicotine receptors to reduce the pleasure of smoking, helping users gradually lose interest in cigarettes. It is suitable for long-term smokers who have the willingness to quit.

(72) Metoprolol Tartrate (CAS: 56392-17-7): A β-receptor blocker used to treat hypertension, angina pectoris, and arrhythmia. It has good water solubility (taking effect 15 minutes after oral administration) and is suitable for cardiovascular disease patients who need to quickly control heart rate and blood pressure. It must be used under medical advice (sudden withdrawal should be avoided).

(73) Tylosin Tartrate (CAS: 74610-55-2): A macrolide antibiotic exclusively for animals, used to prevent and treat respiratory tract infections (e.g., chicken mycoplasmal pneumonia) and digestive tract infections (e.g., swine colibacillosis) in livestock and poultry. It has a strong effect on mycoplasma. Strict compliance with the withdrawal period for animal drugs is required to avoid the development of drug resistance.

(74) Tolterodine Tartrate (CAS: 124937-52-6): Used to treat overactive bladder, relieving symptoms such as frequent urination, urgent urination, and urinary incontinence. It also improves the quality of life affected by abnormal bladder function and enhances the daily comfort of patients.

(75) L-(-)-Dibenzoyl Tartaric Acid (CAS: 2743-38-6): A white, odorless powder, mainly used for the chiral resolution of racemic amines (e.g., chiral amines in pharmaceutical intermediates), suitable for chiral synthesis needs in the pharmaceutical and pesticide fields.

(76) Dibenzoyl Tartaric Acid (CAS: 22333-70-6): White/off-white powder/crystals, a commonly used chiral resolving agent for separating single optical isomers from racemates, suitable for fine chemical and pharmaceutical R&D.

(77) p-Methyl Dibenzoyl Tartaric Acid (CAS: 32634-68-7): White/off-white powder, with higher chiral resolution efficiency than ordinary dibenzoyl tartaric acid, suitable for the preparation of high-purity chiral amines in pharmaceuticals.

(78) p-Methoxy Dibenzoyl Tartaric Acid: A colorless or pale yellow transparent liquid, an important chiral intermediate. In addition to resolving racemic amines, it can also be used for the synthesis of chiral esters, suitable for high-end pharmaceutical intermediate R&D.

(79) L-p-Methyl Dibenzoyl Tartaric Acid Monohydrate (CAS: 71607-31-3): A white to off-white solid, mainly used for the chiral resolution of racemic amines and has important applications in the pharmaceutical and fine chemical fields.

(80) L-p-Methyl Dibenzoyl Tartaric Acid Monohydrate (CAS: 71607-32-4): Mostly white crystalline powder, a commonly used chiral resolving agent. It is mainly used in the pharmaceutical field to resolve chiral amines, helping to improve the optical purity of products such as drugs.

(81) L-(-)-Dibenzoyl Tartaric Acid Monohydrate (CAS: 62708-56-9): A white crystalline powder, odorless, slightly bitter in taste, slightly soluble in water, acidic, and soluble in organic solvents such as ethanol and acetone. It is mainly used as a chiral resolving agent for the resolution of racemic amines.

(82) L-(-)-Dibenzoyl Tartaric Acid (CAS: 2743-38-6): A chiral organic compound, mostly appearing as a colorless transparent liquid, easily soluble in organic solvents such as ethanol and ether. It is mainly used as a chiral ligand in asymmetric synthesis, can also be used as a food additive to adjust

flavor, or act as an intermediate in the pharmaceutical field to facilitate the synthesis of specific drugs.

(83) D-Dibenzoyl Tartaric Anhydride (CAS: 116780-73-5): Mostly white crystalline powder, an important chiral compound intermediate. It is mainly used in the pharmaceutical and fine chemical fields as a chiral resolving agent or synthetic raw material to facilitate the preparation of high-purity chiral products.

(84) D-Dibenzoyl Tartaric Acid (CAS: 17026-42-5): Mostly white crystalline powder, a commonly used chiral resolving agent in industry. It is mainly used in the pharmaceutical and fine chemical fields to separate compounds such as chiral amines, helping to prepare products with high optical purity.

(85) D-(+)-Dibenzoyl Tartaric Acid Monohydrate (CAS: 80822-15-7): **Mostly** white crystalline powder, a stable and selective chiral resolving agent. It is mainly used in the pharmaceutical field to efficiently resolve chiral amines, facilitating the preparation of high-purity pharmaceutical intermediates.

(86) D-(+)-p-Methyl Dibenzoyl Tartaric Acid: Usually white to off-white crystalline powder, a common type of chiral resolving agent. It realizes separation by forming diastereoisomeric salts with compounds such as chiral amines, and is widely used in the preparation of high-optical-purity pharmaceutical intermediates and fine chemical products. Compared with ordinary dibenzoyl tartaric acid, the methyl group in its molecular structure may optimize resolution selectivity and efficiency, making it suitable for the separation of specific types of chiral compounds.

(87) D-Dibenzoyl Tartaric Acid (CAS: 17026-42-5): A commonly used chiral resolving agent, mainly used for resolving chiral amines, especially in the preparation of high-optical-purity amine intermediates in the pharmaceutical field. It can also be used as an auxiliary reagent in asymmetric synthesis in fine chemicals to obtain target products with a single configuration, ensuring the activity and stability of subsequent products (e.g., drugs).

(88) D-(+)-p-Methyl Dibenzoyl Tartaric Acid Monohydrate (CAS: 71607-32-4): Mostly white crystalline powder, a chiral resolving agent with both stability and selectivity. It is mainly used in the pharmaceutical field to resolve chiral amines, effectively facilitating the preparation of high-optical-purity pharmaceutical intermediates.

(89) D-(+)-p-Methoxy Dibenzoyl Tartaric Acid (CAS: 191605-10-4): Mostly white crystalline powder, a chiral resolving agent with specific selectivity. It is mainly used in the pharmaceutical and fine chemical fields to resolve chiral amines, facilitating the preparation of high-optical-purity target products. The methoxy group in its molecule can optimize resolution efficiency.

(90) Brimonidine Tartrate (CAS: 70359-46-5): A commonly used active ingredient in ophthalmic intraocular pressure-lowering drugs, mainly used to

treat open-angle glaucoma and ocular hypertension. It reduces intraocular pressure by decreasing aqueous humor production and increasing aqueous humor outflow, thereby protecting the optic nerve. It can also be used to relieve redness, itching, and other symptoms related to ocular inflammation; some compound preparations can also balance intraocular pressure reduction and eye fatigue relief, meeting different eye health needs.

(91) Di-p-methylbenzoyl Tartaric Acid (CAS: 32634-66-5): A commonly used chiral resolving agent, mostly white crystalline powder, which can form diastereoisomeric salts with chiral compounds such as amines for separation. It is widely used in the pharmaceutical and pesticide fields to facilitate the purification and preparation of chiral drugs (e.g., alkaloids) and improve the optical purity of target products.

(92) DL-p-Methyl Dibenzoyl Tartaric Acid: Used in scenarios where resolution purity is not extreme (e.g., preliminary separation of pesticide intermediates), with lower cost than single-configuration products.

(93) DL-p-Methoxy Dibenzoyl Tartaric Acid: Mainly used in preliminary exploration experiments for chiral resolution to help determine the optimal resolution configuration, suitable for scientific research and process development stages.

(94) D-(+)-p-Methyl Dibenzoyl Tartaric Anhydride (CAS: 156835-63-1): Mostly white crystalline powder, a key intermediate for preparing chiral resolving agents. It is mainly used in the pharmaceutical field to facilitate the resolution of chiral molecules and improve the optical purity of products such as drugs.

(95) L-(-)-Di-p-methoxybenzoyl Tartaric Acid (CAS: 50583-51-2): An efficient chiral resolving agent, mainly used for resolving chiral amines, especially in the preparation of high-optical-purity amine intermediates in the pharmaceutical field to ensure drug activity. It is also used in asymmetric synthesis in fine chemicals to assist in obtaining target molecules with a single configuration, providing key support for the performance stability of chiral drugs, functional materials, and other products.

(96) N,N,N',N'-Tetramethyl-D-tartaramide (CAS: 637-01-4): Mostly a white crystalline solid, a chiral amine compound with stable structure. It is mainly used as a chiral ligand or catalyst in asymmetric synthesis, facilitating the construction of high-optical-purity target molecules in the pharmaceutical and fine chemical fields.

(97) Diethyl Tartrate (CAS: 13811-71-7): A colorless or pale yellow transparent liquid, used for the chiral resolution of racemic alcohols and amines, and can also be used as an auxiliary reagent in chiral synthesis, suitable for the preparation of chiral intermediates in pharmaceuticals and pesticides.

(98) L-(+)-Diethyl Tartrate (CAS: 87-91-2): A chiral organic compound, usually a colorless transparent liquid, with both chiral recognition and

catalytic properties. It is commonly used as a chiral ligand in asymmetric synthesis reactions, a food additive, and a pharmaceutical intermediate.

(99) DL-Diethyl Tartrate (CAS: 57968-71-5): A mixture of D-(-)- and L-(+)- forms, mainly used in chiral resolution scenarios with low optical purity requirements (e.g., synthesis of industrial-grade chiral auxiliaries) or as a raw material for the preparation of single-configuration diethyl tartrate.

(100) D-(-)-Dimethyl Tartrate (CAS: 13171-64-7): Mostly a colorless transparent liquid, easily soluble in organic solvents such as ethanol and ether, and a typical chiral compound. It is mainly used as a chiral ligand or intermediate in asymmetric synthesis, facilitating the preparation of high-optical-purity target products in the pharmaceutical and fine chemical fields.

(101) D-(-)-Diisopropyl Tartrate (CAS: 62961-64-2): Mostly a colorless transparent oily liquid, an important chiral compound. It is mainly used as an inducer and resolving agent in asymmetric synthesis, widely applied in the pharmaceutical and fragrance fields to facilitate the preparation of high-optical-purity products.

(102) Quaternary Ammonium Tartrate: Formed by combining tartaric acid with quaternary ammonium groups (e.g., cetyltrimethylammonium), it has surface activity and chelating ability. It can be used as an ion exchanger (adsorbing metal ions) and antistatic agent (in the textile/plastic field), suitable for industrial wastewater treatment and polymer material modification.

(103) Choline Bitartrate (CAS: 87-67-2): A common component in nutritional supplements, mainly used to supplement choline to support the normal function of the nervous system and liver fat metabolism, and is also commonly used in infant formula foods. It can also be used as a feed additive to improve the growth performance of livestock and poultry, or assist in regulating lipid metabolism in the pharmaceutical field, suitable for multiple scenarios in food, feed, and medicine.

(104) Epinephrine Tartrate (CAS: 51-42-3): A salt formed by epinephrine and tartaric acid, mostly white or off-white crystalline powder, commonly used as an emergency drug in medicine. It is mainly used to relieve anaphylactic shock and acute bronchial asthma attacks, and can also be used for cardiac arrest rescue. It exerts cardiotonic and bronchial dilation effects quickly by activating adrenergic receptors.

(105) Norepinephrine Tartrate (CAS: 3414-63-9): A key emergency drug, mainly used to treat hypotension caused by acute myocardial infarction, cardiopulmonary bypass, etc., and maintain blood pressure after pheochromocytoma resection. It can also be usedafter cardiac arrest resuscitation to increase blood pressure by constricting blood vessels, ensuring blood supply to vital organs such as the brain and heart.

(106) D-Tartaric Acid-(-)-di-tert-butyl Ester (CAS: 117384-46-0): A key chiral auxiliary reagent in the field of asymmetric synthesis, mainly used to

induce the construction of compounds with specific configurations, especially to control the optical purity of product intermediates in pharmaceutical intermediate synthesis. It is also often used as a precursor of chiral ligands or in the preparation of high-optical-activity molecules in fine chemicals, providing structural guarantees for the performance of subsequent drugs, functional materials, and other products.

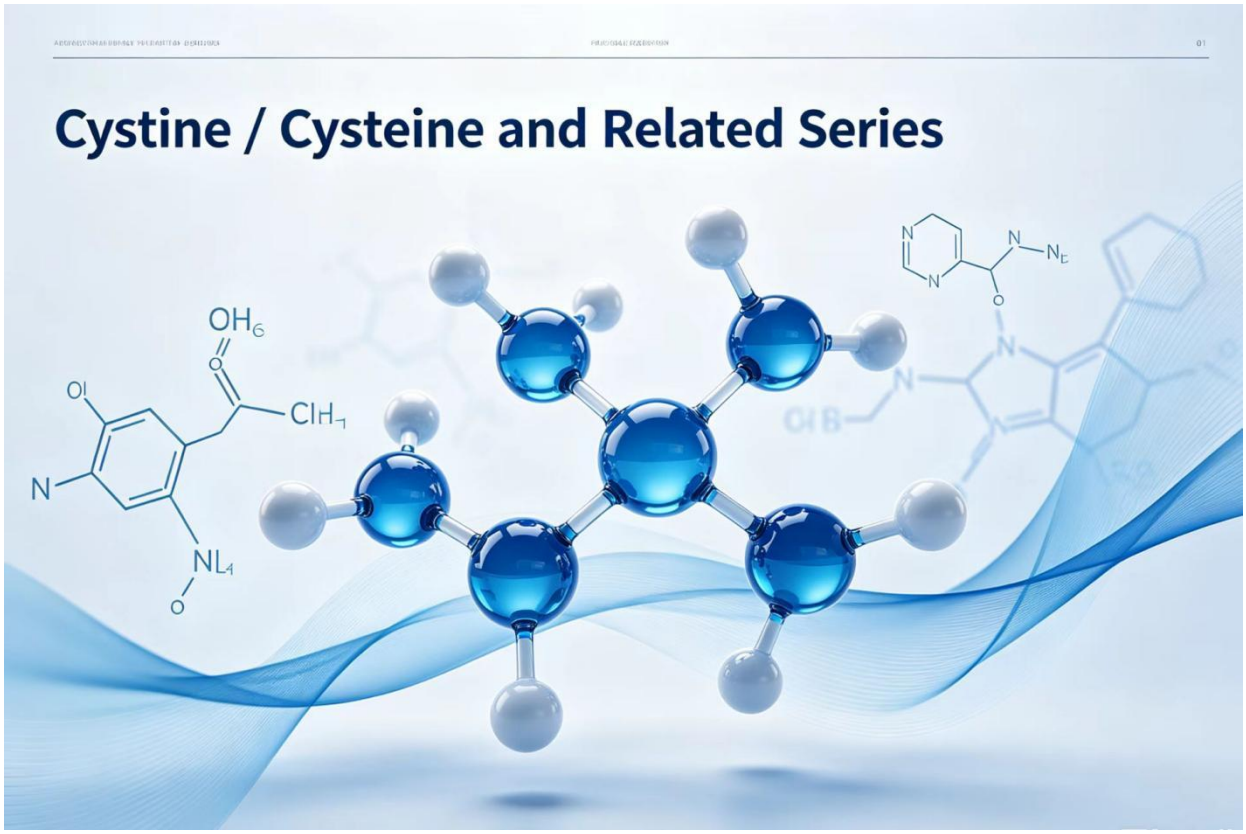
(107) Dimethylaminoethanol Bitartrate (CAS: 5988-51-2): A common component in nutritional supplements, used to improve cognitive function (e.g., enhancing attention and relieving memory decline), and often assists in improving sports performance and muscle coordination. It also has applications in the cosmetic field as a skin conditioner to help improve skin texture, and plays an auxiliary role in the synthesis of some pharmaceutical intermediates, suitable for multiple field needs.

(108) L-(+)-Potassium Antimonyl Tartrate: An important drug for anti-schistosomiasis, mainly killing schistosomes by inhibiting their metabolism, used to treat diseases caused by schistosome infection. It can also be used as a mordant in the textile industry or as a reagent in chemical analysis, but its pharmaceutical application has gradually been replaced by safer drugs due to its high toxicity.

(109) (1S-cis)-4-Amino-2-cyclopentenyl-1-methanol-D-tartrate (CAS: 229177-52-0): A key intermediate for the synthesis of anti-hepatitis C virus drugs, mainly used to construct the specific chiral structure of drug molecules to ensure efficacy. In the field of medicinal chemistry, it mainly serves the production chain of antiviral drugs, providing basic material support for the preparation of high-purity and high-activity hepatitis C treatment drugs.

(110) Pyrantel Tartrate (CAS: 33401-94-4): A broad-spectrum anthelmintic, mainly used to treat ascariasis and hookworm disease. It paralyzes parasites by inhibiting their cholinesterase, thereby expelling them from the body. It can also be used to treat trichuriasis and is effective against infections caused by various intestinal nematodes. Clinically, it is mostly available in tablet or suspension form for oral administration.

(111) Butorphanol Tartrate (CAS: 58786-99-5): A potent analgesic, mainly used to relieve moderate to severe pain (e.g., postoperative pain, cancer-related pain) and can also be used for analgesia during childbirth. It can also be used as an adjuvant anesthetic, exerting analgesic effects by activating opioid receptors. However, due to its addictive potential, it must be used under strict medical supervision.



(XVII) Cystine / Cysteine and Associated Product Series

Cystine and cysteine chelated series products are widely used in food, feed, medicine, daily chemicals, and agricultural fields due to their advantages of high biocompatibility and easy absorption. In food, they can serve as nutritional fortifiers and antioxidants to improve quality; in feed, they promote animal growth, enhance immunity, and optimize metabolism; in the pharmaceutical field, they are used for disease treatment and nutritional supplementation; in daily chemicals, they have skincare effects; in agriculture, they also assist in crop stress resistance and quality improvement. The specific products are as follows:

(1) Cystine Chelated Copper: Primarily used as a feed additive to supplement copper for animals. For example, when accounting for 10% of the compound feed for breeding male geese of the Lion-head breed, it can significantly increase semen volume, sperm density, and survival rate, enhance breeding ability and disease resistance; it can also be used in piglet feed to promote bone development and hemoglobin synthesis, and reduce the incidence of diarrhea.

(2) Cystine Chelated Manganese: Suitable for livestock and poultry breeding in the feed field, it participates in bone formation, energy metabolism, and immune regulation in animals. When added to the feed of breeding male geese (Lion-head breed) and laying hens, it can increase the egg production rate and the survival rate of goslings; in agriculture, it can be used as a component of foliar fertilizer to prevent leaf chlorosis caused by manganese deficiency in crops (such as wheat and corn) and promote photosynthesis.

(3) Cystine Chelated Zinc: It has dual nutritional benefits. When added to feed, it can increase the egg production rate of laying hens and improve the immunity of dairy cows; when added to the diet of fattening pigs, it can promote growth and optimize meat quality; in food, it can be fortified into milk powder and cereal products to simultaneously nourish hair and supplement zinc, suitable for breeding and human nutritional supplementation scenarios.

(4) Cystine Chelated Iron: As a core component of amino acid chelate premixed feed, it supplements iron for livestock and poultry and prevents iron-deficiency anemia in young animals; the food-grade can be added to infant supplementary food and elderly nutritional powder, which is mild and easy to absorb, reducing gastrointestinal irritation, and suitable for people in need of iron supplementation.

(5) Cystine Pearl Chelate: Formed by chelating agents made from hydroxyl-containing organic acids and cystine, which then chelate with trace elements such as calcium and zinc in pearls. It can be used as a base material for skincare masks and serums to enhance skin elasticity, brighten skin tone, and has a certain auxiliary effect of UV protection, suitable for the high-end daily chemical field.

(6) Cystine Compound Chelated Premixed Feed: Contains multiple components such as cystine chelated iron, copper, manganese, and zinc. It can effectively supplement trace elements and high-quality protein required by livestock and poultry, and can replace fish meal at a 1:1 ratio and soybean meal at a 1:1.5 ratio. Suitable for various breeding scenarios of pigs, chickens, ducks, geese, etc., it reduces feed costs while improving breeding efficiency.

(7) Cysteine Chelated Magnesium: Cysteine can enhance the stability and absorbability of magnesium. When added to sports supplements, it can relieve muscle spasms and improve exercise endurance; when used in sleep-aiding health products, it can synergistically regulate nerves and improve sleep quality, suitable for athletes and middle-aged and elderly people with insomnia; it can also be used as a plant foliar fertilizer to prevent magnesium-deficiency chlorosis in crops.

(8) Cysteine Chelated Zinc: With high bioavailability, zinc participates in enzyme activity regulation and immune system maintenance. When added to the diet of fattening pigs, it can improve immune performance and antioxidant capacity and promote growth; the food-grade can be added to beverages, cereals, and other products as a human zinc supplement, suitable for children, pregnant women, and other groups.

(9) N-Acetyl-L-Cysteine Chelate: Chelates formed with metals such as iron, copper, and selenium can be used as nutritional supplements for auxiliary treatment of oxidative stress, cardiovascular diseases, neurodegenerative diseases, etc.; when added to feed, it can enhance the antioxidant capacity of livestock and poultry and reduce the impact of stress responses on growth.

(10) Acetylcysteine Tablets: As a cystine chelating agent, it is specially used to treat cystinuria. By stabilizing the molecular structure of cystine, it prevents its crystalline deposition in the kidneys and protects renal function; it can also be used as an expectorant for auxiliary treatment of respiratory diseases such as chronic bronchitis.

(11) Cysteine Chelated Iron: The reducibility of cysteine improves the stability and absorption rate of iron, and its gastrointestinal irritation is much lower than that of ordinary iron agents such as ferrous sulfate. It is suitable for pregnant women, children, and other groups with iron-deficiency anemia as a nutritional supplement; when added to livestock/aquaculture feed, it can prevent iron-deficiency anemia in young animals, improve the body color of fish and shrimp, reduce the interference of other components in the feed on iron absorption, and improve breeding efficiency.

(12) Plant-Source Cysteine Chelate: Cysteine in plants such as rice and wheat can chelate heavy metals (such as arsenic and lead), reduce absorption by crop roots, and lower heavy metal residues in agricultural products; at the same time, it can promote the absorption of beneficial trace elements such as zinc and selenium by crops, achieving "toxin reduction and nutrition enhancement", suitable for ecological agricultural planting.

(13) L-Seleno-Methylselenocysteine: An amino acid chelated selenium product with high stability and bioavailability. It can be directly absorbed without in vivo conversion and can be used to prepare selenium supplements, suitable for daily health care of people in selenium-deficient areas; it can also be used as a feed additive to increase the selenium content of livestock and aquatic products and produce selenium-rich agricultural products.

(14) Cysteine Chelated Calcium: It has both the nutritional properties of cysteine and the physiological functions of calcium. The food-grade can be used in products such as calcium tablets and yogurt to improve calcium absorption and prevent osteoporosis, suitable for the elderly and children; the feed-grade added to the feed of laying hens and dairy cows can increase eggshell strength and milk calcium content, and improve product quality.

(15) Cystine Chelated Selenium: When added to feed, it can enhance the immunity of livestock and poultry, reduce the occurrence of diseases, and at the same time increase the selenium content in meat, eggs, and milk to meet the human demand for selenium supplementation; when used in aquaculture, it can improve the stress resistance and survival rate of fish and shrimp, and enhance meat flavor.

(16) N-Acetylcysteine Chelated Zinc: Combining the antioxidant properties of acetylcysteine and the physiological activity of zinc, it can be used as a raw material for health products to assist in improving skin inflammation and enhancing immunity; it can also be used in skincare products to relieve redness of sensitive skin and repair the skin barrier.

(17) Cystine Chelated Cobalt: A feed additive. Cobalt is a component of

vitamin B12. When added to the feed of ruminants (such as cattle and sheep), it can promote the synthesis of vitamin B12 by rumen microorganisms, improve digestion and absorption, and increase growth rate and milk production.

(18) Cysteine Chelated Chromium: It can be used as a component of health products to assist in regulating glucose metabolism, suitable for people in the pre-diabetic stage; when added in small amounts to livestock feed, it can improve feed conversion rate, reduce fat deposition, and improve meat quality, suitable for lean-type livestock breeding.

(19) Cystine-Modified Nano-Selenium Chelate: A new type of functional material that combines the biological activity of cystine and the antioxidant properties of nano-selenium. It can be used in high-end health products, pharmaceutical intermediates, or as a feed additive to enhance the antioxidant capacity and immunity of animals, suitable for the field of precision nutrition.

(20) Cysteine Chelated Molybdenum: Used as a foliar fertilizer in the agricultural field to supplement molybdenum required by crops (such as soybeans and peanuts), promote nitrogen fixation, and improve yield and quality; when added to feed, it can assist in the metabolic process of livestock and poultry and enhance disease resistance.

(21) Cysteine Chelated Potassium: The food-grade can be used as an auxiliary component of low-sodium salt substitutes, added to condiments and beverages to meet the needs of potassium supplementation and sodium control, suitable for people with hypertension; in agriculture, it is used as a foliar fertilizer to quickly supplement potassium for crops and enhance lodging resistance and drought resistance, especially suitable for the fruit expansion period of fruits and vegetables.

(22) Cystine Chelated Silicon: When added to feed, it can enhance the hardness and toughness of livestock and poultry bones and reduce the risk of fractures; in laying hen feed, it can also improve eggshell thickness; in agriculture, it is used for crops such as rice and wheat to enhance cell wall strength, improve disease, pest, and stress resistance, and enhance the storage and transportation resistance of agricultural products.

(23) N-Acetyl-L-Cysteine Chelated Iron: A nutritional supplement specially designed for people with iron-deficiency anemia. Its iron absorption efficiency is more than 30% higher than that of ordinary iron agents, and it has no gastrointestinal irritation, suitable for pregnant women, the elderly, and vegetarians; it can also be used as a fortified component in infant milk powder to ensure iron required for growth and development.

(24) Cysteine Chelated Nickel: Used as a catalyst in the industrial field to participate in organic synthesis reactions; when added in small amounts to feed (with strict dose control), it can assist in the rumen metabolism of ruminants and improve the utilization rate of nutrients, which must comply with the safety standards for livestock and poultry feed.

(25) Cystine Chelated Vanadium: Used in the pharmaceutical field for the research and development of health products that assist in regulating blood glucose, suitable for auxiliary conditioning of type 2 diabetes patients; in scientific research, it can be used as a modified component of biomedical materials to improve the biocompatibility of materials.

(26) Cysteine Chelated Titanium: Used as a new type of plant growth regulator in agriculture to promote crop photosynthesis and flower bud differentiation, and improve fruit sweetness and yield, suitable for the cultivation of fruits and vegetables such as strawberries and tomatoes; in industry, it can be used to prepare special coatings to enhance the corrosion resistance of coatings.

(27) Cystine-Glycyrrhizic Acid Compound Chelate: Used in mild skincare products in the daily chemical field, it has both antioxidant and anti-inflammatory effects, can relieve discomfort of sensitive skin, and improve skin redness and dryness; in food, it can be used as a natural preservative and antioxidant to extend the shelf life of pastries and meat products.

(28) L-Cysteine Chelated Germanium: Used in the health product field to prepare products that resist fatigue and enhance immunity, suitable for sub-healthy people; in pharmaceutical research, it can be used as an auxiliary carrier for anti-tumor drugs to improve drug targeting.

(29) Glutathione-Cysteine Compound Chelated Zinc: Combining the antioxidant properties of glutathione and the high absorption rate of cysteine-chelated zinc, it can be used as a raw material for health products to assist in improving liver metabolism and enhancing the body's stress resistance, suitable for people who often stay up late and drink alcohol; it can also be added to infant formula food to gently supplement zinc and reduce gastrointestinal irritation.

(30) Cystine Chelated Boron: Used as a special foliar fertilizer for flowering crops in the agricultural field to promote pollen germination and fertilization, and prevent "flowering without fruiting", especially suitable for rapeseed, fruit trees, and leguminous crops to improve fruit setting rate and seed setting rate; when added in small amounts to feed, it can assist in the bone development and reproductive function regulation of livestock and poultry.

(31) N-Acetylcysteine Chelated Manganese: Used in the pharmaceutical field to prepare health products for auxiliary treatment of osteoporosis. The synergistic effect of manganese and cysteine can promote bone mineralization, suitable for middle-aged and elderly people; when added to feed, it can enhance the immunity of livestock and poultry, reduce stress responses, and improve meat quality.

(32) Cysteine-Modified Alginate Chelated Calcium: Used as a raw material for edible films in the food field to wrap fresh food (such as fruits and meat), extend the fresh-keeping period and reduce nutrient loss; in the daily chemical field, it can be used to prepare mild toothpaste to prevent enamel

damage and assist in relieving gum sensitivity.

(33) Cystine Chelated Neodymium: Used in the scientific research field to prepare rare earth functional materials, and can be used as a modified component of biological probes to improve detection sensitivity; in the field of special ceramics, it can enhance the high-temperature resistance and mechanical properties of materials, suitable for high-end industrial material research and development.

(34) Cysteine-Green Tea Polyphenol Compound Chelated Iron: Combining the antioxidant properties of green tea polyphenols and the high bioavailability of cysteine-chelated iron, it can be used as a natural nutritional fortifier added to breakfast cereals and sports drinks to supplement iron and reduce oxidative deterioration, suitable for healthy food research and development.

(35) L-Cysteine Chelated Selenium: Its bioavailability is much higher than that of inorganic selenium. It can be used as a food nutritional fortifier added to selenium-rich biscuits and milk to meet the human demand for selenium supplementation; when added to feed, it can enhance the immunity of livestock and poultry, reduce the occurrence of diseases, and at the same time increase the selenium content of meat and egg products, helping to produce high-quality selenium-rich agricultural products.

(36) Cysteine Chelated Lithium: Used in the field of pharmaceutical research to develop auxiliary therapeutic drugs for mental diseases, which can assist in regulating the balance of neurotransmitters and provide a new direction for the conditioning of mania and depression; the dose must be strictly controlled to ensure medication safety.

(37) Cysteine-Chitosan Compound Chelated Copper: Used as a natural preservative in the food field to inhibit the reproduction of harmful microorganisms in meat products and fruit and vegetable products and extend the shelf life; in agriculture, it is used as a biological pesticide adjuvant to enhance pesticide adhesion and efficacy and reduce the use of chemical pesticides.

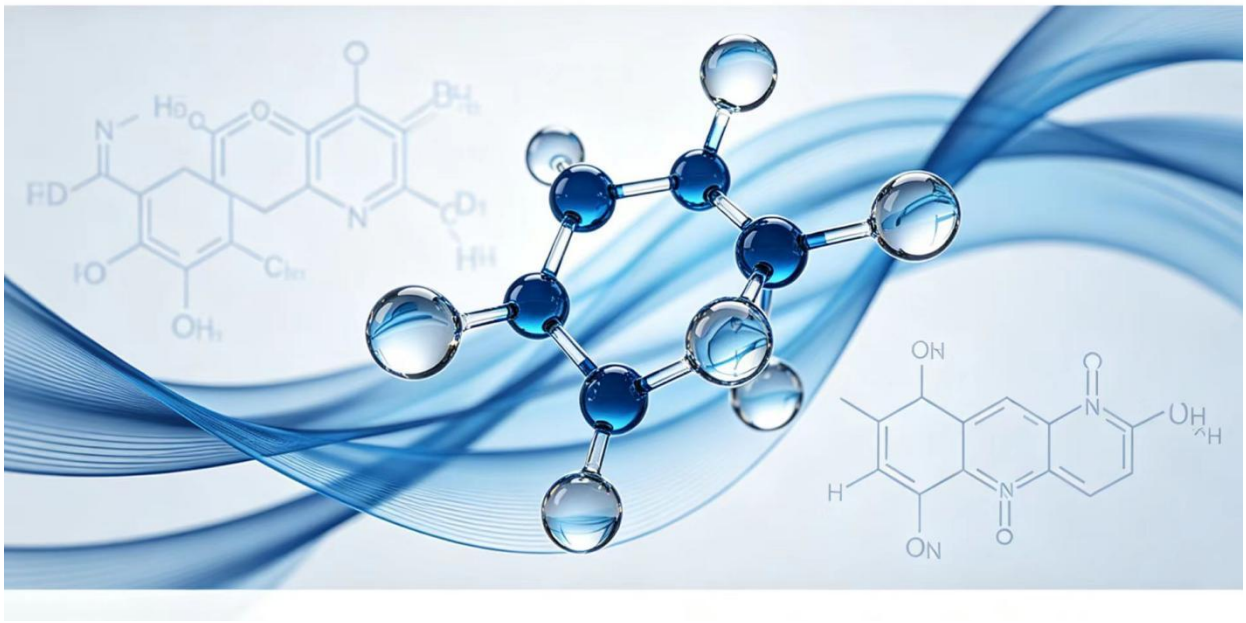
(38) N-Acetyl-L-Cysteine Chelated Cobalt: Mainly used in ruminant feed. Cobalt can promote the synthesis of vitamin B12 by rumen microorganisms, improve digestion and absorption functions, and increase the milk production of dairy cows and the growth rate of beef cattle; it can also be used as a pharmaceutical intermediate for the research and development of vitamin B12 supplements.

(39) Cysteine Chelated Tungsten: Used as a special catalyst in the industrial field to participate in organic synthesis reactions and the preparation of chemical raw materials; in scientific research, it can be used as a component of functional materials to develop new materials with high temperature resistance and high strength, suitable for high-end industrial and scientific research scenarios.

(40) Cysteine-Modified Quantum Dot Chelate: Used as a fluorescent probe in

the biomedical field to accurately label cells or biomolecules, contributing to the early diagnosis and detection of diseases; with high sensitivity and biocompatibility, it has important application value in the research and development of precision medicine.

Phenylalanine Chelation and Related Series



(XVIII) Phenylalanine Chelated and Associated Product Series

The core application of phenylalanine chelated series products is to serve as nutritional supplements for energy supply and participation in protein synthesis in the body. Meanwhile, they can be used as additives in the food and feed fields to improve the nutritional value and absorption efficiency of products.

(1) Phenylalanine Chelated Calcium: It supplements phenylalanine and calcium simultaneously, enabling efficient absorption without relying on vitamin D and causing no gastrointestinal irritation. It is mainly used for nutritional fortification in infant food and health products for the middle-aged and elderly, and can also be used to produce compound amino acid preparations to assist in improving calcium deficiency-related issues.

(2) Phenylalanine Chelated Magnesium: A new type of high-efficiency magnesium supplement with higher absorption efficiency than traditional magnesium salts and low soil residue, with an expected annual compound growth rate of 11% in the market. It can be added to sports nutrition products to relieve muscle fatigue, and also used as a livestock and poultry feed additive to enhance stress resistance and reduce breeding mortality.

(3) Phenylalanine Chelated Iron: As an important trace element supplement, this product causes no gastrointestinal irritation. It is widely used in infant supplementary food and adult iron-supplementing health products, and can also be added to aquaculture feed to improve the body color and disease

resistance of fish and shrimp.

(4) Phenylalanine Chelated Zinc: The amino acid chelated structure improves the bioavailability of zinc and reduces interference from phytic acid. It is mainly used for children's nutritional supplementation (improving picky eating and promoting development), and can also be used as a livestock and poultry feed additive to promote animal weight gain and reduce the incidence of diarrhea.

(5) Phenylalanine Chelated Titanium (e.g., Anmuxi Guotaihong): It belongs to amino acid-containing water-soluble fertilizer, with the core component being 5-ALA anthocyanin phenylalanine chelated titanium. Specifically designed for fruit and vegetable cultivation, it can promote fruit coloration, fruit expansion (preventing cracking), and sweetness enhancement, while also removing rustand brightening fruits to improve the commercial value of agricultural products.

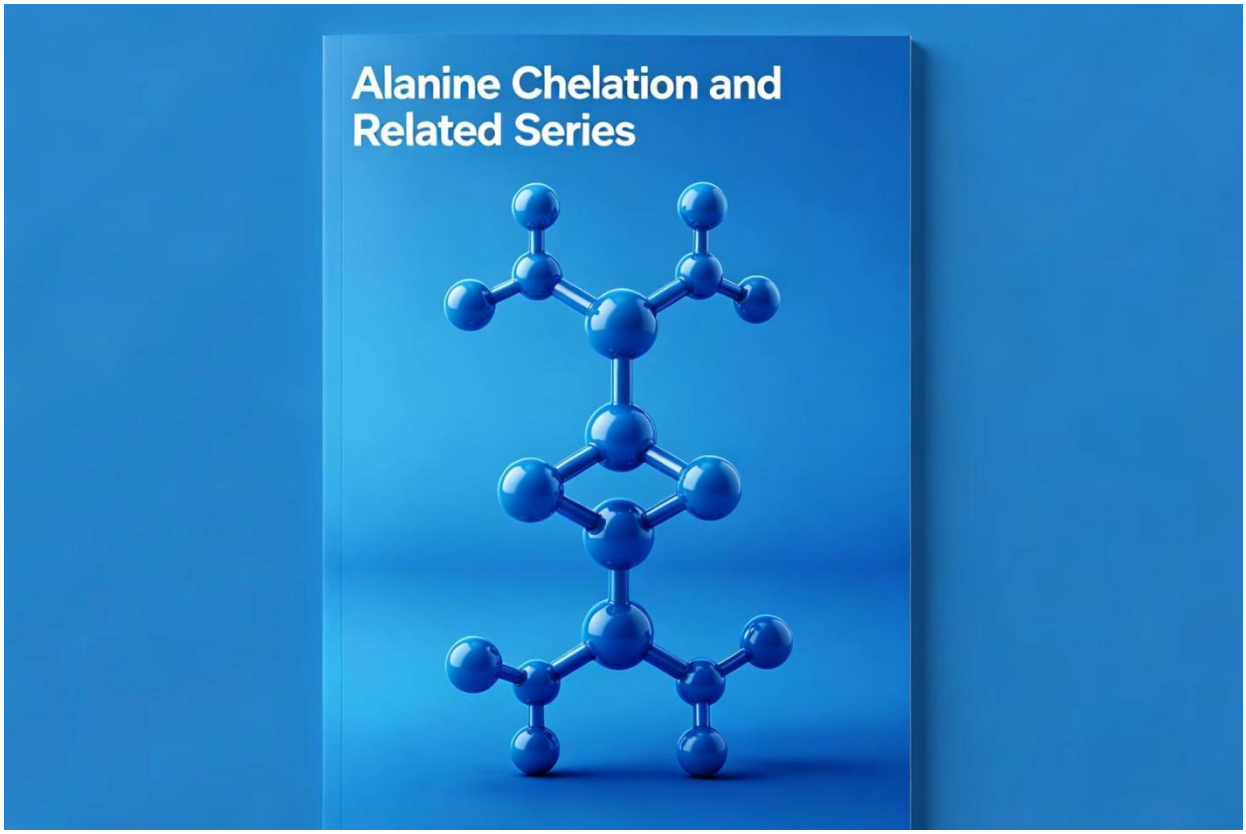
(6) Phenylalanine Chelated Nutritional Sugar-Enhancing and Coloring Agent (Sichuan Taihe Technology Model): Contains high-content phenylalanine, focusing on the cultivation of fruits such as grapes. It can promote the synthesis and accumulation of peel pigments, significantly increase fruit sweetness, solve problems of uneven coloring and insufficient sweetness, and improve fruit quality.

(7) Phenylalanine Nanoparticles (Universal Tumor Immunocarrier): By regulating the electrophysiological behavior of dendritic cells, it activates the innate immune response and reshapes the tumor immunosuppressive microenvironment. It can enhance the effect of immune checkpoint blockade therapy and provide basic carrier support for tumor immunotherapy.

(8) Ph-Mg (Magnesium-Chelated L-Phenylalanine Nanospheres): Used in tumor immunotherapy research. After entering cells, it can bind to potassium channel proteins, activate related pathways, promote the maturation of dendritic cells, and enhance the body's anti-tumor immune capacity, suitable for research on various tumor models.

(9) Ph-Fe (Iron-Chelated L-Phenylalanine Nanoneedles): Focuses on tumor immunotherapy research. It activates potassium ion channels through interaction with potassium channel proteins, thereby triggering activation signals of dendritic cells and enhancing the anti-tumor immune response, with potential clinical application value.

(10) Ph-Zn (Zinc-Chelated L-Phenylalanine Nanosheets): Shows outstanding performance in tumor immunotherapy research, with the best cell uptake effect. It can efficiently activate dendritic cells; in mouse models of breast cancer and colorectal cancer, combining with PD-1 monoclonal antibody therapy can achieve the best tumor suppression effect.



(XIX) Alanine Chelated and Associated Product Series

Alanine chelated series products are mainly used to supplement alanine and support energy metabolism. They can serve as nutritional fortifiers in food and promote animal growth in feed, while chelation technology further enhances their absorption efficiency.

(1) Alanine Chelated Zinc: The chelated form avoids interference from phytic acid, with an absorption rate 25%+ higher than that of zinc sulfate and no in vivo residue. It can improve picky eating in children aged 3-6 years, promote development, and enhance the immunity of the elderly; when added to livestock and poultry feed, it helps piglets and chicks gain 8%-10% daily weight and reduces the diarrhea rate by 25%; when used in aquaculture seedling raising, it increases the survival rate of fry by 15%.

(2) Alanine Chelated Calcium: It enables efficient absorption without relying on vitamin D, with an absorption rate 30% higher than that of traditional calcium carbonate. People with weak gastrointestinal tracts (e.g., gastritis patients) experience no bloating or constipation. Suitable for the elderly to supplement calcium and prevent osteoporosis, and for pregnant and lactating women to meet their needs during pregnancy; as a fortifier in milk powder or health products, it does not precipitate with milk protein and maintains a smooth taste.

(3) Alanine Chelated Magnesium: Alanine promotes the transport of magnesium to cells, with a utilization rate of 70%+ in muscle and nerve cells. It can relieve post-exercise muscle soreness and improve insomnia in the middle-aged

and elderly; when added to livestock and poultry feed in summer, it reduces the decline in egg production rate of laying hens by 10%-12% and lowers the heat stress mortality rate of pig herds by 18%.

(4) Alanine Chelated Iron: It causes no gastrointestinal irritation or iron odor, and the rate of hemoglobin increase is 15% faster than that of ferrous sulfate. It can prevent iron-deficiency anemia in women, post-operative people, and children; when added to livestock and poultry feed, it reduces the mortality rate of young animals by 20%; when used in shrimp and crab feed, it increases the blue shell rate of river crabs by 25% and enhances resistance to vibriosis.

(5) Alanine Chelated Copper: Low-toxic and residue-free, suitable for multiple scenarios. When added to livestock and poultry feed, it reduces the incidence of Newcastle disease in chickens and respiratory diseases in pigs by 18%; it improves the body color of ornamental fish and Penaeus vannamei; as a trace element fertilizer for planting, it prevents "flowering without fruiting" in rice and wheat, increases the seed setting rate by 12%, and inhibits cyanobacteria.

(6) Alanine Chelated Chromium: Its absorption rate is 3 times that of inorganic chromium, enabling precise regulation of glucose and lipid metabolism. When fed to high-yield dairy cows, it increases milk production by 5%-8% and improves milk quality; when used for fattening pigs, the feed-to-meat ratio can be reduced to below 2.8:1; when added to senior pet food, it helps maintain stable blood glucose and prevent diabetes.

(7) Alanine Chelated Manganese: It avoids combination with phytic acid and oxalic acid, increasing bioavailability by 40%. When added to livestock and poultry feed, it reduces the incidence of rickets in chicks by 20% and the eggshell breakage rate of laying hens by 15%; as a foliar fertilizer for soybeans and peanuts, it promotes nitrogen fixation by rhizobia and increases the pod setting rate by 10%; it can also assist in preventing osteoporosis in the middle-aged and elderly.

(8) Alanine Chelated Selenium: It prevents the oxidation and loss of selenium, and selenium can quickly enter cells through alanine. As a human selenium supplement, it enhances the immunity of people in selenium-deficient areas and prevents cardiovascular diseases; when fed to broilers, it can produce selenium-rich meat and reduce the incidence of salpingitis in laying hens; when used in aquaculture feed, it enhances the resistance of fish and shrimp to heavy metals such as lead and mercury.

(9) Alanine Chelated Potassium: It promotes the penetration of potassium into cells and maintains osmotic balance. When added to sports drinks, it supplements potassium lost during exercise and prevents hypokalemic muscle weakness; as a potassium fertilizer for watermelons and muskmelons, it increases sugar content by 1-2 units and reduces the fruit cracking rate by 20%; when used for flowers such as roses, it extends the flowering period by

3-5 days.

(10) Alanine Chelated Molybdenum: Its absorption rate in alkaline soil is 35% higher than that of ammonium molybdate. As a special fertilizer for legumes and rapeseed, it promotes nitrogen fixation by rhizobia and increases the oil content of rapeseed by 3%-5%; it prevents "tip blight" in wheat and corn; when added to ruminant feed, it assists in the synthesis of vitamin B12 and improves rumen digestive function.

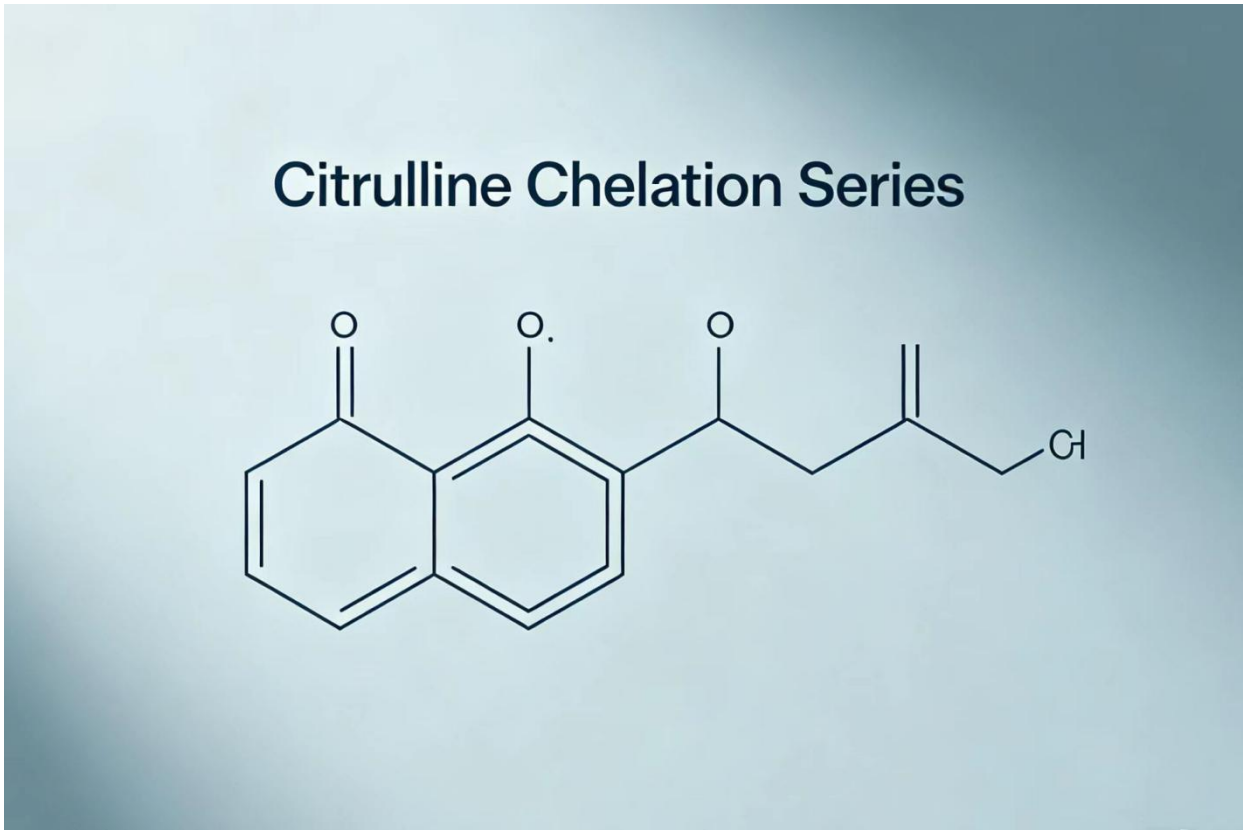
(11) Alanine Chelated Cobalt: Cobalt is a core component of vitamin B12, with an absorption rate 40% higher than that of cobalt chloride. When added to ruminant feed, it reduces the anemia rate of calves by 25% and increases the daily milk production of dairy cows by 0.8-1.2kg; when used in aquaculture feed for eels and soft-shelled turtles, it enhances stress resistance and increases the transport survival rate by 18%.

(12) Alanine Chelated Silicon: It promotes the transport of silicon to plant cell walls or animal connective tissues. When used in rice and wheat cultivation, it enhances stem toughness and improves lodging resistance by 30%; when added to the feed for tomatoes and cucumbers, it thickens the peel, reduces the fruit cracking rate by 22%, and extends the fresh-keeping period; when fed to broilers, it reduces the incidence of leg diseases by 15% and can also assist in repairing human cartilage.

(13) Alanine Chelated Boron: It has a 40% higher absorption rate in alkaline soil and strong mobility. When used in rapeseed and cotton cultivation, it promotes pollen tube elongation and increases the boll setting rate by 15%-20%; it prevents "fruit shrinkage disease" in apples and pears and improves fruit deformity; when added to the feed for flowers such as roses and lilies, it extends the flowering period by 3-4 days and reduces transportation loss.

(14) Alanine Chelated Nickel: Nickel is a key component of urease, with an absorption rate 35% higher than that of nickel nitrate. When added to piglet and chick feed, it promotes urea decomposition and reduces the incidence of gastrointestinal diseases (e.g., the yellow scours rate of piglets decreases by 18%); when used for ruminants such as sheep and cattle, it increases daily weight gain by 8%-10%; it assists rhizobia in nitrogen fixation in soybeans and peas and enhances resistance to barren soil.

(15) Alanine Chelated Vanadium: It acts precisely on glucose metabolism enzymes, with an absorption rate 50% higher than that of sodium vanadate and lower toxicity. When fed to fattening pigs, it improves insulin sensitivity, reduces backfat thickness by 0.3-0.5cm, and increases lean meat rate; when used for laying hens, it reduces cholesterol content in egg yolks by 12%-15% to produce low-fat functional eggs; it can be used as an auxiliary nutritional supplement for people in the pre-diabetic stage.



(X) Citrulline Chelated and Associated Product Series

The citrulline chelation series products are highly efficient nutritional supplements that combine citrulline as a chelating agent with various trace elements. The product has strong stability and high absorption and utilization rate, and can be widely used in agricultural planting, food nutrition enhancement, and health product production. It can efficiently supplement various nutrients and is suitable for multiple scenarios.

(1) L-Citrulline Chelated Zinc: Synthesized via microwave solid-phase method from L-citrulline and zinc acetate; it provides dual benefits of zinc supplementation (supporting immunity and promoting children's development) and citrulline (aiding vasodilation); its absorption rate is 30%+ higher than that of single zinc agents, suitable for children, vegetarians, and the middle-aged and elderly, and can be used as a fortifying component in health foods/infant supplementary food.

(2) L-Citrulline Chelated Magnesium: Magnesium participates in over 300 physiological processes; after chelation, its utilization rate increases by 40% and it has strong stability; it relieves muscle spasms in athletes, improves sleep in the elderly, and assists in blood pressure regulation, suitable for high-intensity athletes, magnesium-deficient people, and those in the pre-hypertensive stage.

(3) L-Citrulline Chelated Iron: It causes no gastrointestinal irritation (no nausea or constipation) associated with traditional iron agents and has a 25% higher absorption rate; it prevents/treats iron-deficiency anemia in

children, women, and post-operative people, and can fortify iron content in adult nutritional cereals and pregnant women's milk powder.

(4) Tripeptide-9 Citrulline Metal Chelate: It complexes copper and iron ions to inhibit free radical formation; it protects skin DNA and reduces collagen loss, suitable for anti-aging serums and face creams, and can be added to sun protection products to enhance antioxidant capacity and reduce photoaging damage.

(5) Citrulline-DL-Malic Acid Chelate: It strongly complexes metals such as calcium, magnesium, lead, and mercury; in the industrial sector, it prevents food spoilage (e.g., beverage browning and can oxidation); in the environmental sector, it treats electroplating/dyeing wastewater (with a heavy metal removal rate of 90%+); it can also be used as a water treatment agent to soften hard water.

(6) Honeydew Melon Amino Acid Chelated Copper: An organic copper fertilizer (containing citrulline) with a utilization rate 50% higher than that of inorganic copper and no soil residue; it promotes photosynthesis in wheat/tomatoes/citrus, resists powdery mildew/canker, and improves fruit color (e.g., bright citrus peel), suitable for various cash crops.

(7) Citrulline Malate (Nutritional Supplement): It increases arginine and nitric oxide in the blood, improves vascular function (blood oxygen saturation increases by 10%-15%); it burns fat for energy and relieves muscle soreness during exercise, suitable for fitness/endurance athletes, and also helps the middle-aged and elderly improve blood circulation and lower blood lipids.

(8) L-Citrulline Chelated Calcium: It can be absorbed without vitamin D, with a utilization rate 35% higher than that of traditional calcium supplements and no stimulation to the gastric mucosa; it prevents osteoporosis in the elderly, can be added to pregnant women's milk powder to supplement calcium during pregnancy, and is also suitable for patients with gastritis/gastric ulcers to supplement calcium.

(9) L-Citrulline Chelated Selenium: It avoids the oxidation and loss of selenium, with a utilization rate increased by 45%; it strengthens thyroid function and protects liver cells (reducing alcohol/drug damage), suitable for people in selenium-deficient areas, and can be used as a food additive for selenium-rich rice/eggs/tea.

(10) Citrulline Chelated Manganese (Agricultural Use): Manganese is not easily fixed by soil; it promotes nitrogen fixation by rhizobia in soybeans/peanuts (pod setting rate increases by 20%), enhances the lodging resistance of rice/corn stems, improves grain plumpness (1000-grain weight increases by 5%-8%), and reduces empty grains.

(11) L-Citrulline Chelated Chromium (Livestock and Poultry Use): Its utilization rate is 60% higher than that of inorganic chromium, enabling precise regulation of glucose and lipid metabolism; when fed to fattening

pigs, it reduces the feed-to-meat ratio to below 2.7:1 and increases lean meat rate; when fed to high-yield dairy cows, it increases milk production by 0.8-1.2kg/day and improves milk protein content, suitable for large-scale breeding.

(12) Citrulline Chelated Cobalt (Ruminant-Specific): Cobalt is a core component of vitamin B12, with a utilization rate increased by 50% after chelation; it prevents anemia and loss of appetite in cattle and sheep, increases daily weight gain by 8%-10%, enhances the rumen's ability to digest roughage, and reduces indigestion.

(13) Citrulline Compound Chelated Trace Elements (Aquaculture Use): Compound chelated zinc, iron, manganese, and selenium; it increases the survival rate of fry by 15%-20%, improves the body color of fish and shrimp (e.g., bright blue Penaeus vannamei and reddish grass carp), and enhances stress resistance (to high temperature/transportation/water quality changes), suitable for freshwater fish and marine shrimp/crab farming.

(14) Citrulline Chelated Titanium (Fruit and Vegetable-Specific Fertilizer): Titanium increases the photosynthetic efficiency of plants by 25%; when used for strawberries/grapes/cherries, it increases sugar content by 1-2 units, promotes uniform coloration, strengthens peel toughness to prevent cracking, extends shelf life by 2-3 days, and improves commercial value.

(15) L-Citrulline Chelated Molybdenum (Legume-Specific Fertilizer): Molybdenum is a key component of nitrogenase, with a utilization rate increased by 40% after chelation; it promotes nitrogen fixation by rhizobia in soybeans/peas/broad beans (nitrogen fixation amount increases by 30%), prevents "flowering without fruiting", and increases grain yield and protein content by 8%-10%.

(16) Citrulline-Metal Chelated Antioxidant (Cosmetic Use): Chelated zinc, selenium combined with vitamin E; it inhibits the oxidation of cosmetic oils (extending shelf life by 3-6 months) and reduces free radical damage to the skin, suitable for cleansing oils, liquid foundations, and antioxidant masks.

(17) L-Citrulline Chelated Potassium (Pet Use): Potassium promotes fluid balance in pets, with an absorption rate increased by 35% after chelation; when added to senior dog/cat food, it prevents hypokalemic muscle weakness and protects heart function, suitable for pets with kidney disease (low-irritation potassium supplementation to reduce kidney burden).

(18) Citrulline Chelated Nickel (Industrial Catalysis Use): The catalytic activity of nickel increases by 50% after chelation with citrulline; it is usedin fine chemicals (e.g., pharmaceutical intermediates, dye synthesis), reduces reaction energy consumption by 30%, decreases by-product formation, and improves product purity.

(19) Citrulline Chelated Boron (Rapeseed-Specific Fertilizer): Boron promotes pollen tube elongation, with a utilization rate increased by 40%; it prevents "flowering without fruiting" in rapeseed, increases the seed setting

rate by 15%-20%, improves the oil content of rapeseeds by 3%-5%, and reduces the empty pod rate.

(20) L-Citrulline Chelated Germanium (Post-Operative Recovery Supplement): Germanium aids oxygen transport, with a utilization rate increased by 45% after chelation; when taken by post-operative people, it accelerates wound healing, reduces inflammatory reactions, and assists in enhancing immunity, suitable for people in the recovery period after surgery and chronic diseases (e.g., liver disease).

(21) Citrulline Chelated Vanadium (Functional Food Use): After chelation with citrulline, vanadium precisely regulates the activity of glucose metabolism enzymes, with a utilization rate 50% higher than that of sodium vanadate; when added to sugar-controlled functional foods (e.g., meal replacement powders, biscuits), it assists people in the pre-diabetic stage in stabilizing blood glucose without side effects.

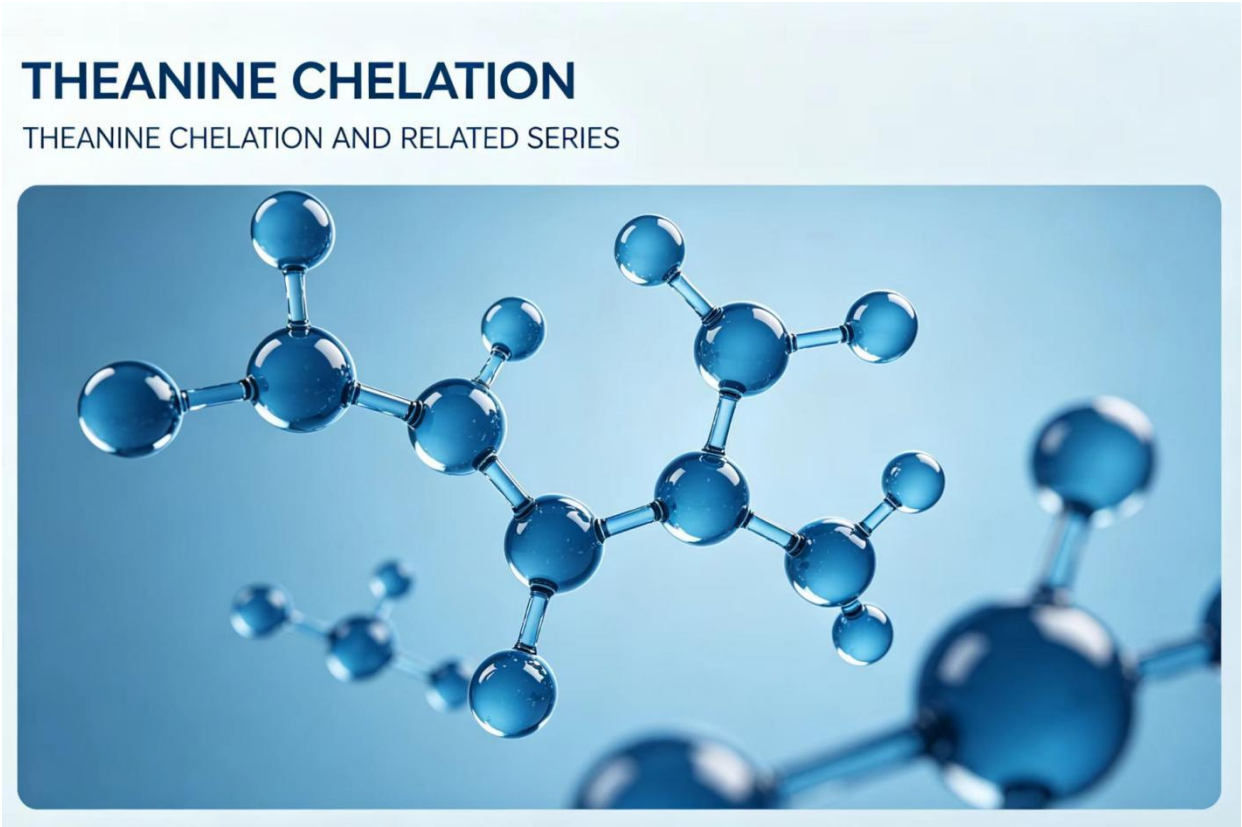
(22) Citrulline Chelated Silicon (Ornamental Plant Fertilizer): Silicon is easily absorbed by flowers after chelation with citrulline; when used for roses, orchids, and succulents, it strengthens stem toughness (preventing lodging), thickens the leaf cuticle (resisting diseases and pests), extends the flowering period by 3-5 days, and improves ornamental value.

(23) L-Citrulline Chelated Iodine (Maternal and Infant Food Use): Iodine is a core component of thyroid hormones; after chelation, there is no iodine volatilization loss, and the absorption rate increases by 40%; when added to infant formula milk powder and pregnant women's nutritional porridge, it prevents abnormal thyroid development in fetuses and iodine-deficiency cretinism in children.

(24) Citrulline Chelated Aluminum (Ecological Remediation Use): It combines with excess phosphorus in soil to form stable chelates; it is used for agricultural ecological remediation to reduce soil phosphorus loss (reducing water eutrophication) and avoid aluminum ion toxicity to crop roots, suitable for protected agricultural soil.

(25) Citrulline-Metal Chelated Antibacterial Agent (Oral Care Use): It chelates silver and zinc ions, with strong antibacterial activity and mildness; when added to toothpaste and mouthwash, it inhibits oral pathogenic bacteria (e.g., Helicobacter pylori, streptococcus), reduces dental plaque and gingivitis, and causes no irritation to oral mucosa.

(26) Citrulline Chelated Lithium (Livestock and Poultry Stress Regulator): After chelation with citrulline, lithium regulates the secretion of neurotransmitters in livestock and poultry; when added to livestock and poultry feed (especially in summer), it relieves the decrease in feed intake and egg production rate caused by high-temperature stress, suitable for laying hen and broiler breeding.



(XXI) Theanine Chelated and Associated Product Series

L-Theanine is used as chelating agent to bind iron, zinc, selenium, calcium and other elements. The absorption rate of trace elements is 35%-45% higher than ordinary preparations, no metallic odor, good biocompatibility, widely used in food, feed, agriculture and daily chemical industries.

1. L-Theanine Iron Chelate

Oral: Iron supplement oral liquid, vegetarian nutritional powder, instant tea powder, menstrual ginger tea, premature infant nutrition supplement, elderly anemia granule, student breakfast cereal, outdoor energy drink

Food processing: Plant-based yogurt additive, fresh-keeping agent for fruits & vegetables, baking fortifier, iron-fortified freeze-dried fruit, nut auxiliary, dairy iron supplement

Feed breeding: Piglet creep feed, broiler weight gain feed, aquatic seedling feed, ornamental fish color-enhancing feed, ruminant iron supplement, senior pet food

Agriculture: Fruit & vegetable foliar fertilizer, iron-deficiency resistant rice fertilizer, flower iron fertilizer, Chinese herbal medicine iron fertilizer, lawn iron fertilizer, matching iron fertilizer for selenium-rich tea

Daily chemicals: Infant hip care cream, lipstick raw material, body wash auxiliary, tableware antibacterial coating

2. L-Theanine Zinc Chelate

Oral: Children probiotic tablets, anti-anxiety oral liquid, sugar-controlled

meal replacement, sports drink, pregnant nutritional supplement, attention-improving lozenges for students

Food processing: Tea drink flavor regulator, coffee improver, baking additive, children milk tablet, fermentation promoter, zinc-fortified nut

Feed breeding: Layer laying feed, broiler growth feed, white shrimp feed, pet hair-beautifying food, calf zinc supplement, ornamental bird molting feed

Agriculture: Strawberry fruit expansion fertilizer, tomato quality-improving fertilizer, tea zinc fertilizer, soybean nitrogen-fixing fertilizer, citrus fruit-preserving fertilizer, succulent color-enhancing fertilizer

Daily chemicals: Oil-control essence, wound healing gel, children sunscreen, pet skin care liquid, hydroponic nutrient solution

3. L-Theanine Selenium Chelate

Oral: Selenium-rich drink, liver-protecting oral liquid, stay-up nutritional capsule, pregnant milk powder, middle-aged & elderly eye care liquid, pet eye nutrition

Food processing: Selenium-rich nuts, selenium-rich tea, selenium-fortified freeze-dried fruit, edible fungus selenium supplement, grain selenium additive

Feed breeding: Dairy cow lactation feed, selenium-rich egg feed, aquatic disease-resistant feed, pet immune food, livestock meat quality improver

Agriculture: Astragalus & angelica selenium-rich fertilizer, rice selenium fertilizer, fruit & vegetable selenium fertilizer, flower fresh-keeping fertilizer, lawn stress-resistant fertilizer

Daily chemicals: Anti-aging cream, anti-hair loss shampoo, oral mouthwash, balcony plant fertilizer, pet bath selenium ingredient

4. L-Theanine Calcium Chelate

Oral: Middle-aged & elderly calcium tablets, pregnant tea drink, children anti-caries lozenges, joint chewable tablets, premature infant nutrient liquid

Food processing: Baking calcium fortifier, plant beverage, breakfast cereal, meal replacement biscuit, dairy calcium supplement

Feed breeding: Pet joint food, eggshell-strengthening layer feed, beef bone development feed, aquatic crustacean calcium supplement, poultry calcium feed

Agriculture: Fruit & vegetable crack-resistant fertilizer, succulent lodging-resistant fertilizer, rice lodging-resistant fertilizer, flower flower-preserving fertilizer,

Chinese herbal calcium fertilizer

Daily chemicals: Anti-caries toothpaste, moisturizing body lotion, nail care agent, tableware cleaning tablet

5. L-Theanine Magnesium Chelate

Oral: Sports drink, sleep-improving oral liquid, electrolyte drink, anti-

fatigue lozenge, sleep milk shake, menopausal drink

Food processing: Coffee improver, grain magnesium additive, dairy magnesium ingredient, meal replacement auxiliary, plant beverage magnesium supplement

Feed breeding: Ruminant stress-resistant feed, livestock stress-resistant feed, aquatic muscle feed, pet joint food

Agriculture: Fruit & vegetable photosynthesis fertilizer, flower chlorophyll fertilizer, Chinese herbal magnesium fertilizer, lawn cold-resistant fertilizer, rice stress-resistant fertilizer

Daily chemicals: Soothing body wash, aromatherapy spray, hand cream, foot care cream

6. L-Theanine Manganese Chelate

Oral: Cognitive improvement liquid, joint lozenge, children nutritional tablet, middle-aged & elderly bone capsule

Food processing: Baking manganese additive, functional cereal, plant beverage, edible fungus manganese supplement

Feed breeding: Aquatic survival feed, pet joint food, duck laying feed, livestock bone feed

Agriculture: Rice lodging-resistant fertilizer, edible fungus yield-increasing fertilizer, flower color-enhancing fertilizer, fruit & vegetable disease-resistant fertilizer

7. L-Theanine Copper Chelate

Oral: Anti-oxidation oral liquid, metabolism capsule, pet hair care food, children immune lozenge

Food processing: Fruit & vegetable fresh-keeping agent, wine brewing auxiliary, vinegar brewing additive, dairy copper ingredient

Feed breeding: Piglet diarrhea-preventing feed, aquatic antibacterial feed, pet hair food, poultry feather gloss feed

Agriculture: Fruit tree disease-resistant fertilizer, flower antibacterial fertilizer, Chinese herbal copper fertilizer

Daily chemicals: Antibacterial hand sanitizer, pet body wash, oral antibacterial gel

8. L-Theanine Cobalt Chelate

Oral: Vitamin B12 auxiliary oral liquid, immune capsule, pet anemia-resistant food

Feed breeding: Ruminant B12 feed, calf anemia-preventing feed, milk-yield improving dairy feed

Agriculture: Legume nitrogen-fixing fertilizer, flower growth fertilizer, Chinese herbal cobalt fertilizer

9. L-Theanine Chromium Chelate

Oral: Sugar-controlled meal replacement, low-GI food, blood glucose

regulating liquid, sugar-controlled biscuit

Feed breeding: Pig fattening feed, livestock metabolism feed, pet weight management food

Agriculture: Fruit & vegetable metabolism fertilizer, Chinese herbal chromium fertilizer

10. L-Theanine Germanium Chelate

Oral: Anti-aging drink, oral beauty liquid, senior pet food

Food processing: Ganoderma & ginseng drink, edible fungus germanium supplement, grain germanium fortifier

Agriculture: Chinese herbal germanium fertilizer, fruit & vegetable germanium fertilizer

Daily chemicals: Anti-aging essence, repairing cream

11. L-Theanine Iodine Chelate

Oral: Infant complementary food, pregnant iodine supplement, seaweed products

Feed breeding: Aquatic iodine feed, poultry thyroid feed

Agriculture: Fruit & vegetable iodine fertilizer

12. L-Theanine Boron Chelate

Agriculture: Soybean nodule fertilizer, rapeseed pod-preventing fertilizer, citrus fruit-preserving fertilizer, strawberry fruiting fertilizer

13. L-Theanine Silicon Chelate

Oral: Beauty capsule, joint care liquid

Feed breeding: Aquatic crustacean strengthening feed, poultry feather feed

Agriculture: Rice lodging-resistant fertilizer, fruit & vegetable crack-resistant fertilizer

Daily chemicals: Hair conditioner, skin care product, nail care oil

14. L-Theanine Titanium Chelate

Oral: Traditional Chinese health drink

Agriculture: Photosynthetic fertilizer, fruit & vegetable yield-increasing fertilizer, flower flowering-prolonging fertilizer

15. L-Theanine Vanadium Chelate

Oral: Sugar-controlled food, blood glucose regulating meal replacement

Feed breeding: Dairy cow lactation feed, aquatic attractant

16. L-Theanine Nickel Chelate

Feed breeding: Aquatic probiotic feed, pet intestinal food

Agriculture: Microbial fertilizer, soil improver

17. L-Theanine Rare Earth Chelate (Lanthanum/Neodymium)

Agriculture: Tea quality-improving fertilizer, fruit & vegetable yield-increasing fertilizer, flower color-enhancing fertilizer

Feed breeding: Livestock meat quality improving feed, pet immune food

18. L-Theanine Composite Chelate

Iron-Zinc: Student cereal, sports drink, outdoor drink, infant nutritional drops

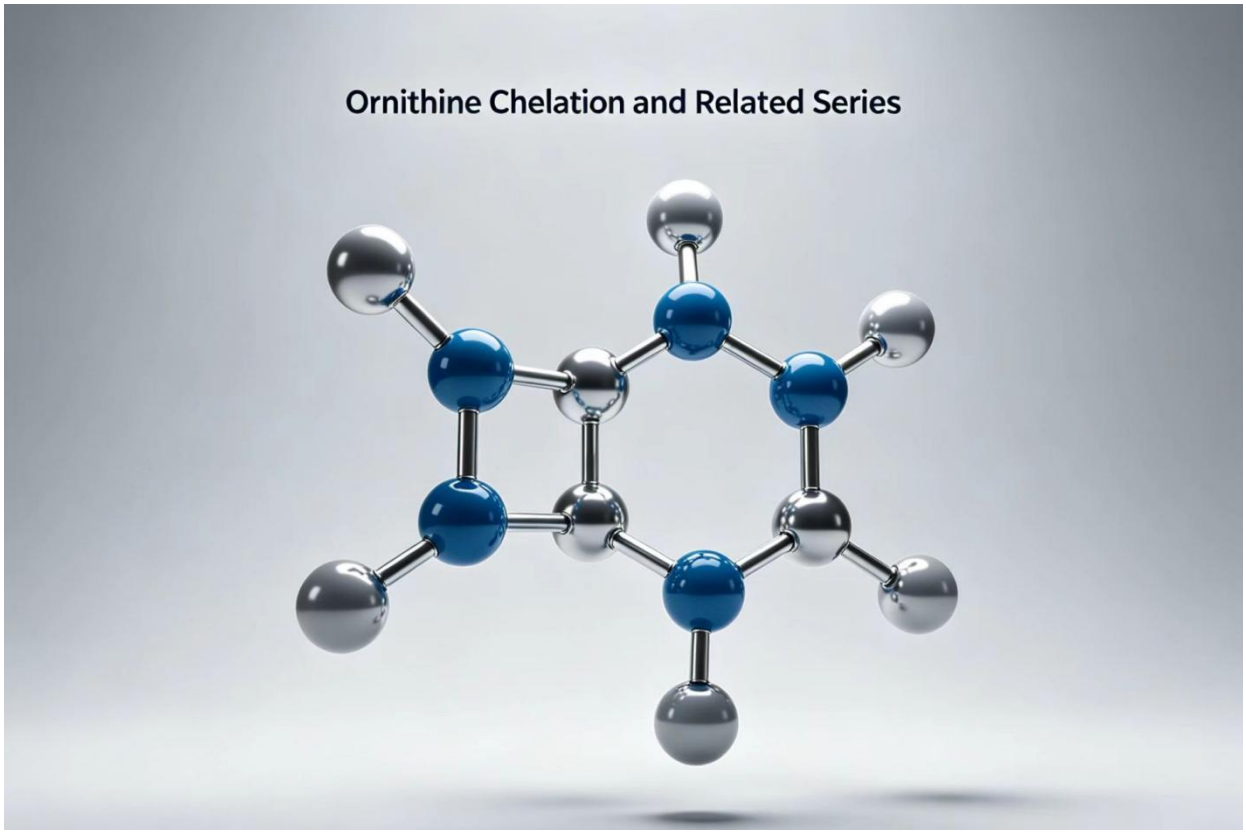
Selenium-Magnesium: Eye nutrient liquid, e-sports drink, anti-aging capsule

Calcium-Zinc: Pregnant supplement, anti-caries toothpaste, joint care food, high-calcium milk powder

Zinc-Selenium: Anti-hair loss liquid, pet immune food, sports energy drink

Iron-Selenium: Anti-fatigue protein powder, outdoor energy food

Calcium-Magnesium: High-calcium milk powder, pregnant calcium supplement, pet joint food.



(XXII) Ornithine Chelated and Associated Product Series

Ornithine series products focus on chelates of metals such as iron, copper, manganese, zinc, and magnesium (suitable for nutritional supplementation in livestock and poultry feed). They also include compound preparations like ornithine aspartate (used for auxiliary treatment of liver diseases) and derivatives such as L-ornithine hydrochloride and eflornithine. The series is summarized as follows:

(1) Ornithine Chelated Iron: Exclusive for livestock and poultry feed. Its iron utilization rate is 35% higher than that of ferrous sulfate, preventing iron-deficiency anemia in piglets/chicks, enhancing immunity, and reducing the incidence of diseases.

(2) Ornithine Chelated Copper: For livestock and poultry feed. Its copper absorption rate is over 50% higher than that of copper sulfate, stabilizing eggshells of laying hens (reducing breakage rate by 15%) and increasing copper content in beef cattle muscles, suitable for large-scale breeding.

(3) Ornithine Chelated Manganese: A core component of livestock and poultry premixed feed. It promotes bone development in broilers/sows (reducing rickets incidence by 20%), maintains reproductive function, and improves breeding efficiency.

(4) Ornithine Chelated Zinc: A key component of livestock and poultry premixed feed. Its zinc utilization rate is over 40% higher than that of zinc sulfate, promoting mucosal health in piglets/fattening pigs, reducing diarrhea, and lowering zinc residues in feces (protecting the environment).

(5) Ornithine Chelated Magnesium: Added to livestock and poultry feed throughout the breeding cycle. It participates in energy metabolism, relieves heat stress in dairy cows (increasing daily milk production by 0.5-0.8kg), improves muscle development in broilers, and enhances meat quality.

(6) Ornithine Chelated Selenium: For livestock/aquaculture feed. Its selenium utilization rate increases by 45%, enabling production of selenium-rich eggs (selenium content ≥0.3mg/kg) and selenium-rich beef. It also enhances the resistance of fish and shrimp to heavy metal toxicity.

(7) Ornithine Chelated Calcium: For livestock and poultry feed. Its calcium absorption rate is 30% higher than that of calcium carbonate, preventing osteoporosis in laying hens in the late egg-laying period (reducing thin-shelled eggs), maintaining bone health in elderly breeding pigs, and extending the breeding cycle.

(8) Ornithine Chelated Cobalt: Exclusive for ruminant feed. Its cobalt utilization rate increases by 50%, helping cattle and sheep synthesize vitamin B_{12}, preventing nutritional anemia, and increasing daily weight gain by 8%-10%.

(9) Ornithine Aspartate (Compound Preparation): Used in clinical medicine. Its core function is to reduce blood ammonia concentration, assisting in the treatment of hepatic encephalopathy, viral hepatitis, and liver cirrhosis. Common preparations include Ruigan (for injection) and Yabosi (granules).

(10) Ornithine Alpha-Ketoglutarate (Compound Preparation): For food/healthcare use. It promotes protein synthesis and reduces muscle breakdown, suitable for post-operative recovery patients, the elderly with sarcopenia, and athletes. It can be used as an additive in protein powder to relieve post-exercise fatigue.

(11) L-Ornithine Hydrochloride (Functional Derivative): For food/aquaculture use. It has high stability and good water solubility. Besides assisting in the treatment of liver cirrhosis, it can be added to sports drinks and meal replacement powders, and also used as an aquaculture feed additive (increasing daily weight gain of fish and shrimp by 10%).

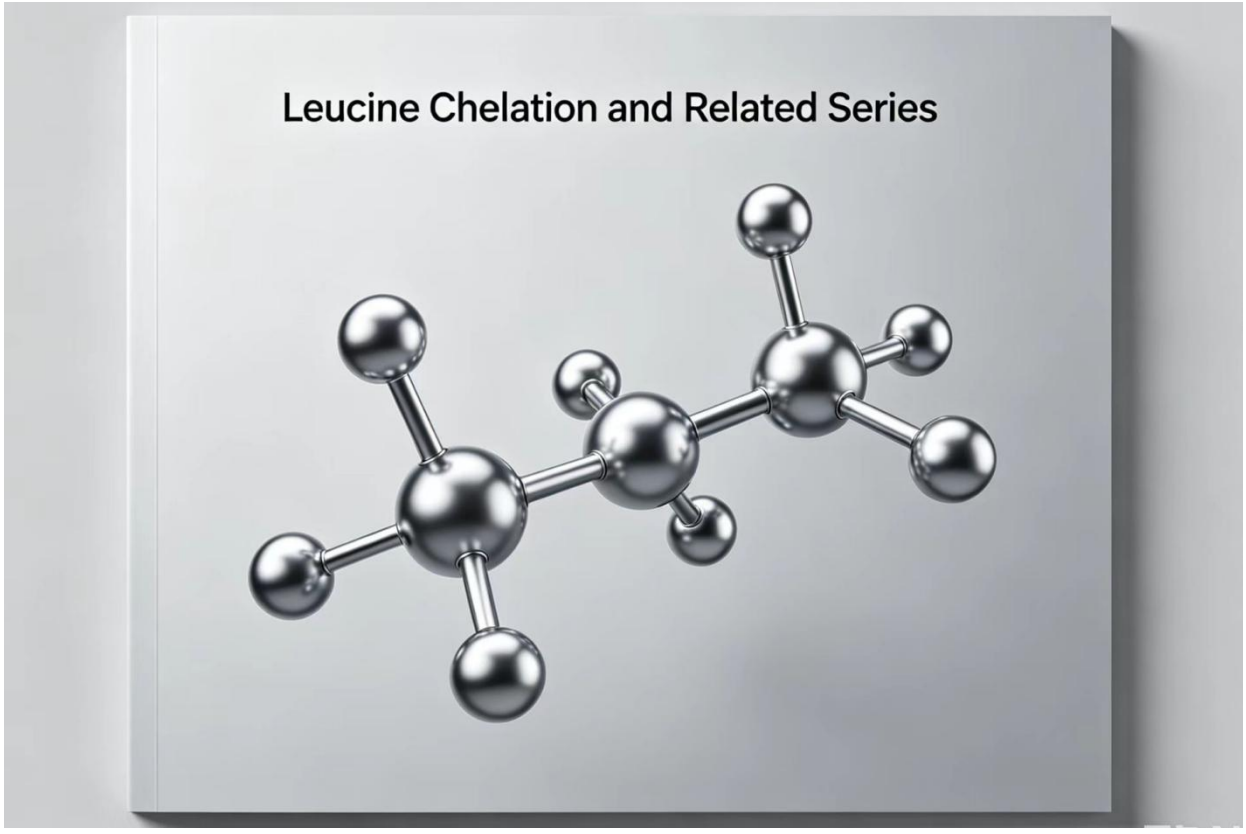
(12) Eflornithine (Functional Derivative): For medicine/cosmetic surgery use. Approvedby the FDA, it is taken orally for maintenance treatment of high-risk neuroblastoma (inhibiting polyamine synthesis), and its external cream can inhibit hair growth (for cosmetic hair removal).

(13) L-Ornithine-L-Aspartate (Functional Derivative): For healthcare/pet use. Ornithine and aspartate are combined at a 1:1 ratio, enhancing liver detoxification function and improving sleep. It can be used in liver-protecting tablets and sleep-aiding capsules, and also added to senior pet food to improve liver metabolism.

(14) Ornithine Carbonate (Functional Derivative): For food/oral care use. It is easily soluble in water with a mild taste, and can be added to children's nutritional oral liquids (for amino acid supplementation) and used as an oral care agent (inhibiting dental plaque growth).

(15) Ornithine Chelated Nickel (Industrial Use): For industrial catalysis. The catalytic activity of chelated nickel increases by 60%, used in the synthesis of pharmaceutical intermediates (e.g., antibiotics), reducing reaction energy consumption and by-product formation.

(16) Ornithine Compound Chelated Trace Elements (Special Breeding Use): For ornamental fish/rare poultry feed. It is a compound chelate of zinc, iron, selenium, and cobalt, improving the scale luster of ornamental fish and increasing the egg production rate of rare poultry such as quails by 15%.



(XXIII) Leucine Chelated and Associated Product Series

Leucine chelated series products are compounds formed by chelating leucine with metal elements. They possess excellent biochemical stability and high biological potency, serving as nutritional supplements while also finding applications in fields like agriculture (e.g., for preparing bird repellents).

(1) Leucine Chelated Calcium: It supplements both calcium and amino acids simultaneously, with a utilization rate 40% higher than that of calcium gluconate. Suitable for people with weak gastrointestinal tracts, it can be added to children's milk powder and elderly cereals to prevent osteoporosis.

(2) Leucine Chelated Zinc: It has strong gastrointestinal stability, and its zinc absorption rate is 35% higher than that of zinc sulfate. In the food sector, it is used to fortify grains; in the feed sector, it promotes weight gain in piglets/chicks (and reduces diarrhea).

(3) Leucine Chelated Iron: It has no iron odor and does not irritate the stomach, with an absorption rate 30% higher than that of ferrous sulfate. It can be made into iron-supplementing oral liquids and nutritional powders for pregnant women, suitable for people with iron deficiency.

(4) Leucine Chelated Cobalt: Its cobalt utilization rate is 45% higher than that of cobalt chloride. In the feed sector, it helps cattle and sheep synthesize vitamin B_{12} (preventing anemia and increasing daily weight gain by 8%); in the research sector, it is used as a carrier for targeted preparations.

(5) Leucine Chelated Nickel: Its catalytic activity increases by 50%. In the industrial sector, it is used for the synthesis of pharmaceutical intermediates (reducing energy consumption); in the research sector, it is used to explore metabolic mechanisms.

(6) Leucine Chelated Magnesium: Its magnesium absorption rate is 35% higher than that of magnesium sulfate, and it does not cause diarrhea. It can be made into sports supplements (to relieve muscle spasms) and sleep-aiding health products, suitable for people with insomnia.

(7) Leucine Chelated Selenium: Its selenium utilization rate increases by 40%. In the food sector, it is used to make selenium-rich health products; in the feed sector, it is used to produce selenium-rich eggs/meat, increasing product added value.

(8) Leucine Chelated Manganese: In the planting sector, it promotes pod formation in soybeans (increasing by 15%) and prevents wheat lodging; in the aquaculture sector, it increases the survival rate of fry by 20% and reduces

element waste.

(9) Transition Metal-Leucine Complexes: Such as $Fe_2(Leu)_6(SO_4)_3 \cdot H_2O$, they are used in biomedical research to support the development of new nutritional agents.

(10) Leucine Chelated Compound Preparation (Calcium + Zinc): A 1:1 compound that supplements two elements simultaneously. Added to children's milk powder and elderly cereals, it solves the inconvenience of "supplementing multiple elements separately".

(11) Leucine Chelated Compound Preparation (Iron + Selenium): Iron supplements blood and qi, while selenium enhances immunity; the absorption rate of both increases by over 30%. It can be made into oral liquids for women and nutritional powders for post-operative use.

(12) L-Leucine Methyl Ester Hydrochloride (Derivative): A pharmaceutical intermediate used in the synthesis of peptide drugs (e.g., antibiotics) to improve drug purity.

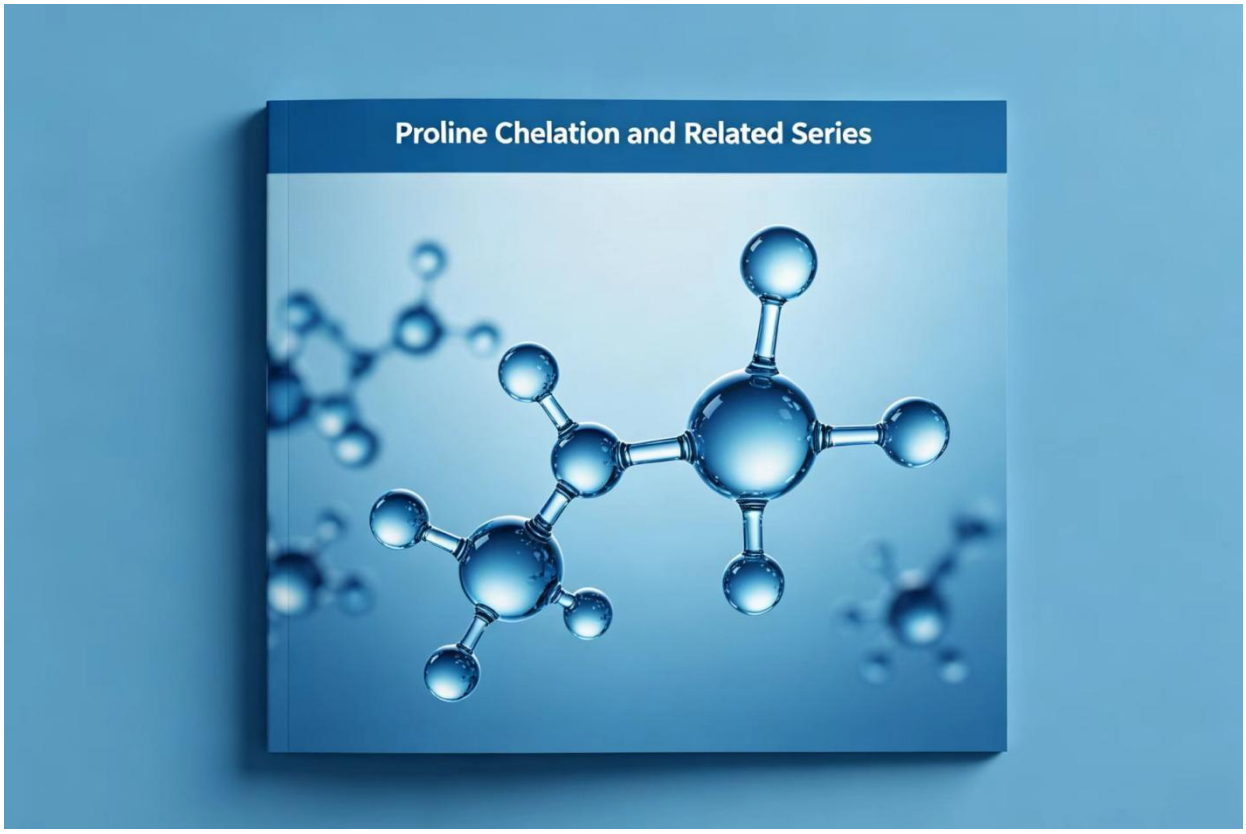
(13) N-Acetyl-L-Leucine (Derivative): In the cosmetics sector, it is used in face creams for sensitive skin (to relieve redness); in the research sector, it is explored for the auxiliary treatment of neurological diseases.

(14) Leucine Chelated Bird Repellent (Agricultural Use): Its bird repellent rate is over 80%. Sprayed on rice fields/orchards, it leaves no residue and does not harm birds, suitable for green agriculture.

(15) Leucine Chelated Copper (Pet Use): Its copper utilization rate increases by 50%. Added to senior dog/cat food, it prevents poor bone development and improves fur luster (reducing hair loss).

(16) Leucine Chelated Titanium (Special Planting Use): Titanium increases photosynthetic efficiency by 25%. Used in the cultivation of strawberries/grapes, it increases sugar content by 1-2 units and promotes uniform coloration.

(17) Leucine Chelated Chromium (Industrial Catalysis Use): Its chromium catalytic activity increases by 55%. Used in dye synthesis and petrochemical processing, it improves reaction efficiency and reduces by-products.



(XXIV) Proline Chelated and Associated Product Series

Proline series products are mainly used in the agricultural field as fertilizer synergists. Through chelation, they improve nutrient utilization, enhance crop stress resistance, promote growth and increase yield, and can also be used for soil remediation. They may also have potential applications in food, medicine and other fields, such as nutritional supplements.

(1) Proline Chelated Manganese: An agricultural trace element fertilizer that supplements manganese for crops, promotes the activity of photosynthetic enzymes, and enhances resistance to low temperatures and drought. It is suitable for field crops such as wheat and corn, and reduces empty grains.

(2) Proline Chelated Calcium: Applied in two fields - in agriculture, it enhances the toughness of crop cell walls (preventing tomato cracking and apple bitter pit disease); in food, it serves as a calcium supplement, suitable for the elderly, pregnant and lactating women, and does not require gastric acid for absorption.

(3) Proline Chelated Zinc: In agriculture, it increases zinc utilization by 35%, promotes flower bud differentiation of fruit trees (e.g., increasing the fruit setting rate of citrus by 15%) and crop photosynthesis; in food, it can be added to children's supplementary food to prevent zinc-deficiency **anorexia.**

(4) Proline Chelated Iron: In agriculture, it prevents iron-deficiency yellowing of crops (e.g., yellowing of new leaves of grapes and strawberries) and increases fruit sugar content by 1-2 units; in medicine, it can be

developed into a low-irritation iron supplement, suitable for people with sensitive gastrointestinal tracts.

(5) Proline Chelated Magnesium: In agriculture, it promotes chlorophyll synthesis, alleviates magnesium-deficiency leaf spot disease of crops (e.g., cucumbers and tomatoes), and increases photosynthetic efficiency by 20%; it is suitable for high-light planting scenarios in protected agriculture and reduces nutrient waste.

(6) Proline Chelated Selenium: In agriculture, it is used to produce selenium-rich crops (e.g., selenium-rich rice and tea), with a selenium absorption rate 40% higher than that of inorganic selenium; it enhances the resistance of crops to heavy metal toxicity and is suitable for planting in farmland around mining areas.

(7) Proline Chelated Copper: In agriculture, it participates in the redox reaction of crops, prevents fungal diseases of fruit trees (e.g., apple ring rot and pear scab); it improves the pollen vitality of crops and is suitable for fruit tree planting where the flowering period is prone to rain.

(8) Proline Chelated Cobalt: In agriculture, it is suitable for leguminous crops (soybeans and peanuts), promotes nitrogen fixation by rhizobia (increasing nitrogen fixation by 30%), and improves the problem of "flowering without fruiting"; it can also be used for special crops (e.g., sugar beets) to increase sugar content.

(9) Proline Chelated Molybdenum: In agriculture, it prevents molybdenum deficiency in crops (e.g., small nodules of soybeans and yellowing of wheat) and promotes nitrogen metabolism; it is suitable for planting in alkaline soils, with a molybdenum utilization rate 35% higher than that of sodium molybdate, reducing soil fixation.

(10) Proline Chelated Calcium-Magnesium Foliar Fertilizer: An agricultural-specific foliar fertilizer, sprayed during the flowering/young fruit stage (e.g., cherries and grapes), reducing the fruit cracking rate by 40%, increasing fruit hardness and storage resistance, and extending the shelf life by 2-3 days.

(11) Proline Chelated Zinc-Iron-Boron Foliar Fertilizer: An agricultural targeted foliar fertilizer, sprayed on solanaceous crops such as tomatoes and peppers, promoting flower bud differentiation (reducing the malformed fruit rate by 25%), improving fruit quality, and enhancing high-temperature resistance.

(12) Proline Chelated Trace Element Compound Fertilizer: An agricultural compound fertilizer that chelates multiple elements such as manganese, zinc, and iron. When added to compound fertilizers, the utilization rate increases by 30%. It is suitable for the full-cycle nutritional needs of field crops (rice and wheat), promoting growth and increasing yield.

(13) Proline Compound Microbial Inoculant: An agricultural soil remediation product. Proline provides carbon and nitrogen sources for the inoculant

(increasing the proliferation rate of beneficial bacteria by 50%), degrades pesticide residues and heavy metals in the soil, activates soil fertility, and is suitable for continuous cropping plots in protected agriculture.

(14) Fish Protein-Proline Chelated Multi-Element Fertilizer: An agricultural organic nutrient fertilizer containing fish protein (promoting absorption) + proline chelated calcium, magnesium, boron, zinc, and iron. It provides comprehensive nutrition for crops, is suitable for organic vegetable and fruit tree planting, and improves the flavor of agricultural products.

(15) Amino Acid-Proline Chelated 5TE Fertilizer: An agricultural high-efficiency nutrient fertilizer with free amino acids (as carriers) + 5 trace elements such as chelated copper and iron. The absorption rate of crops is 2 times faster than that of ordinary fertilizers. It is suitable for nutrient supplementation during the seedling and growth stages to promote strong seedlings.

(16) Proline + Brassinolide (Stress-Resistant Compound): An agricultural stress-resistant combination. Sprayed in dry weather (0.1% proline + 0.01% brassinolide), the drought resistance of crops increases by 40%, and the leaf wilting time is delayed by 3 days. It is suitable for planting in arid areas in northern China.

(17) Proline + Gibberellin (Anti-Freezing Compound): An agricultural anti-freezing combination. Sprayed before fruit tree flowering/wheat jointing (0.2% proline +0.005% gibberellin), the freezing resistance increases by 35%, reducing frozen flowers and buds. It is suitable for areas prone to late spring frost.

(18) Proline + Cytokinin (Post-Disaster Compound): An agricultural post-disaster recovery combination. Sprayed and irrigated at the root within 24 hours after heavy rain (0.15% proline + 0.02% cytokinin), the crop recovery speed is accelerated by 50%, reducing root rot and seedling death. It is suitable for rainy areas.

(19) Proline + Humic Acid (Saline-Alkali Soil Compound): An agricultural soil improvement combination. Seed dressing before sowing (0.2% proline + 1% humic acid) + spraying at the seedling stage (concentration halved) reduces saline-alkali damage (increasing crop survival rate by 30%). It is suitable for planting in saline-alkali soils.

(20) Proline + Urea (Growth Control Compound): An agricultural growthcontrol combination. Sprayed at the seedling stage (0.5% urea + 0.1% proline) and adult plant stage (1% urea + 0.1% proline), it promotes leaf growth and controls excessive stem growth. It is suitable for crops prone to excessive growth such as corn and sorghum.

(21) Proline + Potassium Dihydrogen Phosphate (Quality Improvement Compound): An agricultural quality improvement combination. Sprayed during the flowering and fruiting period (0.2%-0.3% potassium dihydrogen phosphate + 0.1%-0.15% proline), the fruit sugar content increases by 1-2 units and the

coloration is uniform. It is suitable for melon crops (watermelons and strawberries).

(22) Proline + Farmyard Manure (Fermentation Compound): An agricultural fertilizer efficiency improvement combination. Mix 0.5 kg of proline with 1 ton of farmyard manure for fermentation (fermentation speed is 30% faster) + spread 0.1 kg of proline per mu during fertilization to improve fertilizer efficiency. It is suitable for traditional farmyard manure planting scenarios.

(23) Proline + Algin (Synergistic Compound): An agricultural absorption synergistic combination. Algin (low-temperature enzymolysis) is mixed with proline at a ratio of 1:500, and the absorption efficiency of proline by crops increases by 2-3 times. After spraying on tomatoes, the absorption peak is reached in 4 hours, and high-temperature wilting is delayed by 3 days.

(24) Proline + Amino Acid (Root Promotion Compound): An agricultural root promotion combination. Fully water-soluble amino acid solution is compounded with proline at a ratio of 3:1. The number of new roots of cucumbers increases by 35% after transplanting, and the seedling slowing period is shortened by 4 days. It is suitable for crop seedling raising and transplanting scenarios.

(25) Proline + Microbial Inoculant (Disease Resistance Compound): An agricultural disease resistance combination. Irrigate the roots of greenhouse vegetables during field planting (500x inoculant + 0.1% proline) + spray during the fruit setting period (300x inoculant + 0.08% proline), and paint the trunks of fruit trees (50x inoculant + 0.3% proline). The disease incidence rate is reduced by 25%.

(26) Dipalmitoyl Hydroxyproline (Cosmetic Derivative): A cosmetic anti-aging ingredient that regulates collagen synthesis, inhibits collagen degradation, and stabilizes collagen structure. It is often used in high-end anti-wrinkle skincare products (serums and face creams) and is suitable for anti-wrinkle needs of mature skin.

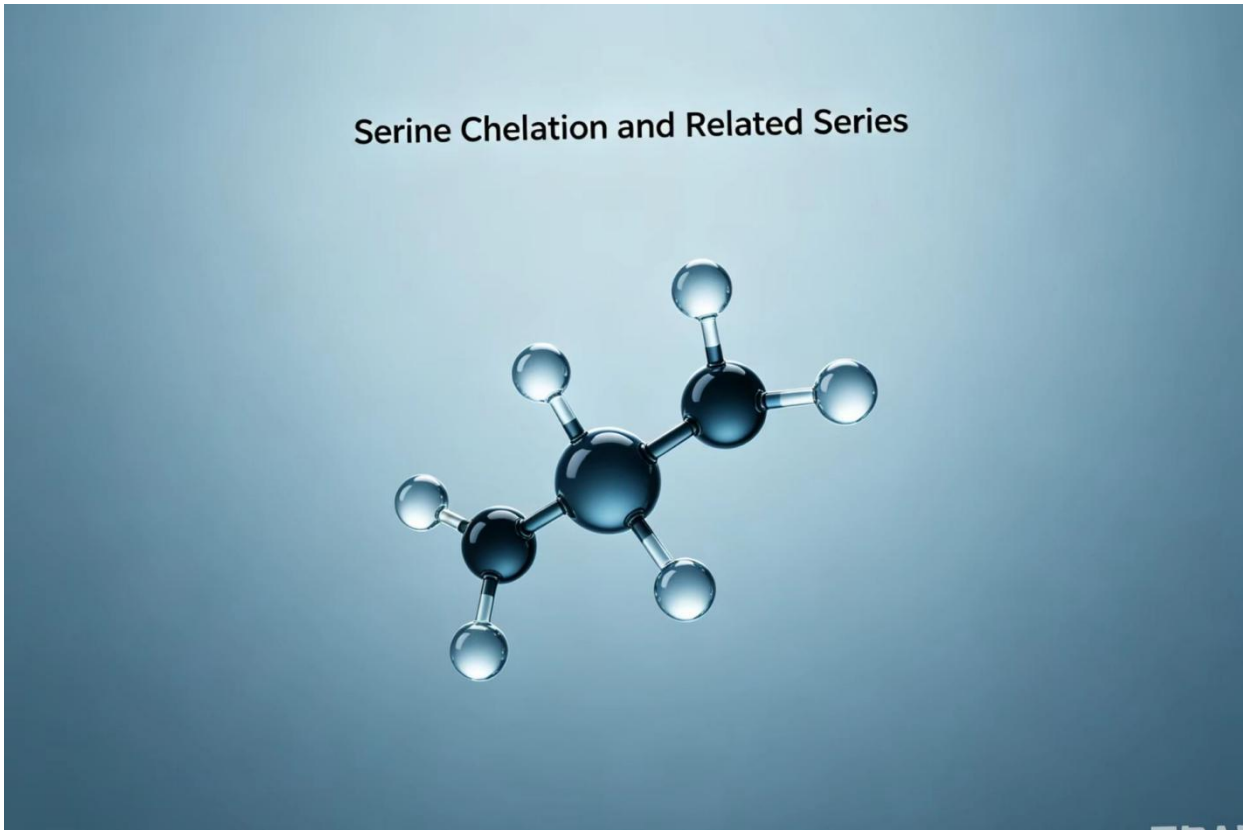
(27) Cyclo(L-phenylalanyl-trans-4-hydroxy-L-proline) (Research Derivative): A cyclic peptide chelating agent for chemical research, used in the study of trace element metabolism mechanisms and the development of new chelated products, providing basic materials for scientific research experiments.

(28) Magnesium Pyroglutamate (Associated Derivative): A pharmaceutical/food intermediate that is easily soluble in water. It is used in the preparation of calcium pantothenate, folic acid, B vitamins, and γ-aminobutyric acid, and is suitable for pharmaceutical synthesis and food additive production fields.

(29) Proline Chelated Titanium (Special Planting Supplement): An agricultural special fertilizer. Titanium increases the photosynthetic efficiency of crops by 25%. It is used in the cultivation of strawberries and grapes, increasing fruit sugar content by 1-2 units and ensuring uniform

coloration, improving commercial value. It is suitable for high-value-added crops.

(30) Proline Chelated Nickel (Research/Industrial Supplement): A chelate for research/industrial use. Nickel is a component of the enzyme active center, used to explore the nitrogen metabolism mechanism of crops, and can also be used as an industrial catalyst (e.g., synthesis of pharmaceutical intermediates) to improve reaction efficiency.



(XXV) Serine Chelated and Associated Product Series

Serine series products build a full-chain product matrix covering seven fields—agriculture, aquaculture, livestock and poultry breeding, food nutrition, cosmetics, medicine, and textile daily chemicals—with "single-element chelates as the foundation, scenario-based compounding as the link, and functional derivatives as the high-end segment". Leveraging the core advantages of "high activity, low irritation, and strong adaptability", they accurately address pain points in various scenarios, forming a complete product ecosystem from basic applications to high-end R&D, balancing practicality and market prospects.

(1) Serine Chelated Iron: Its biological effectiveness is 1.7 times that of EDTA-chelated iron, and the rate of gastrointestinal irritation is reduced by 60%. In the food and medical fields, it can be made into sustained-release iron supplements, suitable for sensitive iron-deficient groups such as children, pregnant women, and the elderly, avoiding side effects like constipation and nausea; in agriculture, as a foliar fertilizer, it can

alleviate iron-deficiency yellow leaf disease in fruit trees such as apples and pears within 3-5 days, increasing the chlorophyll content of new leaves by more than 20%.

(2) Serine Chelated Manganese: Its stability is 8 times higher than that of manganese sulfate. It remains effective in soils with a pH of 4-9 and can increase the remobilization rateof manganese in plant phloem (nutrient transfer to fruits and new leaves). When used for wheat and corn, it can promote the efficiency of the light reaction in photosynthesis, prevent "striped chlorosis" of leaves, and at the same time enhance resistance to low temperatures and drought, reducing the risk of yield loss by 15%-20%.

(3) Serine Chelated Zinc: Its movement speed in plants is 2 times faster than that of zinc sulfate, with an absorption efficiency of over 90%. In agriculture, it is used for citrus and grapes to reduce "little leaf disease" and "fruit shrinkage disease", increasing fruit sweetness by 1-2 sugar units and fruit setting rate by 10%; as a livestock and poultry feed additive, it promotes intestinal development of piglets and chicks, enhances immunity, and increases the survival rate of young animals by 12%-15%.

(4) Serine Chelated Copper: Its toxicity is only 1/3 that of copper sulfate, and the upper limit of safe concentration for fish reaches 0.8mg/L. In aquaculture, it accurately kills cyanobacteria and dinoflagellates, inhibits Trichodina and Chilodonella, without harming beneficial algae (such as Chlorella); as a feed additive, it ensures the eggshell hardness of laying hens and the milk quality of dairy cows, reducing the rate of misshapen eggs by 30%.

(5) Serine Chelated Magnesium: Its absorption rate in ruminants is 50% higher than that of magnesium oxide, and it does not antagonize rumen microorganisms. When used for dairy cows, it relieves the decrease in feed intake caused by heat stress, stably increasing milk production by 8%-10%; when used for beef cattle, it promotes muscle protein synthesis, shortening the fattening cycle by 7-10 days.

(6) Serine Chelated Calcium: Its water solubility at 25℃ is 8 times that of calcium carbonate. It does not require vitamin D for auxiliary absorption, and the calcium deposition rate is increased by 35%. In the food field, it is made into chewable tablets and effervescent tablets, suitable for adolescents (promoting bone development), the elderly (preventing osteoporosis), and lactating women (supplementing calcium loss from lactation); in agriculture, it is used for tomatoes and strawberries, reducing the fruit cracking rate by 40%, extending the fruit storage and transportation period by 3-5 days, and reducing shelf-life loss by 25%.

(7) Serine Chelated Potassium: Its mobility in soil is increased by 3 times, with an absorption rate of 85%, avoiding soil compaction caused by traditional potassium chloride. When used in the fruit expansion period of watermelons and muskmelons, it increases fruit sweetness by 1.5 sugar units,

enhances peel toughness, and reduces transportation damage rate by 20%; when used for rice, it promotes grain filling, reduces empty grains, and increases 1000-grain weight by 2-3g.

(8) Serine Chelated Molybdenum: It activates the activity of nitrogenase in rhizobia of leguminous crops, increasing the number of nodules by 30% and nitrogen fixation efficiency by 40%. When used for soybeans, it increases the number of pods per plant by 5-8 and yield by 15%-20%; when used for rapeseed and cotton, it prevents "flowering without fruiting" and increases oil content/fiber length by 5%-8%.

(9) Serine Chelated Boron: Its stability is 5 times higher than that of borax. It is not fixed in alkaline soil and can promote the elongation of plant pollen tubes. When used for fruits andvegetables such as cucumbers and tomatoes, it increases the fruit setting rate by 15%-20% and reduces "flower and fruit drop"; when used for rapeseed, it reduces the rate of "flowering without fruiting", increases the number of siliques, and improves yield by more than 10%.

(10) Serine Chelated Cobalt: An exclusive chelate for ruminants, its absorption rate is 60% higher than that of cobalt chloride, and it is a key raw material for vitamin B_{12} synthesis. When used for dairy cows and beef cattle, it promotes the reproduction of rumen microorganisms, increases feed digestibility by 8%-10%, and at the same time reduces anemia symptoms and improves meat tenderness.

(11) Serine Chelated Selenium: The conversion rate of organic selenium reaches 98%, far exceeding that of sodium selenite (30%). In the food field, it is made into selenium supplements, suitable for people in selenium-deficient areas and those with low immunity, preventing cardiomyopathy caused by selenium deficiency; in agriculture, it is used for tea and rice to increase the selenium content of crops, creating selenium-rich agricultural products with added value increased by 3-5 times.

(12) Serine Chelated Nickel: Low-toxic and high-efficiency, it can activate the activity of plant urease and promote the absorption of urea-based fertilizers. When used for vegetables and flowers, it reduces root burn caused by urea residues and increases fertilizer utilization rate by 25%; as a livestock and poultry feed additive, it promotes intestinal protein metabolism, reduces nitrogen emissions, and lowers breeding pollution.

(13) Agricultural Stress-Resistant Compound Agent (Chelated Iron + Manganese + Zinc): Focusing on the problem of "simultaneous multiple nutrient deficiencies" during the fruit expansion period of fruits and vegetables and the grain filling period of food crops, it supplements nutrients in one application. It promotes photosynthesis and nutrient absorption, enhances crop resistance to diseases, pests, and saline-alkali, suitable for protected greenhouses and field planting, increasing comprehensive crop yield by 10%-15%.

(14) Aquaculture Compound Agent (Chelated Copper + Zinc): Balances "algae and parasite control" and "growth promotion". Chelated copper regulates the algal ecosystem, and chelated zinc supplements trace elements for fish and shrimp. It reduces the number of water interventions by 30%, lowers breeding costs, and is suitable for high-density intensive ponds of Penaeus vannamei and grass carp, increasing the survival rate by more than 20%.

(15) Food Nutrition Compound Agent (Chelated Iron + Calcium): Solves the problem of "iron-calcium antagonism" and enables synergistic absorption without conflict. The prepared supplements are suitable for pregnant women (preventing anemia + promoting fetal bone development) and developing children, and can be added to milk powder and meal replacement powders, increasing nutrient absorption rate by 40%.

(16) Livestock and Poultry Breeding Compound Premix (Chelated Zinc + Manganese + Magnesium): Formulated according to different physiological stages of pigs, chickens, and cattle, it is added to basic feed. It increases the survival rate of young animals by 10%-15%, improves the egg production rate of poultry by 8%-10%, and reduces trace element residues in feces by 35%, lowering environmental pollution.

(17) Fruit and Vegetable Fresh-Keeping Compound Agent (Chelated Calcium + Magnesium): Used for soaking after harvest. Calcium enhances cell wall toughness, and magnesium delays chlorophyll degradation. It extends the normal-temperature fresh-keeping period of fruits and vegetables such as blueberries and cherries by 5-7 days and the low-temperature refrigeration period by 15-20 days, maintaining the original taste and color, suitable for picking gardens and cold-chain logistics.

(18) Saline-Alkali Soil Improvement Compound Agent (Chelated Iron + Zinc + Molybdenum): Prevents elements from being fixed by high-salt soil and promotes root growth. It alleviates chlorosis and dwarfing symptoms of crops such as cotton and sunflowers, increasing the survival rate by more than 25%, and gradually improves the soil microenvironment, laying a foundation for subsequent planting.

(19) Special Compound Agent for Selenium-Rich Agricultural Products (Chelated Selenium + Boron): Selenium increases crop added value, and boron ensures yield. When used for tea and rice, it makes the selenium content of crops meet the standard (≥0.15mg/kg) and increases the fruit setting rate by 10%, achieving "both quality and yield improvement", suitable for green agricultural bases.

(20) Ruminant Nutrition Compound Agent (Chelated Cobalt + Selenium + Magnesium): Cobalt promotes vitamin B_{12} synthesis, selenium enhances immunity, and magnesium resists stress. When used for dairy cows, it increases milk production by 8%-12% and enriches milk with selenium, while relieving transportation and high-temperature stress and stabilizing feed intake.

(21) N-Acetyl-L-Serine: In the cosmetics field, it acts as a moisturizer to form a "moisture-locking film", with a moisturizing duration twice that of glycerin, suitable for sensitive and dry skin care products (face creams, serums); in the pharmaceutical field, as an intermediate, it synthesizes β-lactam antibiotics and compound amino acid injections with a purity of over 99.5%.

(22) O-Phospho-L-Serine: Participates in human amino acid metabolism and neurotransmitter production. It is used in food for special medical purposes, suitable for post-operative recovery patients (promoting tissue repair) and people with digestive absorption disorders (pancreatitis, irritable bowel syndrome), shortening the recovery cycle by 3-5 days.

(23) L-Serine Methyl Ester Hydrochloride: In the pharmaceutical field, it synthesizes antidepressants (selective serotonin reuptake inhibitors) and antimicrobial peptides; in the chemical industry, as a monomer for polymer materials, it prepares high-temperature-resistant and corrosion-resistant resins, suitable for electronic component packaging and high-end coatings.

(24) D-Serine: An NMDA receptor modulator that helps improve cognitive function in Alzheimer's disease patients and is used for auxiliary treatment of schizophrenia. It is currently in preclinical research and has great market potential.

(25) L-Serine Ethyl Ester: In the cosmetics field, it has both moisturizing and antioxidant effects, scavenging free radicals and delaying collagen loss, suitable for anti-aging skincare products (eye creams, essence milks); in the pharmaceutical field, as an intermediate for local anesthetics, it reduces skin irritation and improves medication safety.

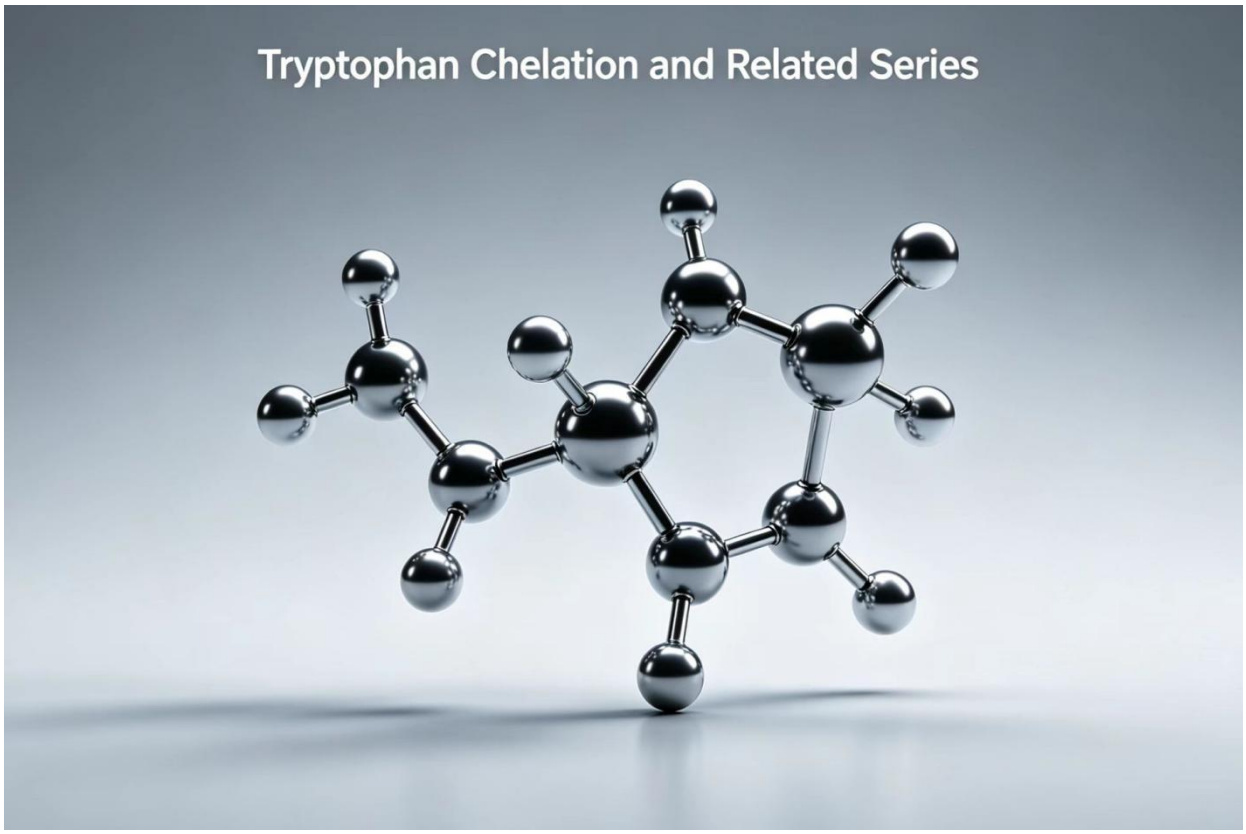
(26) N-Hydroxymethyl-L-Serine: In the textile field, it acts as a fabric finishing agent to make fabrics moisturizing and antistatic, suitable for intimate clothing and infant clothing; in the daily chemical field, it is added to shampoos to reduce hair frizz and improve smoothness, suitable for dry hair.

(27) L-Serine Acetal: In the pharmaceutical field, as an intermediate for antiviral drugs, it synthesizes anti-hepatitis B virus drugs to inhibit viral DNA replication; in the cosmetics field, as a stabilizer, it extends the shelf life of skincare products and reduces the amount of preservatives, suitable for sensitive skin products.

(28) O-Acetyl-L-Serine: In the food field, it acts as a flavor modifier to enhance the mellow taste of dairy products and baked goods; in the pharmaceutical field, as an intermediate for expectorants, it reduces the irritation of drugs to the respiratory mucosa, suitable for children's expectorant drugs.

(29) Polyserine: Polymerized from non-essential amino acid serine through peptide bonds, it mainly acts on the metabolism of fats, fatty acids, and cell membranes, while supporting muscle growth and immune system maintenance.

It is a bioactive polymer with both metabolic regulation and immune support functions.



(XXVI) Tryptophan Chelated and Associated Product Series

Tryptophan chelated series products build a comprehensive product matrix covering five fields—livestock and poultry breeding, aquaculture, food nutrition, pharmaceutical R&D, and cosmetics—with "chelated trace elements as the core, functional derivatives as extensions, and scenario-based compounding as the means". Leveraging the dual advantages of tryptophan as an "amino acid carrier + bioactivity", they not only solve the pain points of traditional trace elements such as "poor absorption, high waste, and strong irritation" but also expand high-end functions like mood regulation and sleep improvement through derivatives, forming a complete product ecosystem from basic nutritional supplementation to precise health intervention.

(1) Tryptophan Chelated Zinc: The chelation of tryptophan and zinc improves bioavailability. It is used in livestock and poultry feed to promote growth and reduce diarrhea rate; it can also be used as a food nutritional fortifier added to elderly nutritional foods to reduce gastrointestinal irritation caused by zinc ions.

(2) Tryptophan Chelated Iron: Relying on the tryptophan carrier to reduce gastrointestinal irritation, it is suitable for livestock and poultry feed to prevent iron-deficiency anemia; it can also be used as a food additive to supplement iron and tryptophan in the human body, avoiding side effects of traditional iron supplements.

(3) Tryptophan Chelated Copper: Tryptophan and copper work synergistically. When added to livestock and poultry feed, it balances amino acids and enhances immunity; in aquaculture, it can inhibit parasites and protect the growth of beneficial algae.

(4) Tryptophan Chelated Manganese: The chelated form of tryptophan improves manganese stability. It is used in livestock and poultry feed to maintain bone development and reproductive function, reduce the deformity rate of breeding poultry eggs, and improve the health status of young poultry.

(5) Tryptophan Chelated Calcium: Tryptophan promotes calcium absorption without the need for vitamin D assistance. It can be made into food supplements to support bone health, and can also be added to livestock and poultry feed to reduce post-partum calcium deficiency.

(6) Tryptophan Chelated Selenium: Tryptophan improves the conversion rate of organic selenium. It is used in livestock and poultry feed to produce selenium-rich meat, and can also be used in crop cultivation to develop selenium-rich agricultural products, supplementing selenium and tryptophan in the human body.

(7) Tryptophan Chelated Cobalt: Tryptophan enhances the absorption of cobalt in ruminants. As a feed additive, it promotes the reproduction of rumen microorganisms, improves feed digestibility, and assists in the synthesis of vitamin B_{12}.

(8) Tryptophan Chelated Magnesium: Tryptophan chelated magnesium is suitable for livestock and poultry stress scenarios. When added to feed, it relieves stress responses caused by transportation and high temperatures, and stabilizes feed intake and production performance.

(9) Tryptophan Chelated Potassium: Tryptophan improves the palatability and absorption efficiency of potassium. It is used in poultry egg feed to increase eggshell thickness; in aquaculture, it balances osmotic pressure and reduces mortality during molting.

(10) Tryptophan Chelated Molybdenum: Tryptophan activates the activity of molybdenum enzymes. When added to soybean meal-based feed, it improves protein utilization; it can also be used in beef cattle feed to shorten the fattening cycle and improve meat quality.

(11) Tryptophan Chelated Boron: Tryptophan improves the mobility of boron in plants. It is used in fruit and vegetable cultivation to promote pollen tube elongation and increase fruit setting rate; in rapeseed cultivation, it prevents "flowering without fruiting".

(12) Tryptophan Chelated Nickel: Tryptophan and nickel synergistically activate urease. When added to livestock and poultry feed, it reduces intestinal damage caused by urea residues; in aquaculture, it promotes molting of crustaceans and increases survival rate.

(13) Tryptophan Chelated Titanium: The tryptophan carrier improves the

absorption efficiency of titanium by plants. It is used in protected agriculture to enhance crop stress resistance, reduce disease occurrence, and improve fruit sweetness and quality.

(14) Tryptophan Chelated Silicon: Tryptophan chelated silicon enhances the strength of plant cell walls. It is used in rice cultivation to improve lodging resistance; in cosmetics, it can be used as an oil-controlling ingredient, suitable for acne-prone skin care.

(15) Tryptophan Chelated Chromium: Tryptophan promotes the cellular absorption of chromium. It is used in livestock and poultry feed to regulate glucose metabolism; it can also be used as a functional food ingredient to assist in blood sugar control and supplement tryptophan.

(16) Tryptophan Chelated Germanium: Tryptophan and germanium synergistically exert antioxidant effects. When added to cosmetics, it extends moisturizing duration; in the pharmaceutical field, it can be used as an immunomodulator to assist in enhancing the body's resistance.

(17) Tryptophan Chelated Vanadium: Tryptophan improves the bioactivity of vanadium. It is used in elderly functional foods to assist in improving insulin sensitivity; in aquaculture feed, it enhances the hypoxia resistance of fish and shrimp.

(18) Tryptophan Chelated Tin: Tryptophan chelated tin has antibacterial properties. It is used in food packaging coatings to inhibit microbial reproduction, extend the shelf life of low-temperature meat products, and reduce food spoilage.

(19) Tryptophan Chelated Zirconium: Tryptophan improves the dispersibility of zirconium in ceramics. As a toughening agent in the ceramic industry, it improves ceramic strength; in the environmental protection field, it can adsorb phosphorus in water bodies to control eutrophication.

(20) Tryptophan Chelated Beryllium: Tryptophan assists in modifying aerospace materials with beryllium, reducing material weight and improving lightweight levels; in laboratories, it can be used as a raw material for precision instrument sensing components.

(21) Tryptophan Chelated Antimony: Tryptophan enhances the flame-retardant efficiency of antimony. It is used in plastic processing to reduce combustion rate, complying with environmental flame-retardant standards and reducing fire hazards.

(22) Tryptophan Chelated Bismuth: Tryptophan and bismuth synergistically protect the gastrointestinal mucosa. As a raw material for gastric mucosa protectants, it is used in gastric ulcer drugs to reduce side effects of traditional bismuth agents.

(23) Tryptophan Chelated Lead: Tryptophan chelated lead has high adsorption capacity. It is used in industrial wastewater treatment to remove lead ions; in laboratories, it can be used as a heavy metal detection probe to assist in

environmental monitoring.

(24) Tryptophan Chelated Mercury: Tryptophan and mercury form stable chelates. It is used in mercury-containing wastewater treatment to efficiently remove mercury ions, suitable for wastewater purification in chemical, medical and other fields.

(25) Tryptophan Chelated Holmium: Tryptophan enhances the stability of holmium in a microgravity environment. It is used in deep-space exploration astronauts' nutritional supplements to maintain serotonin levels and improve sleep and mood.

(26) Tryptophan Chelated Thulium: Tryptophan assists in modifying quantum dot materials with thulium, improving fluorescence quantum yield and reducing photobleaching rate. It is used in display devices and biological imaging fields.

(27) Tryptophan Chelated Dysprosium: Tryptophan regulates the effect of dysprosium on metabolic enzymes. It is used in auxiliary foods for rare diseases (such as phenylketonuria) to reduce phenylalanine production and protect nerve function.

(28) Tryptophan Chelated Erbium: Tryptophan and erbium synergistically respond to infrared light. It is used in medical dressings to produce antibacterial activity, accelerate the healing of chronic wounds such as diabetic foot ulcers, and inhibit drug-resistant bacteria.

(29) Tryptophan Chelated Gadolinium: Tryptophan improves the biocompatibility of gadolinium. As a raw material for MRI contrast agents, it enhances the imaging clarity of tumors and brain lesions and reduces the risk of allergies.

(30) Tryptophan Chelated Lutetium: Tryptophan assists lutetium-177 in targeting and binding to tumor cells. It is used in nuclear medicine imaging and targeted therapy of neuroendocrine tumors to improve lesion detection rate.

(31) Tryptophan Chelated Neptunium: Tryptophan and neptunium form a special nuclear spin structure. As a target material for dark matter detectors, it improves particle capture sensitivity; in the nuclear industry, it can adsorb radioactive substances in reactor wastewater.

(32) Tryptophan Chelated Lawrencium: Tryptophan activates the catalytic activity of lawrencium. It is used in synthetic biology to efficiently convert tryptophan into 5-hydroxytryptophan, and can also assist in crop gene editing to improve stress resistance.

(33) Tryptophan Chelated Ruthenium: Tryptophan enhances the stability of ruthenium in high-pressure environments. It is used in deep-sea aquaculture to improve the high-pressure resistance of fish and shrimp, suitable for deep-sea fish cultivation.

(34) Tryptophan Chelated Nobelium: Tryptophan and nobelium synergistically

regulate neurotransmitter metabolism. It is used in auxiliary foods for neurodegenerative diseases (such as Alzheimer's disease) to reduce β-amyloid deposition.

(35) Tryptophan Chelated Mendelevium: Tryptophan assists mendelevium in improving quantum stability. As a quantum computing material, it extends quantum decoherence time, suitable for quantum bit carrier R&D.

(36) Tryptophan Chelated Einsteinium: Tryptophan maintains the catalytic activity of einsteinium at high temperatures. It is used in extreme high-temperature industrial kilns to improve fuel combustion efficiency and reduce harmful gas emissions.

(37) Tryptophan Chelated Zinc + Iron + Copper + Manganese Compound Agent: A compound of multiple tryptophan chelated trace elements, suitable for general livestock and poultry diets. It simultaneously supplements amino acids and trace elements, improves feed conversion rate, and promotes growth.

(38) Tryptophan Chelated Zinc + Copper + Selenium Compound Agent: Tryptophan chelated elements work synergistically. It is used in high-density aquaculture to enhance the stress resistance and antibacterial ability of fish and shrimp, and reduce mortality caused by diseases.

(39) Tryptophan Chelated Cobalt + Magnesium + Selenium Compound Agent: Compounded according to the physiological characteristics of ruminants. Tryptophan improves element absorption, relieves post-partum and transportation stress, and maintains production performance and health status.

(40) Tryptophan Chelated Manganese + Selenium + Cobalt Compound Agent: Suitable for the nutritional needs of breeding livestock and poultry. Tryptophan chelated elements assist in maintaining reproductive system function, and improve the fertilization rate of breeding eggs and the healthy chick rate of young poultry.

(41) Tryptophan Chelated Zinc + Magnesium + Chromium Compound Agent: Used in aquaculture during overwintering. Tryptophan enhances the low-temperature resistance of elements, improves glycogen reserves of fish and shrimp, and reduces overwintering mortality.

(42) Tryptophan Chelated Zinc + Copper + Plant Extract Compound Agent: Tryptophan chelates and plant extracts work synergistically. It is used in livestock and poultry breeding to replace antibiotics, reduce the number of intestinal pathogenic bacteria, and improve intestinal health.

(43) Tryptophan Chelated Iron + Zinc + Omega-3 Compound Agent: Added to pet food. Tryptophan assists in the absorption of iron and zinc, improves pet anemia and skin problems, and reduces anxiety behavior.

(44) Tryptophan Chelated Manganese + Molybdenum + Boron Compound Agent: Used in fruit tree seedling raising. Tryptophan improves the mobility of elements in seedlings, promotes root development and flower bud differentiation, and

improves transplant survival rate.

(45) Tryptophan Chelated Titanium + Silicon + Zinc Compound Agent: Suitable for protected agriculture crops. Tryptophan enhances the stress resistance of elements, reduces disease occurrence, and improves fruit yield and quality.

(46) Tryptophan Chelated Cobalt + Selenium + Boron Compound Agent: Used in forage grass cultivation. Tryptophan assists in element absorption, improves the protein content of forage grass, and extends the mowing cycle.

(47) Tryptophan Chelated Calcium + Zinc + Nickel Compound Agent: Targeted for shrimp and crab breeding. Tryptophan promotes the absorption of calcium and zinc, assists in molting, and improves molting success rate and weight gain rate.

(48) Tryptophan Chelated Iron + Zinc + Vitamin B_{12} Compound Agent: Suitable for young poultry starter feed. Tryptophan enhances the utilization rate of iron and zinc, reduces the mortality of young poultry, and promotes early intestinal development.

(49) Tryptophan + 5-Hydroxytryptophan + Vitamin B_6 Compound Agent: As a functional food ingredient, tryptophan and 5-hydroxytryptophan synergistically regulate neurotransmitters, assist in shortening sleep latency and improving sleep quality.

(50) Tryptophan + γ-Aminobutyric Acid + B Vitamins Compound Agent: Added to compressed candies and other foods. Tryptophan assists γ-aminobutyric acid in exerting its effects, relieves anxiety, and is suitable for people under high pressure.

(51) Tryptophan Chelated Iron + Zinc + Calcium Compound Agent: Used in infant supplementary food. Tryptophan chelates are low-irritation and easy to absorb, preventing anemia and delayed bone development, and supplementing essential amino acids.

(52) Tryptophan Chelated Calcium + Selenium + 5-Hydroxytryptophan Compound Agent: Suitable for elderly functional foods. Tryptophan assists in the absorption of calcium and selenium, taking into account bone health and sleep improvement, and supplementing nutrition.

(53) Tryptophan Chelated Iron + Zinc + Branched-Chain Amino Acids Compound Agent: Added to sports nutrition foods. Tryptophan improves the utilization rate of iron and zinc, reduces sports anemia, and relieves muscle fatigue.

(54) Tryptophan Chelated Iron + Calcium + Folic Acid Compound Agent: Used for pregnancy nutritional supplementation. Tryptophan chelates reduce gastrointestinal irritation, prevent pregnancy anemia and calcium deficiency, and assist fetal development.

(55) Tryptophan Chelated Iron + Selenium + Vitamin C Compound Agent: As a health care ingredient for plateau environments. Tryptophan enhances the absorption of iron and selenium, improves hemoglobin levels, and relieves altitude sickness.

(56) Tryptophan Chelated Chromium + Vanadium + Dietary Fiber Compound Agent: Added to blood sugar control functional foods. Tryptophan assists chromium and vanadium in regulating glucose metabolism, assists in stabilizing blood sugar, and is suitable for people with high blood sugar.

(57) Tryptophan + Peptides + B Vitamins Compound Agent: Used in special foods for post-operative recovery. Tryptophan and peptides synergistically promote tissue repair, supplement energy and nutrition, and shorten the recovery cycle.

(58) Tryptophan + Lutein + Zeaxanthin Compound Agent: As an eye care food ingredient. Tryptophan assists in the absorption of eye nutrients, improves macular function, and relieves eye fatigue.

(59) Tryptophan Chelated Selenium + Probiotics Compound Agent: Added to fermented foods. Tryptophan enhances the utilization rate of selenium, synergistically with probiotics to improve intestinal flora and enhance immunity.

(60) Tryptophan + Coenzyme Q10 + Vitamin B_1 Compound Agent: Used in anti-fatigue foods. Tryptophan and coenzyme Q10 synergistically supplement energy, relieving physical and mental fatigue.

(61) Tryptophan Chelated Holmium + B Vitamins + Energy Sustained-Release Granules Compound Agent: Used for deep-space exploration nutrition. Tryptophan stabilizes the activity of holmium, maintains astronauts' serotonin levels, and reduces muscle loss.

(62) Tryptophan Chelated Thulium + Quantum Dots + Dispersant Compound Agent: Used in display panel manufacturing. Tryptophan assists thulium in modifying quantum dots, improving color gamut coverage and service life.

(63) Tryptophan Chelated Dysprosium + Low-Phenylalanine Peptides + Vitamin B_{12} Compound Agent: Suitable for rare disease (phenylketonuria) nutrition. Tryptophan regulates the activity of dysprosium, reduces phenylalanine production, and protects nerves.

(64) Tryptophan Chelated Erbium + Growth Factors + Hyaluronic Acid Compound Agent: Used for chronic wound care. Tryptophan enhances the infrared antibacterial activity of erbium, synergistically with growth factors to accelerate wound healing and reduce infection.

(65) Tryptophan Chelated Gadolinium + Fluorescent Dyes + Nutrient Indicators Compound Agent: Used for precision agriculture monitoring. Tryptophan assists gadolinium in imaging, tracks nutrient absorption by crop roots, and optimizes fertilization plans.

(66) Tryptophan Chelated Lutetium + Targeting Antibodies + Imaging Agents Compound Agent: Used in nuclear medicine diagnosis and treatment. Tryptophan assists lutetium-177 in targeting tumors, improving tumor shrinkage rate and reducing treatment side effects.

(67) Tryptophan Chelated Neptunium + Quantum Dots + Scintillators Compound

Agent: As a dark matter detection material. Tryptophan enhances the particle capture ability of neptunium, improving the particle recognition rate of detection equipment.

(68) Tryptophan Chelated Lawrencium + Enzymes + Carbon Sources Compound Agent: Used in synthetic biology fermentation. Tryptophan activates the catalytic activity of lawrencium, increasing the yield of 5-hydroxytryptophan and reducing production costs.

(69) Tryptophan Chelated Ruthenium + Deep-Sea Microorganisms + Unsaturated Fatty Acids Compound Agent: Used in deep-sea aquaculture. Tryptophan enhances the high-pressure resistance of ruthenium, improving the survival rate and growth rate of deep-sea fish.

(70) Tryptophan Chelated Nobelium + DHA + Phosphatidylcholine Compound Agent: Used in auxiliary foods for neurodegenerative diseases. Tryptophan synergizes with nobelium to improve cognitive function and protect nerve cell membranes.

(71) Tryptophan Chelated Mendelevium + Superconducting Materials + Stabilizers Compound Agent: Used in quantum computing materials. Tryptophan assists mendelevium in extending quantum decoherence time, improving the stability of quantum chips.

(72) Tryptophan Chelated Einsteinium + Heat-Resistant Alloys + Combustion Aids Compound Agent: Used in extreme high-temperature industries. Tryptophan maintains the catalytic activity of einsteinium, improving fuel combustion efficiency and enhancing steel quality.

(73) 5-Hydroxytryptophan (5-HTP): A metabolic derivative of tryptophan. Used as a raw material for sleep-aiding health products to regulate neurotransmitters, and can also be used in mood-improving products to assist in relieving anxiety.

(74) Boc-L-Tryptophan: An amino-protected derivative of tryptophan. Used in the synthesis of antidepressant drugs, and as a pharmaceutical intermediate to improve drug stability and targeting.

(75) Fmoc-L-Tryptophan: A derivative of tryptophan for solid-phase peptide synthesis. Suitable for the preparation of peptide drugs such as somatostatin and leuprorelin, improving synthesis efficiency.

(76) N-Acetyl-DL-Tryptophan: An acetylated derivative of tryptophan. Used as a drug stabilizer to extend the shelf life of antibiotics and vaccines; in food, it can be used as an antioxidant to replace synthetic alternatives.

(77) Tryptophan Methyl Ester Hydrochloride: A methyl ester derivative of tryptophan. Used in the synthesis of antihistamine drugs and antiviral drugs (e.g., drugs for hepatitis B treatment), assisting in improving drug activity.

(78) Melatonin: The final metabolic product of tryptophan. Made into tablets or capsules to improve sleep, suitable for people with difficulty falling

asleep or light sleep, regulating sleep rhythm.

(79) L-Tryptophan Ethyl Ester: An ethyl ester derivative of tryptophan. Used as an intermediate for local anesthetics to reduce skin irritation; in cosmetics, it can be used as an anti-aging ingredient to delay skin aging.

(80) Tryptophan Acetal: An acetal derivative of tryptophan. Used in the preparation of expectorant drugs to reduce drug irritation to the respiratory mucosa, suitable for children and sensitive groups.

(81) O-Phospho-L-Tryptophan: A phosphorylated derivative of tryptophan. Used as a raw material for food for special medical purposes to promote tissue repair and supplement nutrition during post-operative recovery.

(82) D-Tryptophan: An optical isomer of tryptophan. Used in the synthesis of immunosuppressants to assist in the treatment of autoimmune diseases and regulate immune system function.

(83) Tryptophan Phosphate Derivatives: Phosphorylated derivatives of tryptophan. Used as intermediates for anticoagulant drugs to assist in the treatment of cardiovascular and cerebrovascular diseases; in cosmetics, they can be used as oil-controlling ingredients to improve acne-prone skin.

(84) Tryptophan Glycosylated Derivatives: Glycosylated modified products of tryptophan. Used as functional sweeteners in low-sugar foods to promote the proliferation of intestinal probiotics and improve intestinal health.

(85) Tryptophan Schiff Base Derivatives: Schiff base derivatives of tryptophan. Used in cosmetics as whitening ingredients to inhibit melanin production; in the pharmaceutical field, they can be used as heavy metal antidotes to chelate lead ions.

(86) L-Tryptophyl-L-Alanine (Tryptophan Dipeptide): A dipeptide derivative of tryptophan. In cosmetics, it promotes the proliferation of skin fibroblasts and increases collagen; in the pharmaceutical field, it is used for auxiliary treatment of stroke sequelae.

(87) Tryptophan-Phosphatidylcholine Complex: A complex formed by tryptophan and phosphatidylcholine. Used as a raw material for brain health health products to assist in improving memory and relieving brain fatigue; in cosmetics, it is added to eye care products to improve dark circles and eye skin sagging.

(88) Tryptophan-Modified Polylactic Acid Derivatives: Tryptophan-modified polylactic acid materials. Used in the preparation of biodegradable medical sutures that are automatically absorbed in the body without the need for removal; they can also be used as cosmetic packaging materials to replace traditional plastic microbeads, reducing environmental residues.

(89) Tryptophan Fluorescent Probe Derivatives: Fluorescently labeled derivatives of tryptophan. Used in food testing to quickly determine tryptophan content in grains; in biological research, they can track tryptophan metabolism pathways in cells to assist in cell biology research.

(90) Tryptophan Silane Derivatives: Silanized modified products of tryptophan. In cosmetics, they act as moisturizing ingredients to enhance the skin's moisture-locking ability, suitable for sensitive skin care products; in the textile industry, they are used as fabric finishing agents to improve the antistatic performance of clothing.

(91) Tryptophan Metal Complexes (Copper/Zinc): Complexes formed by tryptophan with copper and zinc. In the food field, they are used as natural preservatives to extend the shelf life of meat products, replacing synthetic preservatives; in the pharmaceutical field, they are made into external ointments to treat skin bacterial infections.

(92) Tryptophan Photosensitive Polymers: Tryptophan-modified photosensitive polymers. Used in the preparation of 3D printing photosensitive resins for medical implants such as dental stents; they can also be used as raw materials for environmentally friendly inks, which cure quickly under UV irradiation, reducing volatile organic compound emissions.

(93) Tryptophan Glycolipid Derivatives: Glycolipid derivatives of tryptophan. Used in the food industry as emulsifiers to stabilize systems such as yogurt and emulsions; in cosmetics, they are added to makeup remover products to gently dissolve makeup without damaging the skin barrier.

(94) Tryptophan Cyclopeptide Derivatives: Cyclopeptide-structured derivatives of tryptophan. In the agricultural field, they are used as biological pesticides to control rice sheath blight and vegetable downy mildew; in the pharmaceutical field, they are used for the treatment of multi-drug resistant bacterial infections, inhibiting the activity of superbugs.

(95) Tryptophan Quantum Dot Derivatives: Tryptophan-modified quantum dot materials. In cosmetics, they are used as sunscreen ingredients to block full-spectrum UV rays, suitable for sensitive skin sunscreen products; in the pharmaceutical field, they are used for tumor photothermal therapy to accurately kill cancer cells under near-infrared light.

(96) Tryptophan Synthetic Biology Derivatives: Tryptophan derivatives prepared by synthetic biology technology. Used as raw materials for antibody-drug conjugates (ADCs) to improve drug targeting and reduce damage to normal cells; they can also be used as vaccine adjuvants to enhance immune response.

(97) Tryptophan Quantum Entanglement Derivatives: Quantum entanglement-modified products of tryptophan. Used in the field of quantum communication as key carriers to ensure absolute security of information transmission; in biological quantum sensing, they can real-time monitor molecular movement in cells.

(98) Tryptophan-N-Carboxylic Anhydride: A cyclized derivative of tryptophan. Used as an intermediate for peptide drug synthesis to improve reaction efficiency and reduce by-product formation, suitable for the R&D of hormonal and antibacterial peptide drugs.

(99) Isotope-Labeled Tryptophan (^{13}C-Tryptophan): Isotope-labeled tryptophan

derivatives. Used in metabolomics research to track the metabolic pathway of tryptophan in the body, assisting in the analysis of the pathogenesis of diseases such as depression and tumors; in drug clinical trials, they monitor the interaction between drugs and tryptophan.

(100) Tryptophan Derivatives for Deep-Sea Extreme Environments: Tryptophan derivatives adapted to deep-sea environments. Added to deep-sea fish and shrimp feed to enhance high-pressure resistance and promote growth; they can also be used as coating materials for deep-sea detection equipment to reduce seawater corrosion rate.

(101) Tryptophan Neuroprotective Derivatives: Tryptophan derivatives with neuroprotective effects. Used in the preparation of auxiliary treatment drugs for Parkinson's disease to protect dopamine neurons and relieve motor dysfunction symptoms; they can also be used as ingredients in brain fatigue health products to improve attention concentration.

(102) Tryptophan Quantum Computing Packaging Materials: Tryptophan-modified quantum computing packaging materials. Used for quantum chip packaging to improve the stability of quantum bits and extend decoherence time; they can also be used as anti-interference coatings for high-end electronic components to optimize signal transmission efficiency.

(103) Tryptophan Derivatives for Extreme High Temperatures: High-temperature-resistant tryptophan derivatives. Used in the preparation of 1500℃ high-temperature coatings to protect industrial kilns and extend equipment service life; they can also be used as catalysts for high-temperature fuel cells to improve power generation efficiency.

(104) Tryptophan Peptide Nucleic Acid (PNA) Derivatives: Tryptophan-modified peptide nucleic acid derivatives. In gene editing, they assist CRISPR technology to reduce off-target effects, suitable for genetic disease gene therapy research; they can also be used as antiviral drugs to inhibit hepatitis B virus DNA replication.

(105) Tryptophan Metal-Organic Framework (MOF) Derivatives: Metal-organic framework materials constructed from tryptophan. In the environmental protection field, they are used to adsorb carbon dioxide in industrial waste gas; in the pharmaceutical field, they are used as drug carriers to achieve pH-responsive release, increasing drug concentration at tumor sites.

(106) Tryptophan Nuclear Medicine Derivatives: Lutetium-177-labeled tryptophan derivatives. Used for targeted therapy of neuroendocrine tumors to reduce tumor volume; they can also be used as diagnostic agents for thyroid cancer metastases to improve lesion detection rate.

(107) Tryptophan Derivatives for Dark Matter Detection: Tryptophan-modified dark matter detection materials. Used as target materials for detectors to improve the sensitivity of dark matter particle capture; they can also be used as nuclear radiation protection materials to reduce radiation absorption dose.

(108) Tryptophan Synthetic Biology Enzymatic Derivatives: Tryptophan derivatives prepared by enzymatic technology. Used for the efficient conversion of tryptophan to 5-hydroxytryptophan; they can also be added to microbial fertilizers to promote the proliferation of beneficial bacteria and improve soil microenvironment.

(109) Food-Grade L-Tryptophan (High Purity): High-purity L-tryptophan. Used as a food nutritional fortifier added to soy products, grains, and infant formula foods to balance amino acid composition and improve protein utilization; in baked foods, it participates in the Maillard reaction to enhance the roasted flavor.

(110) Feed-Grade L-Tryptophan (Cost-Effective): Feed-specific L-tryptophan. Added to livestock and poultry feed to make up for tryptophan deficiency in the diet, increasing the breast muscle rate of broilers and reducing feather-pecking behavior; in aquaculture feed, it promotes protein synthesis in fish and shrimp and reduces the feed coefficient.

(111) Cosmetic-Grade Tryptophan: Cosmetic-specific tryptophan. With antioxidant and moisturizing effects, it is added to creams, essences, masks and other products to increase skin moisture content, repair UV damage, and maintain skin moisture and smoothness.

(112) Tryptophan Fermentation By-Products: By-products from tryptophan fermentation. After purification, they are used as feed additives to supplement small-molecule peptides and B vitamins, enhancing the immunity of young livestock and poultry; they can also be used as raw materials for bio-organic fertilizers to promote the proliferation of soil microorganisms and improve soil structure.

(113) Tryptophan-Based Food Preservatives: Natural preservatives prepared based on tryptophan. Added to juices, jams, low-temperature meat products and other foods to extend shelf life, replacing synthetic preservatives and improving food safety.

(114) Tryptophan-Modified Starch: Tryptophan-modified starch. In the food industry, it is used as a thickener to stabilize the texture of products such as yogurt and jelly; in the feed industry, it is used as a binder to reduce feed dust and improve pellet integrity.

(115) Tryptophan Enzyme Preparations: Tryptophan-specific enzyme preparations. Used in feed enzymolysis to improve tryptophan utilization, and can also convert tryptophan into high-value derivatives in biological fermentation to optimize fermentation efficiency.

(116) Tryptophan-Based Surfactants: Surfactants prepared from tryptophan. In cosmetics, they are used as cleanser raw materials for gentle cleaning without irritating the skin; in the industrial field, they are used in detergents to reduce the chemical oxygen demand (COD) emission of wastewater.

(117) Tryptophan Compound Probiotic Preparations: Compound products of tryptophan and probiotics. Added to piglet and chick feed to reduce diarrhea

caused by weaning stress and improve intestinal flora balance; in the food field, they are used in fermented milk to assist in regulating human intestinal health.

(118) Tryptophan Flavor Improver (Fermentation Type): Fermentation-prepared tryptophan flavor improvers. Added to condiments such as soy sauce and vinegar to enhance the mellow flavor and reduce salt usage; in baked foods, they are added to enhance the wheat flavor and improve taste.

(119) Tryptophan Compound Vitamin Preparations: Compound products of tryptophan and multiple vitamins. Added to food to simultaneously supplement amino acids and vitamins, improving nutritional comprehensiveness; added to feed to balance livestock and poultry nutrition and maintain production performance.

(120) Tryptophan-Based Moisturizers: Moisturizers with tryptophan as the core component. In cosmetics, they are suitable for sensitive and dry skin care products to enhance the skin's moisture-locking ability; in the textile industry, they are used for fabric finishing to improve skin comfort when wearing clothes.

(121) Tryptophan-Based Degradable Mulch Films: Degradable mulch films modified with tryptophan. Used in agricultural planting to cover soil for moisture retention and soil moisture conservation, and degrade naturally without residue after use, replacing traditional plastic mulch films to reduce soil pollution.

(122) Tryptophan-Modified Cellulose: Tryptophan-modified cellulose materials. In the textile industry, they are used to prepare antibacterial underwear and sportswear to inhibit harmful bacteria such as Escherichia coli and Staphylococcus aureus; in the paper industry, they are used for medical paper and food packaging paper to improve paper strength and air permeability.

(123) Tryptophan Heavy Metal Adsorbents: Tryptophan-based heavy metal adsorption materials. Used in industrial wastewater treatment to remove heavy metal ions such as lead, mercury, and cadmium; they can also be used for pre-treatment of grains and fruits before processing to reduce heavy metal residues in agricultural products.

(124) Tryptophan-Based Antistatic Agents: Antistatic agents prepared from tryptophan. Used in electronic component packaging materials to reduce static hazards and protect precision components; in the textile industry, they are used for antistatic work clothes to reduce safety risks caused by static electricity.

(125) Tryptophan Degradable Packaging Materials: Tryptophan-based degradable packaging materials. Used in food packaging to replace PET plastics, and degrade quickly after use; they can also be used for express packaging and disposable tableware to reduce white pollution.

(126) Tryptophan Industrial Catalysts: Tryptophan-modified industrial catalysts. Used in chemical synthesis reactions to improve efficiency and

reduce energy consumption; they can also be used in petroleum refining desulfurization processes to reduce sulfide emissions.

(127) Tryptophan-Based Ceramic Toughening Agents: Tryptophan-based ceramic toughening agents. Added to ceramic products to improve impact strength and toughness, suitable for high-end tableware and electronic ceramic components, improving the brittle characteristics of ceramics.

(128) Tryptophan Flame-Retardant Materials: Tryptophan-modified flame-retardant materials. Used in plastic processing and building insulation materials to improve the oxygen index and fire rating of materials, complying with environmental flame-retardant standards and reducing fire hazards.

(129) Tryptophan Water Purifiers: Tryptophan-based water purifiers. Used in aquaculture to regulate the water environment and reduce the content of ammonia nitrogen and nitrite; in landscape water treatment, they improve water transparency and enhance water appearance.

(130) Tryptophan Soil Conditioners: Tryptophan-based soil conditioners. Used in saline-alkali soils to adjust soil pH, improving crop survival rate; they can also be used for the remediation of heavy metal-contaminated soils to reduce the activity of heavy metals in soil.

(131) Tryptophan-Based Aerospace Material Additives: Tryptophan-modified aerospace material additives. Used in aluminum alloy processing to enhance material strength and reduce weight; they can also be used as aerospace fuel additives to optimize combustion efficiency.

(132) Tryptophan Textile Dyeing and Finishing Auxiliaries: Tryptophan-based textile dyeing and finishing auxiliaries. Used as dye leveling agents to improve fabric color fastness, and as fabric softeners to enhance hand comfort, reducing chemical pollution during the dyeing and finishing process.

(133) Tryptophan-Based Deep-Space Nutrition Bars: Deep-space nutrition bars with tryptophan as the core nutritional component. Adapted to the extreme environmental needs of astronauts and polar expedition teams, they provide long-lasting energy and essential amino acids to maintain stable physical functions; they can also be used in outdoor emergency rescue to quickly supplement nutrition.

(134) Tryptophan-Modified Quantum Dot Display Films: Tryptophan-modified quantum dot display films. Used in VR glasses and in-vehicle displays to improve contrast and reduce blue light damage; when used in medical display equipment, they can enhance the clarity of pathological section details to assist in accurate diagnosis.

(135) Tryptophan Enzyme Biosensors: Biosensors constructed with tryptophan enzymes. Used for home monitoring of rare diseases (e.g., Hartnup disease) to real-time detect tryptophan metabolites in urine; in the food industry, they monitor tryptophan content in fermentation broth online to ensure stable product quality.

(136) Tryptophan-Based Degradable Aerospace Consumables: Tryptophan-based degradable aerospace consumables. Used for disposable food packaging and experimental consumables in spacecraft, which degrade naturally in space to reduce space debris, adapting to the needs of deep-space exploration missions.

(137) Tryptophan Compound Plant Growth Regulators: Compound preparations of tryptophan and plant growth factors. Used in space station vegetable cultivation to promote growth, increase yield and nutritional quality; they can also be used in crop cultivation in saline-alkali soils to enhance stress resistance.

(138) Tryptophan-Based Antiviral Coatings: Tryptophan-based antiviral coatings. Coated on the surface of medical masks and protective clothing to inhibit viral activity; they can also be used on daily items (e.g., phone cases, door handles) to reduce the risk of contact transmission, adapting to public health protection needs.

(139) Tryptophan 3D Bio-Printing Ink: Tryptophan-based 3D bio-printing ink. Used in tissue engineering to print skin and cartilage scaffolds, providing a suitable microenvironment for cell growth; it can also be used in food 3D printing to customize personalized nutritional foods, meeting special dietary needs.

(140) Tryptophan-Based Quantum Computing Materials: Tryptophan-modified quantum computing materials. Used as quantum chip substrates to enhance thermal conductivity and quantum bit stability; when added to high-end sensors, they can improve magnetic field detection accuracy, adapting to the high-performance needs of precision measurement fields.

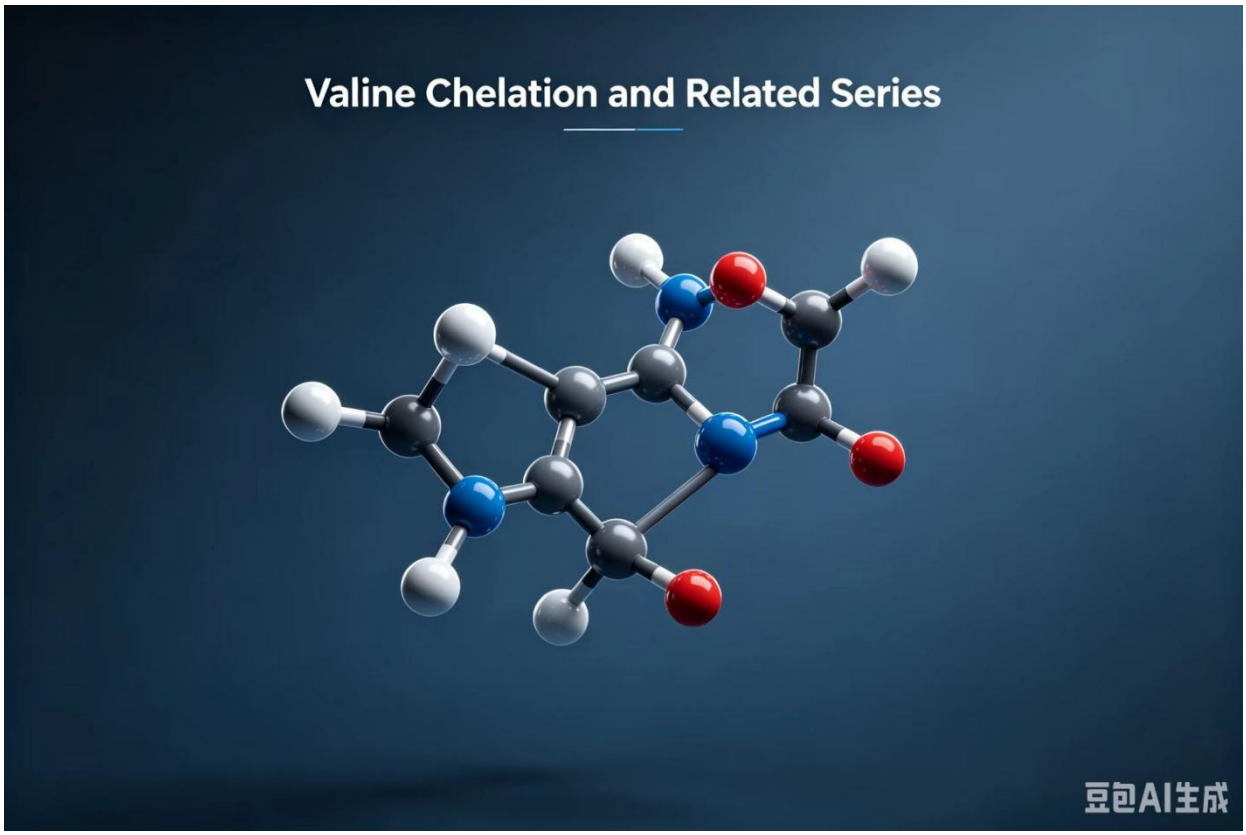
(141) Tryptophan Deep-Sea Detection Equipment Additives: Tryptophan-based deep-sea detection equipment additives. Used in the outer shell of deep-sea robots to enhance high-pressure resistance; they can also be used as lubricants for detection instruments to maintain viscosity stability in low-temperature environments, ensuring the normal operation of equipment.

(142) Tryptophan-Modified Nuclear Radiation Protection Fabrics: Tryptophan-modified nuclear radiation protection fabrics. Used in protective clothing for nuclear power workers and protective equipment in medical radiology departments to enhance radiation shielding capabilities and protect personnel health.

(143) Tryptophan-Based Artificial Intelligence Hardware Materials: Tryptophan-based artificial intelligence hardware materials. Used in AI chip heat dissipation to enhance thermal conductivity and reduce power consumption; when added to sensors, they can accelerate signal response speed, adapting to the high-performance needs of artificial intelligence equipment.

(144) Tryptophan Extreme Environment Nutritional Agents: Tryptophan-based nutritional agents for extreme environments. Adapted to extreme scenarios

such as volcanic expeditions and deep-sea operations, they tolerate high and low temperature environments, maintain nutrient retention rates, and provide nutrition required for basic metabolism for personnel; they can also be used in emergency rescue scenarios to ensure long-term energy supply.



(XXVII) Valine Chelation and Related Product Series

Valine metal chelates cover single-element varieties such as zinc, calcium, iron, copper, manganese and magnesium, suitable for agricultural element supplementation and disease prevention, breeding nutrition supplementation, human trace element supply and other scenarios. It also includes special compound preparations for aquatic products and crops, as well as functional derivatives in pharmaceutical and material fields, forming a multi-scenario product system.

(1) Valine Chelated Zinc

Valine is used as carrier to enhance the stability and absorption rate of zinc. In agriculture, it is applied at the early stage of crop zinc deficiency to prevent nutrient deficiency symptoms. In feed, it fits the young and breeding periods of livestock and poultry. In food, it is used for human growth and development period and the elderly with poor absorption to supplement zinc rapidly.

(2) Valine Chelated Calcium

It improves calcium absorption efficiency relying on the biocompatibility of valine. It serves as a high-absorption calcium source for middle-aged and elderly people with decreased

bone density, adolescents in critical bone development period and pregnant women. It is also used in the peak egg-laying period of laying poultry to prevent eggshell thinning and egg production decline.

(3) Valine Chelated Iron

Valine carrier reduces gastrointestinal mucosal irritation caused by iron. It is suitable for people with early iron deficiency anemia, pregnant women and vegetarians for iron supplementation. In agriculture, it is sprayed when crop new leaves turn yellow and leaf veins lose green. In breeding, it is added to seedling feed to prevent growth retardation caused by anemia.

(4) Valine Chelated Copper

Valine chelation improves the bioavailability of copper. In the early stage of crop fungal diseases such as leaf spot and downy mildew in agriculture, it acts as bactericide with copper supplementing effect to prevent apical necrosis. In breeding, it is added when livestock and poultry suffer faded feathers and slow growth to maintain physiological functions.

(5) Valine Chelated Manganese

Valine carrier promotes manganese transportation in the body. It is mainly used in breeding, added when livestock and poultry have dysplasia of bones, low egg production rate and low hatching rate of breeding eggs to boost metabolism. In agriculture, it is applied in proper amount when crop leaves lose green and stems grow weak.

(6) Valine Chelated Magnesium

Valine relieves the irritation of magnesium and promotes absorption. In breeding, it is added when animals suffer magnesium deficiency spasm or feed intake decline after transportation stress to reduce aggressive behavior. In agriculture, it is applied when interveinal yellowing occurs and photosynthetic efficiency decreases to promote chlorophyll synthesis.

(7) Valine Chelated Potassium

Valine carrier improves the mobility of potassium in crops. It is appliedat crop booting stage and fruit expansion stage to prevent lodging and increase fruit sweetness. It can be used as potassium supplement at the early stage of hypokalemia or after heavy sweating to protect stomach and stabilize electrolytes.

(8) Valine Chelated Selenium

Valine enhances the antioxidant synergistic effect of selenium. It is supplemented when human immunity is low and thyroid function is abnormal to reduce the risk of related diseases. In agriculture, it is applied 1-2 months before crop harvesting to produce selenium-rich products. In breeding, it is added during fattening and egg-laying periods of

livestock and poultry to increase selenium content of meat and eggs.

(9) Valine Chelated Molybdenum

Valine carrier promotes molybdenum transportation to crop root nodules. In agriculture, it is applied during root nodule formation and flowering and podding stages of leguminous crops to promote nitrogen fixation of rhizobia. It is added at the bolting stage of cruciferous crops to reduce flowering without fruiting.

(10) Valine Chelated Cobalt

Valine carrier helps cobalt remain in the rumen of ruminants. In breeding, it is added at the early stage of rumen development and peak milk production period of ruminants to promote rumen microorganisms to synthesize vitamin B12. It acts as auxiliary supplement for vegetarians or people with gastrointestinal absorption disorders causing vitamin B12 deficiency.

(11) Valine Chelated Chromium

Valine enhances the synergistic regulation effect of chromium on insulin. It is supplemented for type 2 diabetic patients with blood glucose fluctuation and obese people for metabolic regulation. In breeding, it is added in the later fattening period of pigs and poultry to improve carbohydrate utilization rate, reduce fat deposition and optimize meat quality.

(12) Valine Chelated Nickel

Valine carrier enhances cell permeability of nickel. In agriculture, it is applied from flowering to fruit setting stage of legume and solanaceous crops to promote pollen germination and prevent flower and fruit dropping. It is used as trace element supplement for people with long-term parenteral nutrition and participates in urea metabolism.

(13) Valine Chelated Boron

Valine chelation increases boron accumulation in crop floral organs. In agriculture, it is sprayed on fruit trees and rapeseed at flowering stage to promote pollen tube elongation and improve fruit setting rate. Applied at cotton square and boll stage, it prevents square and boll dropping and improves fiber quality.

(14) Valine Chelated Sodium

Valine carrier slows down sodium loss. It is supplemented at the early stage of electrolyte disorder caused by heavy sweating in high temperature operation and diarrhea to restore sodium balance rapidly. In aquaculture, it is added to water when fish and shrimp face salinity fluctuation to reduce stress mortality.

(15) Valine Chelated Strontium

Valine cooperates with strontium to activate osteoblast activity. It is supplemented with calcium products for middle-aged and elderly people with osteoporosis. Added to oral care products, it inhibits dental plaque formation and enhances enamel acid resistance.

(16) Valine Chelated Phosphorus

Valine carrier improves phosphorus effectiveness in acidic soil. In breeding, it is added during key bone development and milk production periods of livestock and poultry, cooperating with calcium to promote bone health. In agriculture, it is applied to crops with poor phosphorus absorption in acidic soil to prevent growth retardation caused by phosphorus deficiency.

(17) Valine Chelated Iodine

Valine enhances thyroid targeting of iodine. It is supplemented for people with iodine deficiency goiter and abnormal thyroid function. In aquaculture, it is added to water or feed to prevent iodine deficiency diseases of fish and shrimp and guarantee growth and development.

(18) Valine Chelated Fluorine

Valine carrier promotes fluorine deposition in enamel. It is used for daily oral care and crowds with high caries incidence to enhance enamel hardness. In breeding, it is added at the tooth and bone development stage of young livestock and poultry to assist in improving bone strength.

(19) Special Compound Preparation of Valine Chelated Zinc, Iron and Magnesium for Aquaculture：

With valine chelated zinc, iron and magnesium as core ingredients, it is suitable for fry cultivation period and crustacean molting period. Added to feed or water, it supplements essential amino acids, promotes protein synthesis, and improves survival rate of shrimp larvae and growth speed of fish.

(20) Crop Stress-resistant Compound Preparation of Valine Chelated Magnesium and Copper：

Core ingredients are valine chelated magnesium and copper. Suitable for crops after sowing, transplanting and under low temperature and drought stress. Foliar spraying enables magnesium to regulate nitrogen balance and assist phosphorus and silicon absorption, while copper sterilizes and supplements elements to establish stress resistance system quickly.

(21) Livestock and Poultry Fattening Compound Preparation of Valine Chelated Selenium, Zinc and Manganese

Contains valine chelated selenium, zinc and manganese. Used in the middle and later fattening period of pigs and cattle and fattening period of poultry. Added to feed, selenium improves meat antioxidant capacity, zinc and manganese promote protein deposition, helping livestock and poultry gain weight rapidly and reduce disease risk.

(22) Fruit and Vegetable Quality Improvement Compound Preparation of Valine

Chelated Potassium, Calcium and Magnesium

With valine chelated potassium, calcium and magnesium as core ingredients, it is sprayed or flushed at apple coloring stage, grape fruit expansion stage and tomato fruiting stage. Potassium improves fruit sweetness and hardness, calcium reduces fruit cracking, and magnesium maintains photosynthetic efficiency to prolong picking period.

(23) Ruminant Lactation Compound Preparation of Valine Chelated Cobalt, Selenium and Calcium

Contains valine chelated cobalt, selenium and calcium. Suitable for dairy cows and dairy goats at peak lactation period. Added to feed, cobalt promotes vitamin B12 synthesis to increase milk yield, selenium reduces mastitis, and calcium supplements lactation consumption to prevent postpartum paralysis.

(24) Chinese Herbal Medicine Quality Improvement Compound Preparation of Valine Chelated Selenium, Molybdenum and Zinc

Core ingredients are valine chelated selenium, molybdenum and zinc. Sprayed from vigorous growth stage to 1-2 months before harvesting of astragalus, angelica and other Chinese medicinal materials. Selenium and zinc increase the content of astragaloside and angelica polysaccharide, and molybdenum promotes accumulation of photosynthetic products.

(25) Field Crop Yield-increasing Compound Preparation of Valine Chelated Boron, Molybdenum and Potassium

Contains valine chelated boron, molybdenum and potassium. Sprayed at wheat flowering stage, rice booting stage and corn bell stage. Boron promotes pollination and fruiting, molybdenum improves nitrogen utilization rate, potassium enhances lodging and disease resistance to increase 1000-grain weight.

(26) Young Livestock and Poultry Health Care Compound Preparation of Valine Chelated Iron, Zinc and Manganese

With valine chelated iron, zinc and manganese as core ingredients, it is used 1-2 months after weaning of chicks, piglets and calves. Added to starter feed, iron prevents anemia, zinc improves intestinal barrier function, and manganese promotes bone development to reduce diarrhea mortality.

(27) Protected Vegetable Anti-senescence Compound Preparation of Valine Chelated Magnesium, Potassium and Boron

Contains valine chelated magnesium, potassium and boron. Flushed or sprayed at the later fruiting stage of protected tomato and cucumber. Magnesium maintains leaf photosynthetic capacity, potassium supplements fruiting consumption, and boron prevents floral organ senescence to guarantee fruit quality and prolong harvesting period.

(28) Pet Nutritional Compound Preparation of Valine Chelated Calcium, Phosphorus and Zinc

Core ingredients are valine chelated calcium, phosphorus and zinc. Suitable for growth period of young puppies and kittens and bone maintenance period of elderly pets. Mixed with pet food, calcium and phosphorus cooperate to promote bone development, and zinc improves skin and hair condition to reduce hair loss and dandruff.

(29) Fruit Tree Fruit Retention Compound Preparation of Valine Chelated Boron, Calcium and Zinc

Contains valine chelated boron, calcium and zinc. Sprayed after flower withering of citrus and apple and at young fruit expansion stage of pear. Boron improves fruit setting rate, calcium increases peel toughness to prevent fruit cracking, and zinc avoids fruit malformation to raise commodity rate.

(30) Aquaculture Anti-stress Compound Preparation of Valine Chelated Sodium, Potassium and Magnesium

With valine chelated sodium, potassium and magnesium as core ingredients, it is added during fish and shrimp transportation or sudden change of water environment temperature and salinity. It adjusts osmotic pressure and reduces inappetence and death caused by stress.

(31) Boc-N-methyl-L-Valine

Derived from L-valine as parent body, it is used as synthetic intermediate of polypeptide drugs and anti-cancer drugs, supplied for pilot test and large-scale production of drug research and development to accurately regulate drug molecular structure, and also applied in functional polymer material modification.

(32) Boc-L-Valine N-Hydroxysuccinimide Ester

Active ester derived from L-valine, mainly used in biopharmaceutical field. It acts as protein coupling agent in the research and development of antibody-drug conjugates and vaccines, realizing efficient connection between drug molecules and carrier proteins and ensuring preparation activity.

(33) Fmoc-L-Valine

L-Valine introduced with Fmoc protecting group, widely used in solid-phase polypeptide synthesis such as insulin and growth hormone. Added in laboratory research stage, the protecting group avoids side reactions and ensures accurate assembly of polypeptide chains, and can also be used as raw material for nutritional supplement of postoperative rehabilitation crowds.

(34) L-Valine Methyl Ester Hydrochloride

Methylated derivative of L-valine, used in the production of functional food such as sports

nutrition supplements, acting as essential amino acid to assist muscle repair. Added to skin care products to improve skin compatibility and assist in repairing skin barrier function.

(35) N-Acetyl-L-Valine

Acetylated derivative of L-valine, used as pharmaceutical excipient in the production of oral tablets and capsules to improve drug dissolution and bioavailability. Added to infant formula food as easily digestible amino acid source to reduce gastrointestinal burden.

(36) Valine Schiff Base Complex

L-valine forms Schiff base with aldehydes and then complexes with metals, used as catalyst in organic asymmetric catalysis to improve reaction efficiency and product purity. It can also prepare functional film materials to enhance high temperature resistance and corrosion resistance.

(37) L-Valyl-L-Prolyl Dipeptide

Condensed from L-valine and L-proline, used in sports nutrition supplements to promote muscle damage repair and relieve fatigue after high-intensity exercise. It is also applied in nutritional support for postoperative recovery patients to improve protein absorption and utilization rate.

(38) Valine Modified Nano Carrier

Nano carrier surface modified with L-valine groups, used in drug delivery systems such as tumor targeted nanoparticles. Valine improves carrier biocompatibility and cell targeting, helping drugs accurately reach lesions and reduce damage to normal cells.

(39) Valine Derived Surfactant

Green surfactant derived from L-valine, used in baby care products with low irritation and easy biodegradation. It also serves as drug solubilizer to improve solubility and oral absorption efficiency of insoluble drugs.

(40) N-tert-Butoxycarbonyl-L-Valine

L-Valine introduced with Boc protecting group, used as synthetic raw material of peptide drugs, antibiotics and antiviral drugs. The protecting group protects amino acid structure during research and development to ensure directional reaction.

(41) L-Valyl-L-Leucyl Dipeptide

Condensed from L-valine and L-leucine, used in special medical formula food for postoperative crowds and people with weak digestive function. It is also applied in nutritional agents for the elderly to improve protein utilization rate and maintain muscle mass.

(42) Valine Metal Organic Framework Material

Constructed with L-valine as organic ligand, used for gas adsorption and separation such as

carbon dioxide capture. It can also be used as heavy metal ion adsorbent to treat industrial wastewater and adsorb heavy metals such as lead and cadmium.

(43) Valine Compound Aquatic Attractant (Chelated Zinc + Betaine)

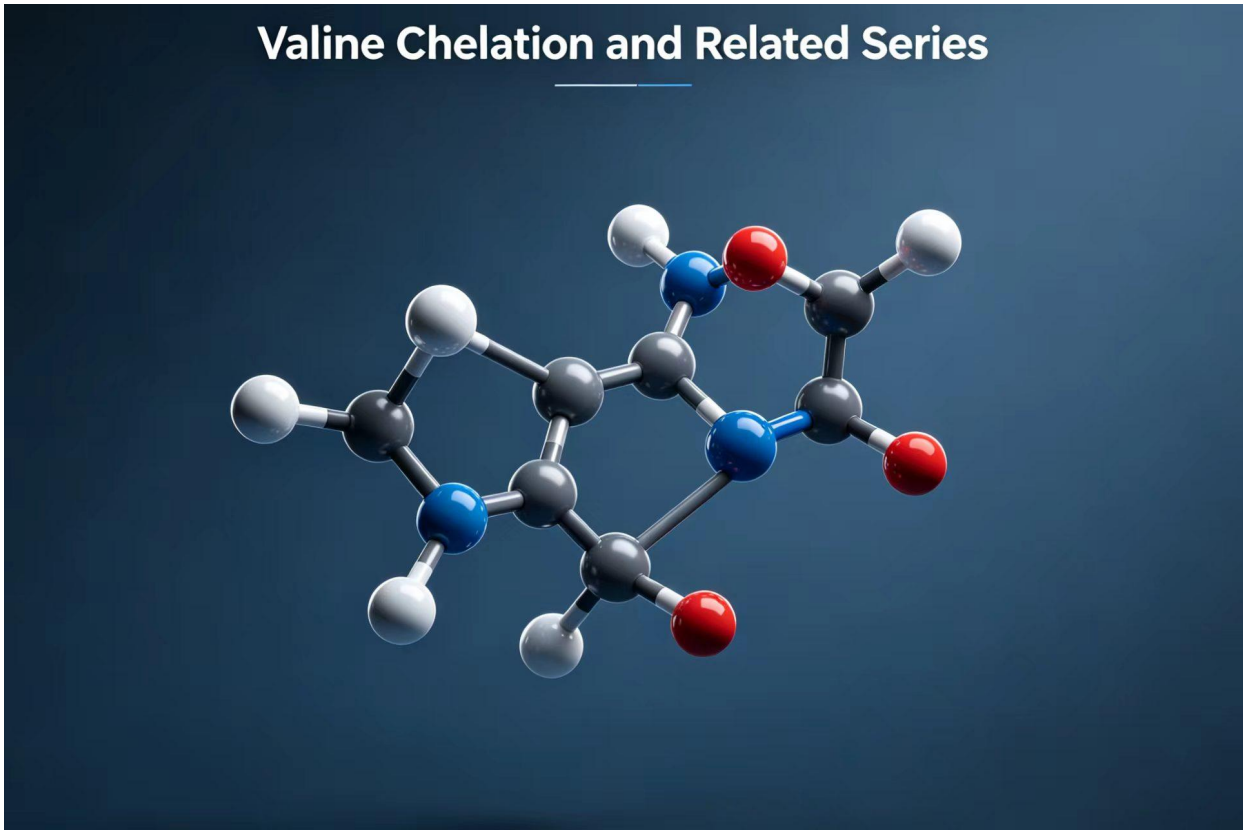
Core ingredients contain valine chelated zinc and betaine, added to fish and shrimp feed in aquaculture. Zinc meets growth demand, betaine enhances food attraction, raising feeding frequency and feed utilization rate, suitable for breeding varieties such as Penaeus vannamei and grass carp.

(44) Valine Compound Stress-resistant Foliar Fertilizer (Chelated Magnesium + Humic Acid)

Contains valine chelated magnesium and humic acid, applied to crops in arid and saline-alkali areas. Magnesium promotes photosynthesis, humic acid improves soil microenvironment, enhancing crop stress resistance and reducing yield loss.

(45) Valine Compound Pet Intestinal Regulator (Chelated Zinc + Probiotics)

Contains valine chelated zinc and Bacillus subtilis, added to pet food. Zinc repairs intestinal mucosa, probiotics regulate flora balance, reducing pet diarrhea rate, especially suitable for pets during feed switching and postoperative recovery.



(XXXVIII) Tyrosine Chelated and Associated Product Series

Tyrosine chelated series products are compounds formed by combining tyrosine (as a chelating carrier or derivative matrix) with metal ions (iron, zinc, copper, etc.) or functional groups (DOTA, NOTA, etc.). They integrate the

biocompatibility of tyrosine with the core functions of metal ions, and are widely applicable in fields such as nutritional supplementation, medical diagnosis and treatment, breeding and planting, scientific research, and daily chemicals. The core advantage of this series lies in enhancing the stability and bioavailability of metal ions while reducing irritation—it not only meets the trace element needs of humans, animals, and plants, but also provides key raw materials for high-end fields such as medical imaging and drug delivery.

(1) Tyrosine Chelated Iron (Nutritional Supplement Type): Formed by chelating tyrosine with divalent iron, it has low gastrointestinal irritation and high absorption rate. It is used to improve iron-deficiency anemia in humans (suitable for pregnant women and vegetarians) and can also serve as an iron-labeling tool for biochemical research.

(2) Tyrosine Chelated Zinc (Food Fortification Type): With higher bioavailability than ordinary zinc salts, it is added to children's supplementary food and elderly nutritional powders to supplement zinc—improving children's appetite and maintaining the elderly's immunity. It has strong stability and is not prone to reacting with food components.

(3) Tyrosine Chelated Copper (Medical Auxiliary Type): It assists in improving connective tissue abnormalities (e.g., decreased vascular elasticity) caused by copper deficiency in humans; it is also used in small amounts as a crop foliar fertilizer to promote pollen development and fruit setting of fruits and vegetables, reducing malformed fruits.

(4) DOTA-Tyrosine-Lysine-DOTA (Imaging Reagent Raw Material): Featuring a dual-DOTA ring chelating structure, it can chelate gadolinium and gallium ions. As a core component of contrast agents for magnetic resonance imaging (MRI) and PET imaging, it is suitable for the R&D of diagnostic methods for deep tissue lesions in the brain and liver.

(5) DOTA-3-Tyrosyl-Octreotide (DOTA-TOC, Tumor Diagnosis and Treatment Type): Targeting somatostatin receptors, it chelates ^{68}Ga (for imaging) and ^{177}Lu (for treatment). It is used for PET diagnosis and radioactive targeted therapy of neuroendocrine tumors, realizing "integrated diagnosis and treatment".

(6) NOTA-TATE (Tyrosyl-Modified Type, Precision Imaging): Containing a tyrosine-modified TATE peptide carrier, it targets and binds to tumor somatostatin receptor 2 after chelating ^{68}Ga. It is used for PET imaging of gastroenteropancreatic neuroendocrine tumors, with higher imaging clarity than traditional reagents.

(7) Tyrosine Chelated Manganese (Breeding-Specific Type): Enhances the absorption of manganese in the intestines of egg-laying poultry. When added during the egg-laying period, it promotes calcium deposition in eggshells, reducing thin-shelled eggs; when used during the fattening period of beef cattle, it assists in improving bone development and reducing the risk of

limb deformation.

(8) Tyrosine Chelated Magnesium (Sports Nutrition Type): Tyrosine synergizes with magnesium to quickly relieve post-exercise muscle spasms and regulate neural excitability. It is added to sports drinks and protein powders, suitable for people engaged in high-intensity sports such as marathons and fitness.

(9) Tyrosine Chelated Gadolinium (MRI Contrast Raw Material): With good water solubility and high biosafety, it serves as a component of MRI contrast agents to shorten the relaxation time of tissues, enhance the imaging effect of brain and liver lesions, and is not prone to accumulation in the body.

(10) Tyrosine Chelated Selenium (Selenium-Rich Food Raw Material): Protects selenium from oxidation. It is added to selenium-rich rice and protein powders to supplement selenium for people in selenium-deficient areas, assisting in enhancing antioxidant capacity and reducing the risk of cardiovascular diseases.

(11) Tyrosine Chelated Cobalt (Ruminant-Specific Type): Avoids destruction by rumen microorganisms, promotes the synthesis of vitamin B_{12} in the rumen of cattle and sheep, and prevents cobalt-deficiency anemia; it also improves the digestibility of crude fiber and enhances feed conversion efficiency.

(12) Tyrosine Chelated Zinc (Daily Chemical-Specific Type): With low irritation and easy skin absorption, it can inhibit Propionibacterium acnes when used in oil-controlling and acne-removing creams; when added to baby lotions, it improves the skin barrier and reduces dryness and flaking.

(13) HYNIC-(Tyrosine^3)-Octreotide (SPECT Diagnostic and Therapeutic Agent): Targeting somatostatin receptors, it chelates ^{99m}Tc (for imaging) and ^{188}Re (for treatment). It is used for SPECT imaging diagnosis and targeted radiotherapy of neuroendocrine tumors, suitable for the diagnostic and therapeutic needs of primary hospitals.

(14) Tyrosine-Iron Chelate (EU-Certified Feed Grade): Approved by the EU for fattening poultry, egg-laying poultry, and turkeys. It improves iron bioavailability, promotes the growth and development of poultry, increases egg production, and improves egg quality (e.g., increasing iron content in egg yolks).

(15) Zinc(II)-Coordinated Oligotyrosine (Cell-Penetrating Peptide): Forms a stable complex with zinc ions. After being labeled with fluorescence, it can enter mammalian cells through endocytosis. As a drug delivery carrier, it helps small-molecule drugs enter cells accurately to exert their effects.

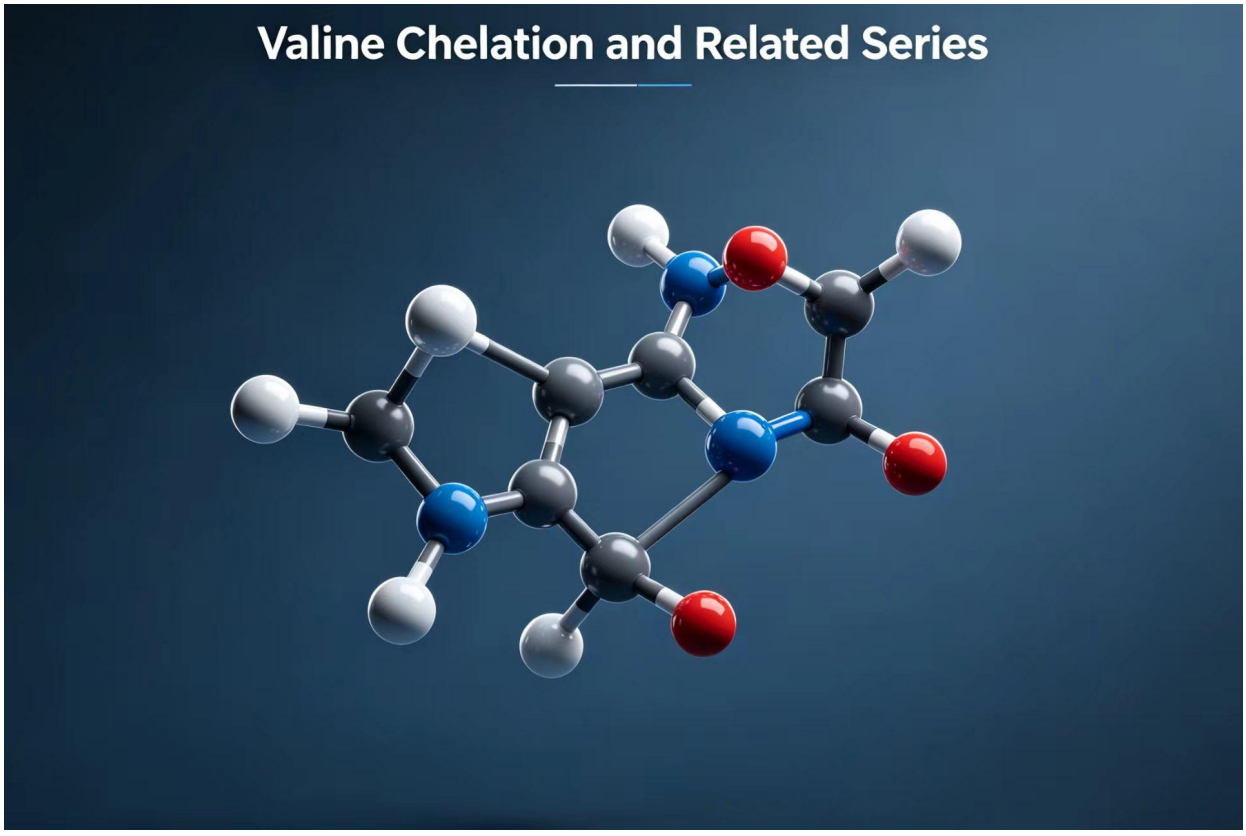
(16) Tyrosine Chelated Chromium (Metabolism-Regulating Type): Assists in improving insulin sensitivity in patients with type 2 diabetes, and synergizes with tyrosine to regulate blood glucose—suitable for middle-aged and elderly people with large blood glucose fluctuations; it is also used in small amounts in the late fattening period of pigs to reduce fat deposition.

(17) Tyrosine Chelated Boron (Fruit Tree Fruit-Retaining Type): Used for foliar spraying of apples and citrus during the flowering period to promote pollen tube elongation and increase fruit setting rate; its chelated structure reduces boron loss in soil, suitable for fruit tree planting in acidic soil.

(18) Tyrosine-Ruthenium Chelate (Optoelectronic Material Raw Material): Possessing excellent photoluminescent properties, it is used to prepare organic optoelectronic materials (e.g., LEDs, photosensitive layers of solar cells) to improve the photoelectric conversion efficiency of devices.

(19) Tyrosine Chelated Potassium (Crop Fruit-Expanding Type): Used for flushing application on tomatoes and grapes during the fruit-expanding period to promote sugar accumulation and coloration of fruits; the tyrosine carrier enhances the mobility of potassium in crops, reducing fruit cracking.

(20) Tyrosine-Gallium Chelate (Scientific Research Probe Type): Serves as a metal ion probe for tracking the metabolism of gallium in organisms, suitable for scientific research experiments on the mechanism of metal ion transport in tumor cells.



(XXIX) Isoleucine Chelated and Associated Product Series

Isoleucine chelates and their derivatives are functional products for animal nutrition, mainly including three categories: single-metal chelates, multi-element compound agents, and associated derivatives. With isoleucine as the carrier, they boast advantages of high stability, high absorption rate, and

low irritation—enabling efficient trace element supplementation, adaptation to multiple breeding scenarios, and solving the problem of additive application in large-scale breeding. Centered on animal nutrition, this product system extends to scientific research, medical care, and other fields, covering all breeding needs. Below is the complete optimized product list by category:

(1) Isoleucine Chelated Zinc: Its intestinal absorption rate is 30% higher than that of ordinary zinc salts. It promotes enzyme synthesis and hormone secretion, suitable for piglets during the weaning period and laying poultry during the initial egg-laying period, reducing stress-induced growth retardation.

(2) Isoleucine Chelated Manganese: Inhibits lactic acid accumulation, protects myoglobin membranes, maintains fat metabolism, and improves protein deposition. Suitable for beef cattle during the fattening period and broilers during the rapid growth period.

(3) Isoleucine Chelated Magnesium: Participates in cellular respiration and high-energy phosphate bond transfer, providing energy while reducing tail-biting and feather-pecking behaviors. Suitable for young animals such as calves and chicks.

(4) Isoleucine Chelated Copper: Avoids binding with phytic acid, promotes SOD synthesis, improves fur luster, and enhances resistance to bacterial diseases. Suitable for the entire breeding cycle.

(5) Isoleucine Chelated Iron: With a water solubility of over 95%, it promotes hemoglobin synthesis and prevents iron-deficiency anemia in piglets. Suitable for dairy cows during the lactation period (increasing iron content in milk).

(6) Isoleucine Chelated Calcium: Enables absorption without the assistance of vitamin D3, strengthening bones and teeth. Suitable for young animals (preventing rickets) and high-yield laying poultry/dairy animals (preventing postpartum paralysis).

(7) Isoleucine Chelated Selenium: Converts into glutathione peroxidase, exerting antioxidant effects and improving sperm motility of breeding males. Suitable for breeding livestock/poultry and high-altitude breeding requiring hypoxia resistance.

(8) Isoleucine Chelated Cobalt: Prevents rumen degradation, promotes vitamin B_{12} synthesis in ruminants, and improves crude fiber digestibility. Suitable for cattle, sheep, and aquatic crustaceans (shrimp, crabs) during the molting period.

(9) Isoleucine Chelated Chromium: Improves insulin sensitivity in breeding boars, reduces sperm deformity rate, and extends the peak egg-laying period of laying hens. Suitable for breeding livestock and poultry farms.

(10) Isoleucine Chelated Boron: Promotes follicle development in breeding

poultry (increasing fertilization rate) and strengthens bones of young poultry (reducing leg diseases). Suitable for rare poultry and special aquatic products (eels).

(11) Isoleucine Chelated Nickel: Promotes chitin synthesis in insects (increasing insect body hardness) and aids urea metabolism in ruminants. Suitable for Tenebrio molitor breeding and plateau yaks.

(12) Isoleucine Chelated Potassium: Regulates osmotic pressure in aquatic products in saline-alkali areas and supplements potassium loss in livestock and poultry under high temperatures. Suitable for coastal aquatic farms and high-temperature poultry farms in southern regions.

(13) Isoleucine Chelated Zinc + Manganese (3:1): Promotes fur development and enhances stress resistance. It reduces the heat stress mortality rate of broilers in summer and improves the cold resistance of piglets in winter. Suitable for intensive poultry farms.

(14) Isoleucine Chelated Calcium + Magnesium (5:1): Strengthens bones and protects muscles and nerves, reducing spasms in laying poultry and limb weakness in dairy animals. Suitable for high-yield laying hens and dairy cows during the peak lactation period.

(15) Isoleucine Chelated Iron + Copper + Selenium: Prevents "three deficiencies" in young animals and increases the weaning survival rate of piglets to over 98%. Suitable for intensive pig farms.

(16) Isoleucine Chelated Zinc + Cobalt: Promotes rumen development in ruminants and improves molting success rate of aquatic products. Suitable for cattle and sheep farms as well as shrimp and crab farms.

(17) Isoleucine Chelated Selenium + Zinc + Boron: Improves fertilization rate of breeding fish and promotes the synthesis of active ingredients in medicinal animals. Suitable for special aquatic seedling farms and scorpion/centipede farms.

(18) Isoleucine Chelated Calcium + Phosphorus + Zinc: Supplements calcium and phosphorus simultaneously (avoiding phosphorus deficiency when 补钙 alone) and protects teeth. Suitable for young minks/foxes and young pets (puppies, kittens).

(19) N-Acyl Isoleucine Zinc: Improves surface activity and doubles the retention time of zinc in aquatic products. When used externally, it inhibits pet fungi. Suitable for aquatic farms and pet daily chemical products.

(20) Isoleucine-Vitamin B6 Chelate (10:1): Promotes isoleucine metabolism and reduces amino acid waste. Suitable for the breeding of ornamental fish, racing pigeons, and other special animals.

(21) Isoleucine Metal-Organic Framework Materials (MOFs): Releases copper/zinc in a sustained manner, avoids intestinal irritation, and extends feed shelf life. Suitable for newborn calves and premature pets.

(22) Isoleucine-Taurine Chelated Zinc (8:5:1): Strengthens the intestinal

barrier of aquatic products and improves the endurance of racing dogs. Suitable for sea cucumber/abalone seedling farms and military/police dog bases.

(23) Isoleucine-Trehalose Chelated Zinc: Enhances stress resistance of aquatic products (reducing seedling mortality by 30%) and reduces the decline in feed intake of livestock and poultry in winter. Suitable for aquatic farms and poultry farms in northern regions.

(24) Isoleucine-Hyaluronic Acid Chelated Calcium: Protects pet joints and enhances feather luster of ornamental birds. Suitable for pet hospitals and parrot farms.

(25) Isoleucine-Chitosan Chelated Copper: Forms a protective film on the surface of aquatic larvae and inhibits pathogenic bacteria in pet oral cavities. Suitable for seedling farms and pet teeth cleaning products.

(26) Isoleucine-Phytase Chelate: Increases the granulation survival rate of phytase to 85% and eliminates the anti-nutritional effect of phytic acid. Suitable for large-scale feed factories.

(27) Isoleucine-γ-Aminobutyric Acid (GABA) Chelated Zinc: Reduces stress-induced diarrhea in piglets and extends the resting time of laying hens. Suitable for piglet farms and high-end egg enterprises.

(28) Isoleucine Chelated Silicon: Promotes wool fiber synthesis in Angora rabbits and helps crops resist lodging. Suitable for ecological cycle farms (integrating breeding and planting).

(29) Isoleucine Chelated Vanadium (V^{4+}): Promotes milk production in dairy cows and improves the marbling of beef cattle. Suitable for low-fat milk factories and high-end beef cattle farms.

(30) Isoleucine Chelated Strontium: Strengthens the bones of ostriches and improves the scale luster of koi fish. Suitable for rare poultry farms and ornamental fish farms.

(31) Isoleucine Chelated Lithium: Stabilizes the mood of plateau animals and improves the repeatability of experimental animal data. Suitable for plateau pastures and biomedical laboratories.

(32) Isoleucine-Graphene Quantum Dot Chelated Iron: Increases iron absorption rate by 40% and enables metabolic tracking. Suitable for research-oriented breeding farms and environmental testing institutions.

(33) Isoleucine Chelated Germanium: Promotes the synthesis of active ingredients in medicinal animals and increases germanium content in black-bone chickens. Suitable for sika deer farms and functional food enterprises.

(34) Isoleucine-Polylactic Acid (PLA) Chelated Calcium: Supplements calcium in a sustained manner, is biodegradable, and pollution-free. Suitable for ecological aquatic cage culture.

(35) Isoleucine Chelated Neodymium (Nd^{3+}): Activates antifreeze proteins in fish and promotes the synthesis of unsaturated fatty acids in fish eggs.

Suitable for high-latitude cold-water aquatic farms.

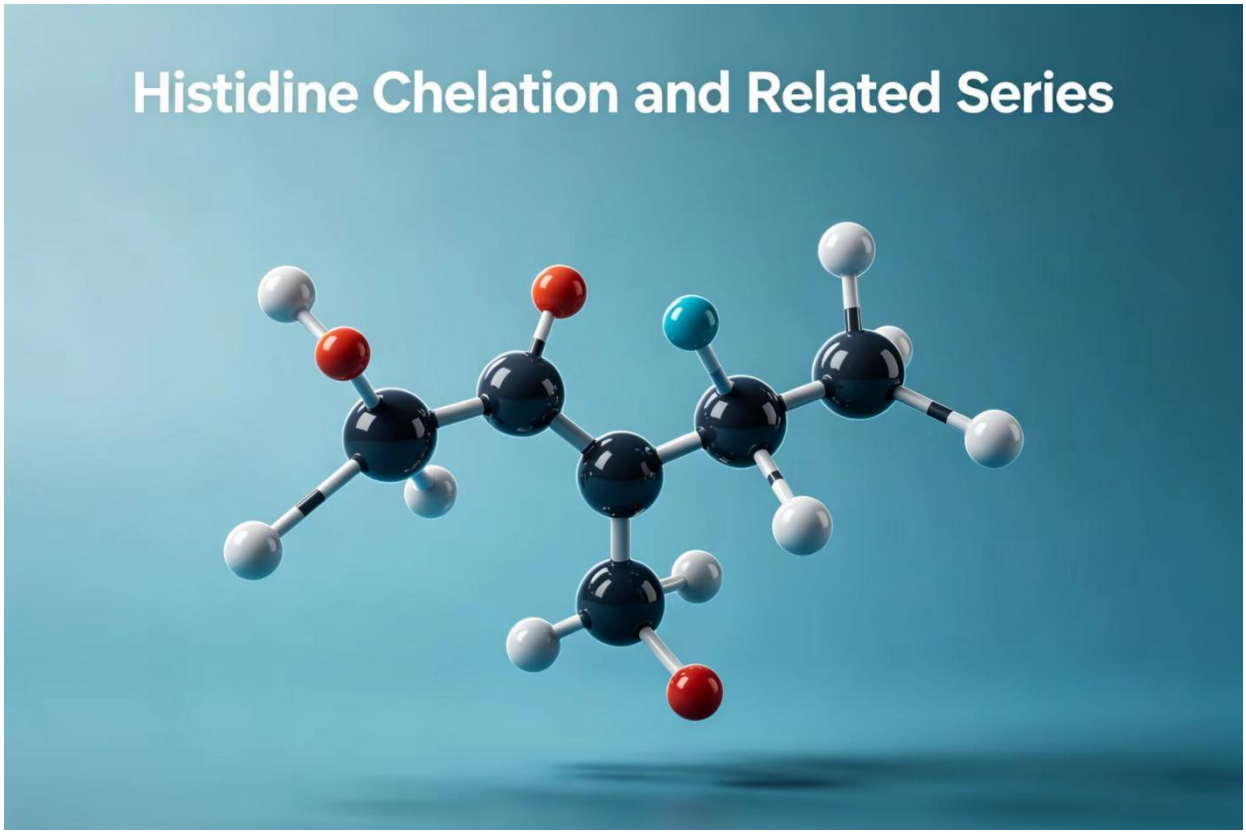
(36) Isoleucine-Lactoferrin Chelated Zinc: Reduces the infection risk of young endangered animals and serves as pet nutritional paste. Suitable for endangered animal protection centers and high-end pet brands.

(37) Isoleucine-Modified Aptamer Chelate: Enables targeted tumor cell imaging. Suitable for biomedical research institutions.

(38) Isoleucine-Horseradish Peroxidase (HRP) Chelated Copper: Serves as a labeling reagent for Western blotting. Suitable for animal disease diagnosis institutions.

(39) Isoleucine Chelated Nickel-Cobalt Bimetal: Increases biogas methane production by 20% and serves as crop fertilizer. Suitable for ecological energy farms.

(40) Isoleucine-Antimicrobial Peptide Chelated Copper: Reduces the "secret death disease" of prawns. Suitable for antibiotic-free aquatic seedling farms.



(XXX) Histidine Chelated and Associated Product Series

Histidine chelated series products take the imidazole group of histidine as the core chelating site. By stably combining with metal ions, they possess high stability, strong targeting, and broad adaptability. Their core function enables the purification and separation of histidine-tagged proteins, while also extending to diverse scenarios such as trace element supplementation,

soil remediation, and drug delivery. Product types include single-metal chelates, multi-element compound agents, and functional derivatives, which are widely used in biological research, agricultural planting, animal nutrition, medical health care, daily chemicals, and industrial fields. They not only meet the precise operation needs of the research end but also adapt to the efficient application scenarios of the industrial end.

(1) Histidine Chelated Zinc: Promotes flower bud differentiation of dragon fruit, increases the bulb size of onions and their pyruvate content, suitable for high-value-added crop bases.

(2) Histidine Chelated Copper: Remediates copper-contaminated soil (reducing available copper by 30%-50%), prevents blight in wheat/rice during the heading stage, suitable for contaminated cultivated land and grain-oil crop planting.

(3) Histidine Chelated Manganese: Prevents manganese-deficiency chlorosis in tomatoes/cucumbers, enhances resistance to low temperatures and drought, suitable for protected vegetables and cash crops.

(4) Histidine Chelated Iron: Alleviates iron-deficiency chlorosis in citrus/grapes, increases fruit sugar content, and promotes root development of strawberry seedlings, suitable for orchards and seedling bases.

(5) Baofengyu Polypeptide: Contains histidine and peptide amino acids, relieves weak seedlings, chlorosis, and premature senescence of crops, improves disease and pest resistance, suitable for protected and field planting.

(6) Histidine Chelated Molybdenum: Promotes nitrogen fixation by rhizobia in soybeans/peanuts (increasing by 20%-30%), prevents "flowering without fruiting" in rapeseed, suitable for legumes and oil crops.

(7) Histidine Chelated Silicon: Enhances the stem toughness of rice/wheat (reducing lodging by 40%) and improves insect resistance, suitable for field grain-oil crops and high-standard farmland.

(8) Histidine Chelated Titanium: Helps high-altitude wolfberries/Angelica sinensis resist saline-alkali, promotes the synthesis of medicinal components, suitable for plateau medicinal plant planting.

(9) Histidine Chelated Boron-Zinc Compound Agent: Promotes flowering and pod formation of rapeseed/cotton (increasing pod setting rate by 15%-20%), prevents little leaf disease, suitable for rapeseed belts and cotton-producing areas.

(10) Histidine Chelated Cerium: Inhibits the absorption of lead and cadmium by corn/wheat (reducing heavy metals in grains by 40%-60%), suitable for safe planting in moderately and lightly contaminated farmland.

(11) Histidine Chelated Potassium-Sodium Compound Agent: Prevents blossom-end rot and fruit cracking in tomatoes/eggplants, increases fruit hardness, suitable for greenhouse solanaceous fruit planting.

(12) Histidine Chelated Germanium: Increases organic germanium in the fruiting bodies of Ganoderma lucidum/shiitake mushrooms (+30%-40%), enhances immune efficacy, suitable for medicinal fungus bases.

(13) Histidine Chelated Magnesium-Potassium Compound Agent: Reduces flower and fruit drop of mangoes/durians, increases fruit sweetness by 1-2 sugar units, suitable for tropical fruit-producing areas.

(14) Feed-Grade Histidine Chelated Zinc: Its absorption rate is twice that of inorganic zinc, reduces diarrhea in piglets, strengthens the feathers of broilers, and improves eggshell hardness of laying hens, suitable for large-scale pig and poultry farms.

(15) Histidine Chelated Iron-Copper-Manganese Premix: Supplements trace elements for calves/lamb (preventing anemia, promoting fur growth, and protecting bones), avoids binding with phytic acid, suitable for ruminant farms.

(16) Histidine Phytase: Decomposes phytic acid in aquatic feed, releases calcium, zinc, and copper (increasing utilization rate by 40%), reduces soft-shell disease in fish and shrimp, suitable for aquatic seedling raising and breeding.

(17) Histidine Chelated Cobalt: Promotes the synthesis of vitamin B_{12} in the rumen of cattle and sheep, increases crude fiber digestibility (+5%-8%), reduces nutritional diarrhea, suitable for large-scale cattle and sheep farms.

(18) Pet-Grade Histidine Chelated Calcium: Compound with vitamin D_3, promotes calcium absorption in elderly dogs and cats (preventing osteoporosis), reduces gastrointestinal irritation, suitable for pet food and hospitals.

(19) Histidine Chelated Selenium-Iodine Premix: Increases selenium and iodine content in duck/quail eggs (producing functional eggs), enhances resistance to avian influenza, suitable for characteristic egg production farms.

(20) Histidine Chelated Nickel: Promotes the activity of digestive enzymes in sea cucumber/abalone larvae, increases seedling survival rate (from 60% to 85%), suitable for high-end marine product seedling bases.

(21) Histidine Chelated Iron-Folate Premix: Supplements iron and folate for experimental mice, stabilizes physiological indicators, suitable for biomedical laboratories.

(22) Histidine Chelated Lithium: Stabilizes neurotransmitters in polar penguins/Arctic foxes, reduces low-temperature stress, suitable for polar research stations.

(23) Histidine Chelated Copper-Antimicrobial Peptide Complex: Inhibits Vibrio in Penaeus vannamei (reducing the mortality rate of "secret death disease" to <5%), suitable for antibiotic-free aquatic farms.

(24) Histidine Chelated Metal Medium (Ni-NTA Superflow Agarose): Specifically adsorbs 6×His-tagged proteins with a purification efficiency of over 95%, suitable for recombinant protein purification.

(25) Histidine Chelated Metal Medium (HisPur Cobalt Resin): Highly specifically recognizes exposed histidine residues, reduces non-specific adsorption, suitable for high-purity enzyme/antibody purification.

(26) Histidine-Polyethylene Glycol-Carboxylic Acid (His-PEG-COOH): Chelates metal ions + connects biomolecules, used for ion detection and biosensing, suitable for environmental testing laboratories.

(27) Histidine-Tryptophan-Biotin Solution: A component of the Ames test kit, mixed with top agar medium to detect the mutagenicity of food/drugs, suitable for toxicology laboratories.

(28) Histidine-Modified Magnetic Nanoparticles: Targetedly bind to histidine-tagged membrane proteins, enabling rapid separation by magnetic field, suitable for cell membrane protein extraction.

(29) Histidine Chelated Iron: Its absorption rate is three times that of ferrous sulfate, prevents iron-deficiency anemia in children/pregnant women, suitable for pharmaceutical and health product enterprises.

(30) L-Histidine and Glycine-Zinc Compound Capsules: Gluten-free and lactose-free, suitable for vegetarians and intolerant groups to supplement zinc, adapting to the high-end health product market.

(31) Zinc-Histidine-Vitamin C-Selenium Yeast Complex: Synergistically resists oxidation and improves immunity, with excellent tolerance, suitable for the elderly and post-operative populations.

(32) Compound Amino Acid Injection (18AA-Ⅱ): Contains 18 amino acids including histidine, supplements nutrition for patients with insufficient oral intake, suitable for clinical use in hospitals.

(33) Histidine Chelated Copper Preparation: Treats Menkes disease and adult copper deficiency, administered intravenously or orally, suitable for pediatrics and endocrinology departments.

(34) Histidine-Glutamine Chelate: Reduces post-operative inflammation, repairs intestinal mucosa, and shortens hospital stay by 2-3 days, suitable for clinical nutrition departments.

(35) Histidine Chelated Zinc-Copper Compound Preparation: Promotes the excretion of excess copper in patients with Wilson's disease, supplements zinc to stabilize metabolism, suitable for hospitals specializing in rare diseases.

(36) Histidine Betaine (CAS: 534-30-5): Maintains color and preserves freshness of food (extending shelf life by 5-7 days), and provides anti-aging and moisturizing effects in cosmetics, suitable for food/daily chemical enterprises.

(37) Histidine Chelated Zinc Food Additive: Gently supplements zinc for

infants (no gastrointestinal irritation), suitable for formula milk powder/rice flour, complying with safety standards.

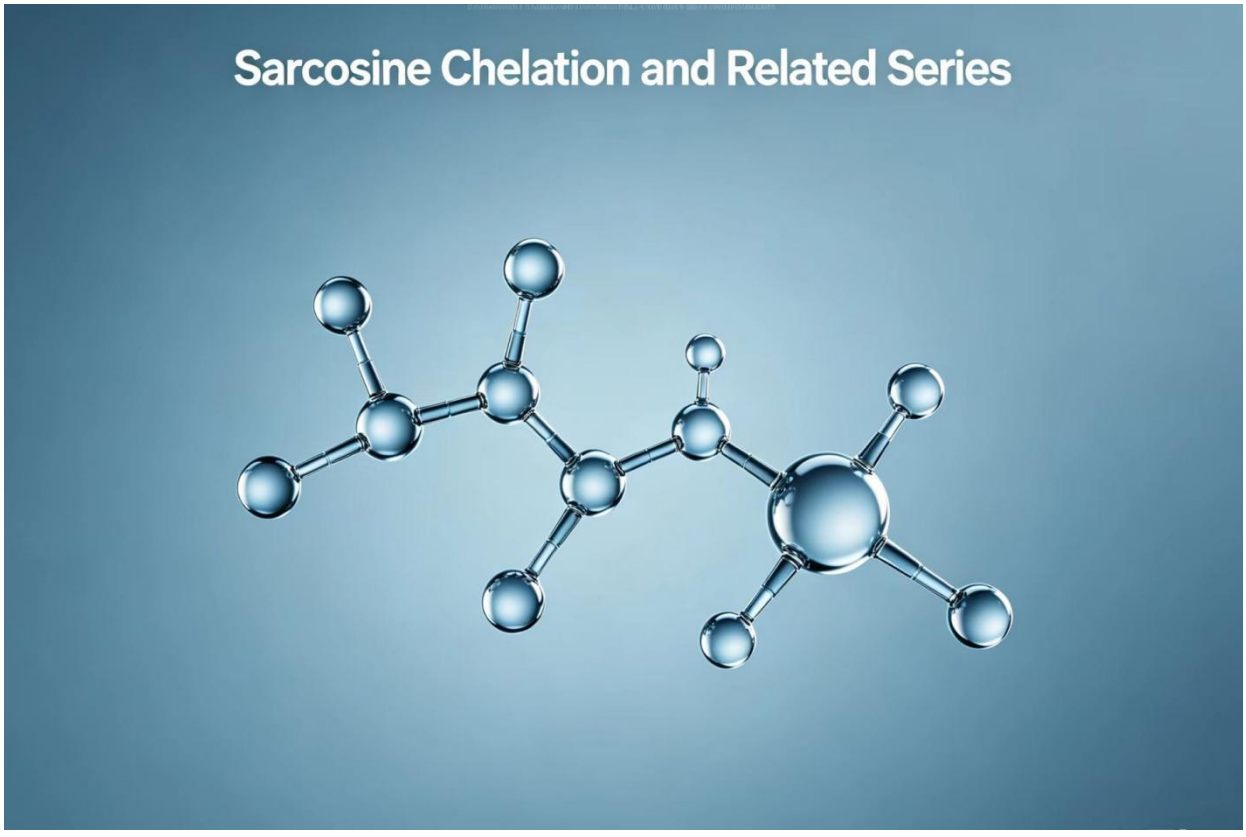
(38) Histidine Chelated Zinc-Fluoride Compound Agent: Used in toothpaste formulations to inhibit oral bacteria and strengthen tooth enamel, suitable for daily chemical enterprises.

(39) Histidine Chelated Palladium: Catalyzes the synthesis of pharmaceutical intermediates, extends the catalyst life by three times, suitable for pharmaceutical and chemical enterprises.

(40) Histidine-Creatine Chelate: Promotes the absorption of creatine during exercise (+15% reserve), reduces muscle soreness, suitable for sports nutrition brands.

(41) Histidine-Modified Activated Carbon: Adsorbs arsenic/fluoride in drinking water (rate over 95%) without secondary pollution, suitable for water purifier enterprises.

(42) Histidine Chelated Nickel-Cobalt Bimetallic Catalyst: Improves the oxygen reduction activity of hydrogen fuel cells, extends service life by 50%, suitable for new energy enterprises.



(XXXI) Sarcosine Chelated and Associated Product Series

The sarcosine chelation series is centered around N-methylglycine, which stably binds metal ions through amino and carboxyl groups to form highly active chelates.

Its core advantages are high solubility, high bioavailability, and low irritation. The product has a wide range of applications and can accurately adapt to the needs of multiple fields such as agriculture, food, and medicine, efficiently supplementing nutrition and improving application effectiveness.

(1) Sarcosine Magnesium: Its water solubility is 40% higher than that of inorganic magnesium salts. It aids post-exercise physical recovery and improves cognitive efficiency, suitable for sports nutrition products and brain-boosting health supplements.

(2) Sarcosine Chromium: Forms an 8-hour sustained-release complex with chromium ions, enhances insulin sensitivity to regulate metabolism, and has a patented structure, suitable for blood glucose management health supplements.

(3) Sarcosine Calcium: Produced using chloroacetic acid as raw material, its absorption rate is 35% higher than that of calcium carbonate (with no gastrointestinal irritation). Used for food fortification and bone health, suitable for infant supplementary food and elderly calcium supplements.

(4) Sarcosine Zinc: Exists in forms such as zinc carnosine, with antioxidant effects and the ability to promote gastric mucosa repair (anti-ulcer, with over 20 years of clinical application in Japan); it can also supplement zinc, suitable for gastrointestinal health supplements and children's zinc supplements.

(5) Sarcosine Iron: Prevents iron ion oxidation, with an absorption rate 2.5 times that of ferrous sulfate (no iron odor), and prevents iron-deficiency anemia, suitable for iron supplements for pregnant women and children.

(6) Sarcosine Manganese: Easily absorbed, reduces exercise-induced muscle spasms, and promotes adolescent bone development, suitable for sports supplements and children's nutritional foods.

(7) Sarcosine Nickel: An industrial catalyst that stably disperses nickel ions, lowering the hydrogenation temperature of vegetable oil by 10-15℃ (reducing by-products), suitable for fine chemical enterprises.

(8) Pet-Grade Sarcosine Calcium-Phosphorus Compound Agent: Increases the absorption rate of calcium and phosphorus in pets by 25%, prevents osteoporosis in elderly dogs and cats, suitable for pet food and nutritional pastes.

(9) Sarcosine Molybdenum: Promotes nitrogen fixation by rhizobia in leguminous crops (+25%-30%) and prevents "flowering without fruiting" in rapeseed, suitable for oil crops and leguminous planting bases.

(10) Sarcosine Copper: An ophthalmic adjuvant that inhibits Pseudomonas aeruginosa and promotes corneal repair, suitable for auxiliary treatment preparations for dry eye and keratitis.

(11) Sarcosine Selenium: Exclusive for aquaculture, with an absorption rate in fish and shrimp 3 times higher than that of inorganic selenium. It

enhances stress resistance and increases selenium content in fish meat, suitable for high-end aquatic farms.

(12) Sarcosine Cobalt: A precursor for vitamin B_{12} synthesis, reducing by-products in chemical synthesis, suitable for the production of raw materials for anemia treatment drugs.

(13) Sarcosine Vanadium: Mimics the effect of insulin, assisting in the treatment of type 1 diabetes (suitable for patients with insulin resistance), suitable for pharmaceutical enterprises specializing in rare diseases.

(14) Sarcosine Germanium: A feed additive for special poultry, increasing organic germanium content in poultry meat and enhancing resistance to respiratory diseases, suitable for characteristic poultry farms.

(15) Sarcosine Silicon: Promotes the formation of a "silicon layer" in rice/wheat, reducing rice planthopper infestation by 40% and enhancing lodging resistance, suitable for field grain and oil crops.

(16) Sarcosine Copper-Citrate Compound Agent: Used for external deworming in animal husbandry, targeting and damaging the nervous system of ticks/mange mites (safe for cattle and sheep), suitable for large-scale pastures.

(17) Sarcosine Zinc-Boron Compound Agent: Promotes root growth of vegetable seedlings (length +20%-25%) and improves transplant survival rate, suitable for seedling bases and protected agriculture.

(18) Sarcosine Cerium: Exclusive for plant anti-aging, scavenges free radicals in leaves (delaying aging by 10-15 days) and improves photosynthetic efficiency, suitable for strawberry/grape cultivation (extending the harvesting period and shelf life).

(19) Sarcosine Gadolinium: Auxiliary for nuclear medicine protection, stabilizes gadolinium ions to reduce radiation damage to normal cells during MRI examinations, suitable for nuclear medicine departments in hospitals.

(20) Sarcosine Potassium-Sodium Chelated Compound: Enhances plant salt-alkali resistance, regulates cell osmotic pressure (reducing the wilting rate of cotton fields in northwest China by 40%) and promotes nutrient absorption, suitable for the cultivation of cash crops in saline-alkali soils.

(21) Sarcosine Molybdenum-Tungsten Compound Agent: A raw material for special lubricants, improving the temperature resistance of lubricating oil (withstanding over 300℃), suitable for the lubrication of industrial gears and engine bearings.

(22) Deuterated Sarcosine: Such as sarcosine-4,4,4-d3, a raw material for diagnostic drugs, assisting in magnetic resonance imaging/spectroscopy for disease diagnosis, suitable for biomedical research institutions.

(23) N-Acyl Sarcosine: Such as sodium lauroyl sarcosinate, a mild surfactant used in facial cleansers and shampoos,suitable for daily chemical enterprises.

(24) Sodium Sarcosinate (Sodium N-Methylglycinate): An amino acid-type

surfactant (non-irritating and easily degradable), suitable for the daily chemical, health care, and pharmaceutical fields.

(25) 5-Sarcosine: A natural compound used as a food additive to improve taste, or to aid muscle recovery and reduce fatigue, suitable for functional drinks and sports meal replacements.

(26) Sarcosine Ethyl Ester Hydrochloride: An intermediate for antitussive drugs, and can also inhibit oral bacteria, suitable for pharmaceutical enterprises and oral care brands.

(27) Sarcosine-Glutamine Chelate: Used for post-operative recovery, reducing inflammation and repairing intestinal mucosa (shortening hospital stay by 2-3 days), suitable for clinical nutrition departments.

(28) Sarcosine-Modified Activated Carbon: Has a heavy metal adsorption rate of over 92% (reusable for 5-8 times), suitable for industrial wastewater treatment and household water purifiers.

(29) Sarcosine-Modified Silicone Oil: Endows silicone oil with hydrophilicity, used for hair smoothing in conditioners and anti-irritation in baby skincare products, suitable for high-end daily chemical enterprises.

(30) Sarcosine-Polylactic Acid Copolymer: A pharmaceutical packaging material (improving biocompatibility), made into microspheres for sustained-release of anti-tumor drugs (extending drug efficacy by 12 hours), suitable for pharmaceutical packaging enterprises.

(31) Sarcosine-Yeast Extract Compound Agent: Promotes microbial fermentation (efficiency +20%), suitable for enzyme preparation and probiotic production enterprises.

(32) Sarcosine-Modified Epoxy Resin: Improves the flexibility and adhesion of coatings (extending the anti-corrosion life of oil pipelines by 5-8 years), suitable for anti-corrosion projects.

(33) Sarcosine-Probiotic Embedding Agent: Tolerates high temperatures during feed granulation (survival rate over 85%), suitable for aquatic and livestock microecological enterprises.

(34) Sarcosine-Modified Water-Based Ink: Used for food packaging printing (preventing migration of harmful substances), suitable for packaging and printing enterprises.

(35) Sarcosine-Ganglioside Complex: Repairs nerve fibers damaged by stroke sequelae, suitable for neurological pharmaceutical enterprises.

(36) Sarcosine-Chitosan Chelated Adsorbent: Increases the removal rate of phosphorus and nitrogen in water by 35% (reducing eutrophication), suitable for fishpond and landscape water treatment.

(37) Sarcosine-Modified Polyester Fiber: Has 30% higher moisture absorption and breathability (with antibacterial properties), used for medical protective clothing and infant clothing, suitable for textile enterprises.

(38) Sarcosine-Panthenol Complex: Promotes oral mucosa repair (relieving

ulcer pain), suitable for oral gels and care brands.

(39) Sarcosine-Green Tea Polyphenol Complex: A food preservative (extending shelf life by 2-3 times), suitable for food processing enterprises (replacing chemical preservatives).

(40) Sarcosine-Polyurethane Hot Melt Adhesive: Has strong low-temperature adhesion (maintaining adhesion at -20℃), used for sealing cold-chain food packaging, suitable for packaging enterprises.

(41) Sarcosine-Modified Orthodontic Bracket Adhesive: Improves adhesion to tooth surfaces (reducing the falling-off rate by 25%) and reduces irritation to tooth enamel, suitable for dental medical device enterprises.

(42) Sarcosine-Humic Acid Complex: A soil conditioner (improving air permeability by 30%), suitable for the improvement of barren soils such as mountain orchards.

(43) Biotin-Associated Derivatives: ① Biotin-sarcosine (used for biochemical research and drug development); ② DOTA-biotin-sarcosine metal chelate (chelating gadolinium/erbium, used as a nuclear medicine imaging agent/drug carrier), suitable for biological laboratories and pharmaceutical enterprises.

(44) Sarcosine-Fluorescein Chelated Lanthanum: A molecular diagnostic tool (with a tumor marker detection sensitivity reaching the ng level), suitable for in vitro diagnostic reagent enterprises.

(45) Sarcosine Chelated Lithium: An electrolyte additive for lithium-sulfur batteries (reducing lithium dendrites, extending lifespan by 30%), suitable for high-altitude/low-temperature energy storage equipment.

(46) Sarcosine-Trehalose Chelate: An extreme environment protective agent (maintaining astronauts' muscle function), suitable for polar scientific expedition food R&D institutions.

(47) Sarcosine-Modified CRISPR Vector: Increases cell transfection efficiency by 18%-22% (reducing off-target effects), suitable for molecular biology laboratories and gene therapy pharmaceutical enterprises.

(48) Sarcosine Chelated Titanium: Improves the corrosion resistance of aluminum alloy coatings, suitable for the protection of aircraft components.

(49) Sarcosine-Horseradish Peroxidase (HRP) Complex: Increases the sensitivity of immunoassays by 10%-15%, suitable for reagents for the detection of infectious diseases and tumor markers.

(50) Sarcosine-Fetal Bovine Serum Compound Agent: Shortens the cell culture cycle by 15%, suitable for antibody and vaccine production enterprises.

(51) Sarcosine-Modified Sequencing Primer: Reduces the mismatch rate of gene sequencing by 15%-20%, suitable for gene sequencing enterprises.

(52) Sarcosine-Dimethyl Sulfoxide (DMSO) Compound Agent: A cell cryopreservation protective agent (increasing the recovery rate by 20%-25%), suitable for biological sample banks and cell therapy enterprises.

(53) Sarcosine-Aluminum Adjuvant Complex: Enhances the immune response of vaccines by 30%-40% (reducing local irritation), suitable for influenza and COVID-19 vaccine production enterprises.

(XXXII) One-Stop Supply of Fragrances, Flavors and Scents

- Fragrances & Flavors • Empowering a Life of Diverse Tastes, with Scents Covering All Scenarios!

- Select Thousands of Fragrances & Flavors, from Food & Daily Chemicals to Pharmaceuticals & Catering, meeting scent and flavor needs in one stop!

- Combining Natural and Synthetic Options, Integrating Classic and Bestselling Products — A professional fragrance and flavor supplier, helping your business thrive with delightful scents!

We specialize in the fragrance and flavor industry, integrating five core systems: base oils, solid monomers, essential oils, compound seasonings, and scenario-specific fragrances, covering thousands of popular products. From ethyl maltol and natural vanillin for food flavor enhancement, to santalol and white musk ketone for daily chemical scents, to snail noodle essence and wok aroma essence for catering, as well as TCM-grade essential oils and compliant natural fragrances — our full range of products adapts to diverse scenarios including food, daily chemicals, pharmaceuticals, catering, health preservation, and aromatherapy. Our products combine natural organic properties with high cost-effectiveness, including long-selling classic items and 2025 best-selling new products. We can meet different needs such as bulk purchasing and customized blending, helping partners accurately connect with the market and seize the dividends of the scent and flavor track!

I. Base Oils (Carrier Oils)

- **Classic Types:** Grape Seed Oil, Olive Oil, Palm Oil, Pumpkin Seed Oil, Shea Butter Oil, Castor Oil, Walnut Oil, Wild Camellia Oil, Pine Nut Oil, Aloe Oil, Jojoba Oil, Evening Primrose Oil, Hemp Seed Oil, Borage Oil, Cottonseed Oil, Pomegranate Seed Oil, Soybean Oil, Coconut Oil, Wheat Germ Oil, Seabuckthorn Seed Oil, Avocado Oil, Rosehip Oil, Sweet Almond Oil, Seabuckthorn Fruit Oil, Rice Bran Oil, Safflower Seed Oil, Sesame Oil, Walnut Kernel Oil

- **Popular Types:** Golden Jojoba Oil (CAS: 90045-98-0), Sunflower Oil, Macadamia Nut Oil, Meadowfoam Seed Oil, Cranberry Seed Oil, Flaxseed Oil, Marula Oil, Tamanu Oil, Calendula-Infused Oil, St. John’s Wort Oil, Chamomile-Infused Oil, Calendula Oil

- Functional Types: Rice Bran Oil (whitening carrier), Safflower Seed Oil (antioxidant), Walnut Kernel Oil (high moisturizing), Chamomile-Infused Oil (soothing & repairing), Grape Seed Oil (CAS: 8024-22-4, high smoke point for blending)

II. Solid Monomers

- Classic Types: Natural Camphor, Thymol, Menthol, Synthetic Camphor, Natural Borneol, Cinnamic Acid, Synthetic Borneol

- Core Flavor-Enhancing Types (Top 10 Market Repurchase Rate): Vanillin (CAS: 121-33-5, universal for food & daily chemicals), Ethyl Maltol (CAS: 4940-11-8, two types: pure scent & roasted scent), Maltol (CAS: 118-71-8, exclusive for baking), Methyl Cinnamate (CAS: 103-26-4), Ethyl Cinnamate (CAS: 103-36-6), 6-Methylcoumarin

- Stable Functional Types: p-Hydroxybenzaldehyde (CAS: 123-08-0), Butylated Hydroxyanisole (BHA, CAS: 25013-16-5), Propyl Gallate (PG, CAS: 121-79-9), Sodium Dehydroacetate (CAS: 4418-26-2)

III. Monomer Spices

- Classic Types: Ocimene, Citral, α-Terpineol, Cinnamaldehyde, D-Limonene, Linalool, β-Ionone, Terpinene-4-ol, α-Pinene, Hesperidin, Isoeugenol, Tetrahydrolinalool, β-Pinene, Myrcene, Terpinolene, γ-Terpinene, Geraniol, Fenchol, Linalyl Acetate, Cineole, Phellandrene, Methyl Eugenol, cis-3-Hexenyl Acetate, Turpentine Oil, Carvacrol, Raspberry Ketone, Citronellyl Acetate, Terpineol, Citronellol, cis-3-Hexenyl Salicylate, Eugenol, Citronellal, cis-3-Hexenol

- 2025 Bestselling Monomers: Isoamyl Acetate (CAS: 123-92-2), Natural β-Pinene (CAS: 127-91-3), p-Cymene (CAS: 99-87-6), Natural Linalyl Acetate (CAS: 115-95-7), Synthetic Anethole, Sabinene (78% natural), Methyl Cedryl Ketone (CAS: 32388-55-9), Tonka Musk (CAS: 1506-02-1), Santalol (CAS: 67801-20-1), γ-Methylionone (CAS: 1335-46-2), β-Methylionone (CAS: 127-43-5)

- Functional Monomers: Tetrahydrolinalool (CAS: 78-69-3), Citronellyl Formate (CAS: 105-85-1), Furaneol (CAS: 3658-77-3), δ-Decalactone, γ-Octalactone, Phenylacetaldehyde (98%), Acetophenone (CAS: 98-86-2), Isobutyric Acid (CAS:

79-31-2), Butyric Acid (CAS: 107-92-6), Capric Acid (CAS: 334-48-5), Methyl Hexanoate (CAS: 106-70-7), Allyl Heptanoate(CAS: 142-19-8), Octanal (CAS: 124-13-0), Valeraldehyde (CAS: 110-62-3), Diacetyl (CAS: 431-03-8), Methyl Anthranilate (CAS: 134-20-3), Ethyl Caprate (CAS: 110-38-3), Melonal (CAS: 106-72-9), Maple Lactone/Methylcyclopentenolone

- Core Daily Chemical Scents: Limeene, Lilial, Rhodinol, White Musk Ketone, Cedrol, Sandalwood Oil, Cedarwood Oil, Cinnamon Bark Oil, Vetiver Oil

IV. Monomer Essential Oils

- Classic Types: Benzoin Oil, Ylang-Ylang Oil, Neroli Oil, Spearmint Oil, Eucalyptus Oil, Calendula Oil, Petitgrain Oil, Borneol Oil, Star Anise Oil, Onion Oil, Garlic Oil, Palmarosa Oil, Michelia Alba Oil, Bitter Orange Leaf Oil, Egg Yolk Oil, Rose Essential Oil, Thyme Oil, Chili Oil, Clove Bud Oil, Rosewood Oil, Cedarwood Oil, Cypress Oil, Clove Oil, Rosemary Oil, Peppermint Oil, Fir Oil, Azalea Oil, Jasmine Oil, Cedar Oil, Sandalwood Oil, Bergamot Oil, Woody Fragrance Essential Oil, Tea Tree Oil, Lychee Seed Oil, Ginger Oil, Valerian Oil, Lemongrass Oil, Geranium Oil, Dill Seed Essential Oil, Lavender Essential Oil, Lemon Oil, Sweet Orange Oil, Lotus Leaf Oil, Coriander Seed Oil, Parsley Oil, Virginia Cedarwood Oil, Black Pepper Oil, Wild Chrysanthemum Oil, Cinnamon Oil, Citronella Oil, Carrot Seed Oil, Clary Sage Oil, Frankincense Oil, Fennel Oil, Mushroom Oil, Mandarin Oil, Grapefruit Oil, Osmanthus Essential Oil, Horseradish Oil, Okra Seed Oil, Lithospermum Essential Oil, Cucumber Oil, Lemon Eucalyptus Oil, Melissa Essential Oil, Violet Oil, Radish Seed Oil, Apple Oil, Vetiver Oil/Root Oil, Cabbage Oil, Chamomile Oil, White Lotus Oil

- **Popular Natural & Organic Types:** Basil Essential Oil, Bergamot Essential Oil (furan-free, suitable for sensitive skin), Carrot Seed Essential Oil, Citronella Essential Oil, Cinnamon Leaf Essential Oil, Coriander Essential Oil, Dill Essential Oil, Eucalyptus Essential Oil (blue gum), Fennel Essential Oil, Frankincense Essential Oil, Lime Essential Oil, Litsea Cubeba Essential Oil, Agarwood Essential Oil

- **Niche Bestsellers:** Ylang-Ylang Extra Essential Oil, Tonga Sandalwood Essential Oil, Narrow-Leaf Lavender Essential Oil, Thymol-Type Thyme Essential Oil, Cineole-Type Rosemary Essential Oil, Damascus Rose Essential Oil, Peppermint Essential Oil

- **TCM-Grade Monomers:** Peppermint Oil (TCM-grade), Cinnamon Oil (TCM-grade), Basil Oil, Patchouli Oil, Curcuma Zedoaria Oil, Turmeric Oil, Perilla Leaf Oil, Mugwort Oil

V. Chinese Herbal Oils

- **Classic Types:** Ginseng Oil, Dalbergia Odorifera Oil, Ligusticum Wallichii Oil, Saposhnikovia Divaricata Oil, Turmeric Oil, Honeysuckle Oil, Juniperus Communis Oil, Bay Leaf Oil, Schizonepeta Tenuifolia Oil, Centipeda Minima Oil, Atractylodes Macrocephala Oil, Rheum Palmatum Oil, Bitter Almond Oil, Tangerine Oil, Cinnamomum Camphora Oil, Citrus Aurantium Amara Oil, Forsythia

Suspensa Oil, Perilla Frutescens Var. Crispa Oil, Sambucus Williamsii Oil, Angelica Sinensis Oil, Pyrola Calliantha Oil, Pine Needle Oil, Atractylodes Lancea Oil, Rehmannia Glutinosa Oil, Jade Tree Oil, Pine Tar Oil, Zanthoxylum Bungeanum Oil, Myrrh Oil, Honey-Fried Glycyrrhiza Uralensis Oil, Cinnamomum Cassia Twig Oil, Mugwort Oil, Rice Bran Oil, Pimenta Dioica Oil, Michelia Figo Oil, Croton Tiglium Oil, Paeonia Suffruticosa Bark Oil, Sinapis Alba Oil, Amomum Villosum Oil, Vitex Negundo Oil, Spatholobus Suberectus Oil, Paeonia Lactiflora Oil, Carthamus Tinctorius Oil, Arisaema Erubescens Oil, Myristica Fragrans Oil, Perilla Frutescens Seed Oil, Perilla Frutescens Leaf Oil, Panax Notoginseng Oil, Curcuma Zedoaria Oil,Glycyrrhiza Uralensis Oil, Camphor Oil, Olea Europaea Oil, Polyporus Umbellatus Oil, Nardostachys Chinensis Oil, Basil Oil, Notopterygium Incisum Oil, Lycopus Lucidus Oil, Juniperus Communis Seed Oil, Wintergreen Oil, Celery Seed Oil, Curcuma Longa Oil, Eucommia Ulmoides Oil, Angelica Pubescens Oil, Gentiana Macrophylla Oil, Epimedium Brevicornum Oil, Bupleurum Chinense Oil, Litsea Cubeba Oil, Artemisia Annua Oil, Pinus Densiflora Oil, Agarwood Oil, Thyme Oil, Eupatorium Fortunei Oil, Cedar Oil, Pueraria Mirifica Oil, Asarum Sieboldii Oil, Aconitum Kusnezoffii Oil, Pinellia Ternata Oil, Artemisia Capillaris Oil, Carum Carvi Oil, Styrax Tonkinensis Oil, Hyssopus Officinalis Oil, Houttuynia Cordata Oil, Citrus Medica L. Var. Sarcodactylis Oil, Natural Origanum Vulgare Oil, Linaloe Wood Oil, Cuscuta Chinensis Oil, Patchouli Oil, Synthetic Origanum Vulgare Oil, Poria Cocos Oil, Adenophora Stricta Oil, Acorus Tatarinowii Oil, Angelica Dahurica Oil, Lycopodium Clavatum Oil, Salvia Miltiorrhiza Oil, Phellodendron Amurense Fruit Oil, Brucea Javanica Oil, Cimicifuga Foetida Oil, Ganoderma Lucidum Oil, Astragalus Membranaceus Oil, Vaccaria Segetalis Oil, Sanguisorba Officinalis Oil, Lindera Aggregata Oil, Citrus Aurantium L. Var. Amara Oil, Cnidium Monnieri Oil, Elsholtzia Ciliata Oil, Magnolia Officinalis Oil, Reynoutria Japonica Oil, Baeckea Frutescens Oil, Citrus Reticulata Peel Oil

- **Dual-Use (Food & TCM) Types:** Salvia Miltiorrhiza Oil, Angelica Sinensis Oil, Astragalus Membranaceus Oil, Ligusticum Wallichii Oil, Eucommia Ulmoides Oil, Goji Berry Oil, Carthamus Tinctorius Oil, Honeysuckle Oil, Chrysanthemum Oil, Forsythia Suspensa Oil, Perilla Frutescens Seed Oil, Cinnamomum Cassia Twig Oil, Honey-Fried Glycyrrhiza Uralensis Oil, Rehmannia Glutinosa Oil, Paeonia Lactiflora Oil

- **Functional Types:** Gastrodia Elata Oil, Angelica Pubescens Oil, Notopterygium Incisum Oil, Saposhnikovia Divaricata Oil, Schizonepeta Tenuifolia Oil, Angelica Dahurica Oil, Asarum Sieboldii Oil, Atractylodes Lancea Oil, Atractylodes Macrocephala Oil, Poria Cocos Oil, Polyporus Umbellatus Oil, Alisma Orientalis Oil, Plantago Asiatica Seed Oil, Coix Lacryma-Jobi Var. Ma-yuen Oil, Citrus Reticulata Peel Oil, Evodia Rutaecarpa Oil, Elsholtzia Ciliata Oil, Eupatorium Fortunei Oil, Huoxiang Zhengqi Oil (TCM compound essential oil)

- **Derivatives of "Spice Kings":** Clove Essential Oil (King of Flavor

Enhancement), Lemongrass Essential Oil (King of Flavor Enhancement), Angelica Dahurica Oil (King of Fishy Odor Removal), Kaempferia Galanga Oil (dual-effect: fishy odor removal & preservation), Lysimachia Foenum-graecum Oil (King of Preservation), Gardenia Jasminoides Oil (King of Coloring), Turmeric Oil (King of Coloring), Citrus Reticulata Peel Oil (King of Flavor Balancing), Glycyrrhiza Uralensis Oil (King of Flavor Balancing)

VI. Compound Essential Oils

- Classic Types: Foot Massage Oil, Pore Minimizing Oil, Breast Care Massage Oil, Whitening Care Oil, Scar & Blemish Removing Oil, Full-Body Ginger Therapy Massage Oil, Dark Spot Purifying Oil, Varicose Vein Relief Oil, Stretch Mark Reduction & Skin Tightening Oil, Relaxation & Soothing Essential Oil, Shoulder & Neck Therapy Oil, Muscle Relaxation & Circulation Massage Oil, Antibacterial & Acne-Removing Oil, Mugwort Massage Oil, Romantic Charm Massage Oil, Eye Soothing Oil, Moisturizing Oil, Lavender Massage Oil, Wrinkle Reduction & Skin Rejuvenation Oil, Stress Relief & Calming Oil, Endocrine Regulation Oil, Uterus & Ovary Care Oil, Scraping & Detoxification Essential Oil, SPA Oil

- Daily Chemical Scenario Types: Refreshing Compound Oil, Air Purifying Compound Oil, Anti-Allergy & Repair Compound Oil, Oil-Control & Acne-Removing Compound Oil, Moisturizing Compound Oil, Anti-Aging & Firming Compound Oil, Fine Line Reduction Compound Oil, Neck Care Compound Oil, Hand Nourishing Compound Oil, Foot Soothing Compound Oil, Dandruff & Itch Relief Compound Oil, Hair Nourishing Compound Oil

- Health Preservation Scenario Types: Joint Care Compound Oil, Womb Warming & Cold Dispelling Compound Oil, Breast Care Compound Oil, Lymphatic Detoxification Compound Oil, Post-Exercise Recovery Compound Oil, Sun Protection & Repair Compound Oil, Post-Sun Soothing Compound Oil

- Mood Regulation Types: Mood Lifting Compound Oil, Stress Relief & Relaxation Compound Oil, Meditation Calming Compound Oil, Emotional Balance Compound Oil

- **Aromatherapy Bestsellers:** Aromatherapy Diffuser Compound Oils (woody/flowery/fruity/herbal notes), Morning Scent Compound Oil (bestseller for hair & body care: lime + lily of the valley + white musk)

VII. Scenario-Specific Food Flavors

- **Exclusive for Chinese Catering:** Snail Noodle Hot Pot Flavor, Boiled Beef Flavor, Sour Bamboo Shoots & Fatty Beef Flavor, Wok Aroma Flavor, Stir-Fry Aroma Flavor, Fried Lard Flavor, Cantonese Sausage Liquid Flavor, Perilla Bullfrog Sauce

- **Exclusive for Snack Foods:** Salted Egg Yolk Oil Liquid Flavor (suitable for puffed foods/frozen foods), Sauce-Flavored Pork Liquid Flavor, Spicy Chicken Liquid Flavor, Roast Chicken Pizza Powder Seasoning, Sichuan-Spicy Crayfish Powder, Spicy Sichuan Pepper Fish Seasoning, Honey Butter Seasoning

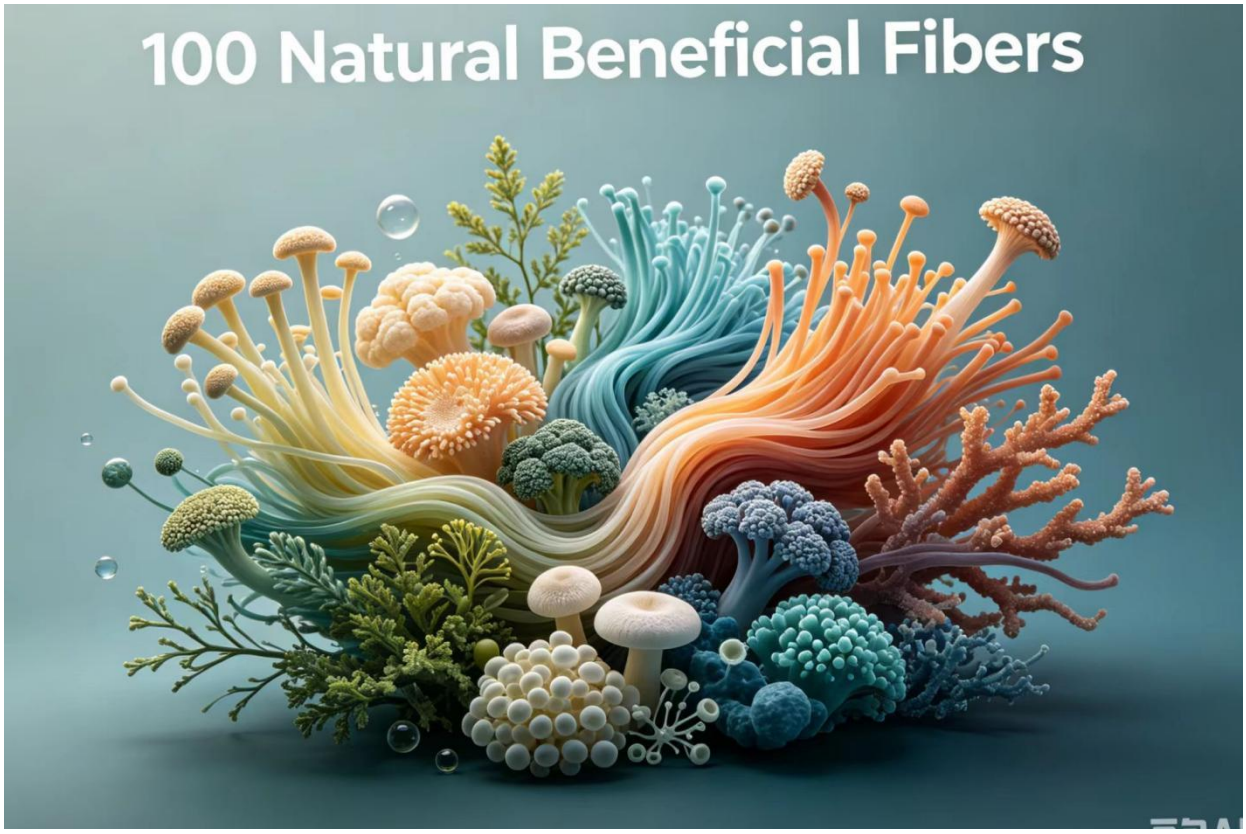
- **Characteristic Flavor Types:** Black Truffle Ham Flavor, Roast Duck Flavor, Dongpo Pork Flavor, Hunan Bacon Flavor, Sichuan Pepper Beef Flavor, Peach Oolong Flavor, Osmanthus Oolong Flavor, Korean Spicy Chicken Flavor, Passion Fruit Flavor (suitable for desserts/beverages/marinated foods/e-cigarettes), Sweet Potato Flavor (exclusive for baking/fishing bait), Watermelon Flavor (2025 summer beverage bestseller), Fresh Milk Flavor (TOP 1 baking ingredient)

VIII. Compliant Natural Fragrances (Meeting Safety Standards)

- **FEMA-Certified Types (Natural Fragrances for Food Use):** Clove Leaf Oil (FEMA 2325), Clove Bud Oil (FEMA 2323), Basil Oil (FEMA 2119), Star Anise Oil (FEMA 2096), Patchouli Oil (FEMA 2838), Anethole (FEMA 2086), Cardamom Oil (FEMA 2241), Natural Menthol (FEMA 2665), Bay Leaf Oil (FEMA 2125), Wintergreen Oil (FEMA 3113)
- **High-Purity Daily Chemical Fragrances:** D-Limonene (99% purity, raw material for oil stain removal in daily chemicals), Isopropyl Myristate (IPM, 98% purity, moisturizing raw material for cosmetics), gamma-Undecalactone (floral-scented daily chemical fragrance), Isoamyl Salicylate (fragrance for soap & food use)

IX. Functional Compound Seasonings (Adapting to Convenient Consumption Needs)

- **Paste/Powder Compound Types:** Braised Sauce Paste Flavor, Crucian Carp Paste Flavor, Pork Paste Flavor, Seafood Paste Flavor, Chicken Paste Flavor, Abalone Paste Flavor, Shrimp Paste Flavor, Pork Bone Broth Powder Flavor, High-Strength Umami Powder, Braised Beef & Ox Tripe Powder Flavor, Spicy Cheese Chip Powder
- **Exclusive Sprinkling Powders:** Buckwheat Chip-Specific Sprinkling Powder, Turkish Roast Chicken Seasoning, Sauce-Flavored Squid Seasoning, Curry Crayfish Seasoning, Yogurt Onion Seasoning, Tangerine Peel Powder Seasoning, Sea Salt Flavor Pea Crisp Seasoning, Spicy Crayfish Seasoning



(XXXIII) Hundred Natural Beneficial Fiber Collection

100 natural functional ingredients, centered on dietary fiber, covering diverse needs such as intestinal health maintenance, sugar control & satiety enhancement, and immune regulation. Sourced from plants, fungi, and marine organisms without amino acid additives, they are suitable for global multi-scenarios including food, health products, and cosmetics, featuring simplicity, intuitiveness, safety, and practicality.

(1) Soybean Phospholipids (Natural Phospholipids) (Emulsifying & Nutritious Type): Extracted from soybeans, containing phosphatidylcholine, phosphatidylethanolamine, etc., with both emulsifying and nutritional functions, suitable for food additives and health products.

(2) Phosphatidylcholine (PC) (Specific Phospholipids) (Neuroprotective Type): A core component of cell membranes, promotes neurotransmitter synthesis and improves cognitive function, suitable for brain health supplements, CAS: 97281-44-2.

(3) Phosphatidylserine (PS) (Functional Phospholipids) (Brain Function Regulating Type): A key component of brain nerve cell membranes, enhances concentration and relieves stress, suitable for brain health products for students and the elderly, CAS: 51446-62-9.

(4) Glycerophosphatidylcholine (alpha-GPC) (Phospholipid Derivatives) (Neurorestorative Type): Rapidly converts to choline, supports nerve repair and cognitive improvement, suitable for people with memory decline, CAS :28319-77-9.

(5) Sunflower Phospholipids (Plant Phospholipids) (Low-Fat Nutritious Type): Extracted from sunflower seeds, containing phosphatidylcholine and unsaturated fatty acids, suitable for low-fat foods and nutritional supplements.

(6) Oligosaccharides (Vitafiber Dietary Fiber) (Functional Oligosaccharides) (Prebiotic Carrier Type): Naturally derived dietary fiber with prebiotic properties, promotes the proliferation of beneficial intestinal bacteria, suitable for functional foods.

(7) Isomaltooligosaccharide (Prebiotic Oligosaccharides) (Flora Regulating Type): Not easily digested by the human body, specifically promotes the proliferation of bifidobacteria, improves intestinal microecology, CAS :5426-28-8.

(8) Fructooligosaccharide (Short-Chain Prebiotics) (Intestinal Health Maintenance Type): Naturally present in plants such as Jerusalem artichoke, promotes the growth of lactic acid bacteria and relieves constipation, CAS 30806-47-2.

(9) Resistant Dextrin (Water-Soluble Dietary Fiber) (Sugar Control & Satiety Type): A starch processing product, resistant to digestion with low glycemic index, enhances satiety, suitable for meal replacements and sugar-controlled foods, CAS:94649-26-6.

(10) Polydextrose (Synthetic Dietary Fiber) (Multifunctional Type): Low-calorie and high-fiber, with both thickening and intestinal regulating effects, suitable for low-energy foods, CAS:68424-04-4.

(11) Galactooligosaccharide (Natural Oligosaccharides) (All-Population Suitable Type): Naturally present in breast milk, promotes the proliferation of probiotics, suitable for infant foods and health products, CAS: 13003-71-7.

(12) Lactulose (Lactulose) (Osmotic Laxative Type): Regulates intestinal osmotic pressure and improves constipation, suitable for the elderly and children, CAS:4618-18-2.

(13) Pueraria Oligosaccharides (Medicinal and Edible Oligosaccharides) (Spleen-Invigorating & Intestinal-Protecting Type): Extracted from Pueraria lobata, with both prebiotic and traditional Chinese medicine conditioning effects, suitable for medicinal and edible foods.

(14) Coconut Meat Dietary Fiber (Plant-Derived Fiber) (High-Fiber & Low-Calorie Type): A by-product of coconut meat processing, containing soluble and insoluble fibers, promotes intestinal peristalsis, suitable for baked goods and meal replacements.

(15) NMN (β-Nicotinamide Mononucleotide) (Anti-Aging Active Ingredient) (Cellular Energy Regulating Type): Participates in NAD+ synthesis, supports cellular metabolism, and assists in anti-aging, CAS :1094-61-7.

(16) AKG (α-Ketoglutaric Acid) (Metabolic Intermediate) (Energy Supplement

Type): Participates in the tricarboxylic acid cycle, promotes amino acid metabolism, suitable for sports nutrition and anti-aging products, CAS:328-50-7.

(17) γ-Aminobutyric Acid (GABA) (Functional Ingredient) (Neurosoothing Type): An inhibitory neurotransmitter of the central nervous system, relieves anxiety and improves sleep, suitable for sleep-aiding and stress-reducing foods, CAS:56-12-2.

(18) Soybean Polysaccharides (Plant Polysaccharides) (Intestinal Barrier Type): A by-product of soybean processing, enhances intestinal barrier function, suitable for health products and food additives.

(19) Soybean Dietary Fiber (Cereal By-Product Fiber) (Bidirectional Regulating Type): Contains soluble and insoluble fibers, improves constipation and assists in lipid reduction, suitable for soybean products and meal replacements.

(20) Sodium Starch Octenylsuccinate (Modified Starch) (Emulsifying & Stabilizing Type): A food-grade emulsifier and thickener, suitable for beverages and baked goods, CAS :126-97-6.

(21) Plasmalogen (Special Phospholipids) (Neuroprotective Type): Present in animal cell membranes, improves cognitive function, extracted from scallops, CAS:916-96-3.

(22) Xylooligosaccharide (Functional Oligosaccharides) (Prebiotic Type): Promotes the proliferation of beneficial intestinal bacteria, not easily digested and absorbed by the human body, CAS :35405-74-6.

(23) Stachyose (Natural Functional Oligosaccharides) (Legume-Derived Type): Mainly present in leguminous plants, regulates intestinal flora balance, CAS:10094-58-3.

(24) Xylitol (Functional Sugar Alcohol) (Sugar-Free Suitable Type): Low-calorie and anti-caries, metabolism does not depend on insulin, suitable for sugar-free foods, CAS :87-99-0.

(25) Erythritol (Natural Sugar Alcohol) (Zero-Calorie Type): Zero-calorie with high tolerance, taste close to sucrose, widely used in food and beverages, CAS :149-32-6.

(26) Maltitol (Functional Sugar Alcohol) (Moisturizing & Thickening Type): Low glycemic index, with moisturizing and thickening properties, CAS 585-88-6.

(27) Sorbitol (Multifunctional Sugar Alcohol) (Multi-Effect Type): Serves as a sweetener, moisturizer, and bulking agent, CAS: 50-70-4.

(28) Stevioside (Natural High-Potency Sweetener) (High-Multiple & Zero-Calorie Type): Derived from stevia extract, zero-calorie, with a sweetness about 300 times that of sucrose, CAS:57817-89-7.

(29) Mogroside (Natural Sweetener) (Medicinal and Edible Type): A medicinal and edible raw material, low-calorie and high-sweetness, CAS: 88901-36-4.

(30) Chitosan (Natural Aminopolysaccharide) (Multi-Scenario Suitable Type): A deacetylated product of chitin, divided into α-, β-, and γ-types; α-type is derived from animal shells, β-type from squid cartilage, with antibacterial, lipid-lowering, and heavy metal adsorption functions, suitable for pharmaceutical, food, and environmental protection fields, CAS: 9012-76-4.

(31) Inulin (Natural Water-Soluble Dietary Fiber) (Dual-Attribute Type): Also a functional oligosaccharide, promotes the growth of probiotics, CAS: 9005-82-9.

(32) Fructan (Long-Chain Functional Carbohydrates) (Long-Chain Prebiotic Type): Has prebiotic properties and can improve intestinal health, CAS: 25942-29-6.

(33) L-Arabinose (Functional Monosaccharide) (Sugar Control Type): Inhibits sucrose absorption and regulates blood sugar, CAS :87-72-9.

(34) Fucoidan (Marine-Derived Functional Polysaccharide) (Marine Active Type): Derived from brown algae such as kelp, with immune regulation and intestinal health maintenance effects, CAS :9072-19-9.

(35) Pectin (Water-Soluble Dietary Fiber) (Gel Regulating Type): Present in fruits, with thickening and gelling effects, and regulates intestinal function, CAS:9000-69-5.

(36) Konjac Glucomannan (Natural Macromolecular Polysaccharide) (High-Viscosity & Low-Calorie Type): High-viscosity and low-calorie, with both dietary fiber and thickener functions, CAS:37220-17-0.

(37) Trehalose (Natural Disaccharide) (Moisturizing & Stress-Resistant Type): Has moisturizing and stress-resistant protection effects, suitable for food and cosmetics fields, CAS :99-20-7.

(38) Isomalt (Functional Sugar Alcohol) (Stable & Anti-Caries Type): Low-calorie, non-cariogenic, and highly stable, CAS: 534-73-6.

(39) Mannooligosaccharide (Prebiotic Oligosaccharides) (Bifidobacterium-Specific Type): Promotes the proliferation of bifidobacteria and improves intestinal microecology, CAS :100702-65-8.

(40) Gum Arabic (Natural Water-Soluble Polysaccharide) (Emulsifying Fiber Type): Has both dietary fiber and emulsifying stabilizer functions, CAS: 9000-01-5.

(41) Linoleic Acid (Polyunsaturated Fatty Acid) (Essential Fatty Acid Type): An essential fatty acid for the human body, regulates lipid metabolism, CAS: 60-33-3.

(42) γ-Linolenic Acid (Functional Fatty Acid) (Anti-Inflammatory & Skin-Care Type): Helps regulate inflammatory responses and improve skin health, CAS:463-40-1.

(43) EPA (Eicosapentaenoic Acid) (Omega-3 Fatty Acid) (Cardiovascular Health Maintenance Type): Maintains cardiovascular health and assists in regulating

blood lipids, CAS: 10417-94-4.

(44) DHA (Docosahexaenoic Acid) (Brain Gold Type): Promotes brain development and visual health, CAS: 6217-54-5.

(45) Coenzyme Q10 (Liposoluble Quinone) (Energy Metabolism Type): Participates in the mitochondrial respiratory chain to provide energy, protects the cardiovascular system, and relieves fatigue, suitable for health products and cardiovascular maintenance products, CAS: 303-98-0.

(46) Phytosterols (Natural Active Ingredients) (Lipid-Regulating Type): Inhibits cholesterol absorption and assists in lowering blood cholesterol levels, suitable for functional foods and health products, CAS: 83-46-5 (β-Sitosterol).

(47) Antihypertensive Peptides (Bioactive Peptides) (Vascular Regulating Type): Exerts effects by inhibiting angiotensin-converting enzyme.

(48) Antimicrobial Peptides (Natural Active Peptides) (Broad-Spectrum Antimicrobial Type): Has broad-spectrum antimicrobial effects and enhances body defense.

(49) Immunoglobulin IgG (Active Protein) (Anti-Infective Type): Enhances the body's anti-infective capacity, CAS: 9007-83-4.

(50) Lactoferrin (Multifunctional Active Protein) (Iron-Transport Type): Binds and transports iron, regulates intestinal flora, CAS :9047-02-3.

(51) Inositol (Vitamin-Like Substance) (Metabolic Maintenance Type): Participates in fat metabolism and maintains reproductive system health, CAS :87-89-8.

(52) Glutathione (Water-Soluble Antioxidant) (Cell-Protecting Type): Scavenges free radicals and maintains cell function, suitable for health products and whitening skin care products, CAS: 70-18-8.

(53) Bioflavonoids (Natural Antioxidants) (Vascular-Protecting Type): Assists in protecting blood vessels and enhancing immunity.

(54) Calcium (Macromineral) (Bone-Regulating Type): A core component of bones and teeth, participates in neuromuscular regulation, CAS: 7440-70-2 (Elemental Calcium).

(55) Zinc (Trace Element) (Growth & Immune Type): Promotes growth and development, regulates immunity and metabolism, CAS: 7440-66-6 (Elemental Zinc).

(56) Iron (Trace Element) (Hematopoietic Type): Participates in hemoglobin synthesis and prevents iron-deficiency anemia, CAS :7439-89-6 (Elemental Iron).

(57) Bifidobacterium (Probiotic) (Flora Balance Type): Regulates intestinal flora balance and promotes nutrient absorption.

(58) Lactic Acid Bacteria (Probiotic) (Intestinal Acidifying Type): Ferments to produce lactic acid and improves intestinal microecology.

(59) Synbiotic (Compound Preparation) (Synergistic Maintenance Type): A compound preparation of probiotics and prebiotics, synergistically enhancing intestinal health effects.

(60) Vitamin E (Liposoluble Antioxidant) (Cell Membrane-Protecting Type): Scavenges free radicals and protects cell membranes, CAS 1406-66-2.

(61) Vitamin C (Water-Soluble Antioxidant) (Immune & Collagen Type): Enhances immunity and promotes collagen synthesis, CAS :50-81-7.

(62) β-Carotene (Vitamin A Precursor) (Antioxidant & Eye-Protecting Type): Antioxidant and protects eyesight, CAS:7235-40-7.

(63) SOD (Superoxide Dismutase) (Antioxidant Enzyme) (Free Radical-Scavenging Type): Efficiently scavenges superoxide anion free radicals.

(64) Sodium D-Ascorbate (Food-Grade Antioxidant) (Color-Protecting & Fresh-Keeping Type): Delays oxidative deterioration, protects color and preserves freshness, CAS: 7378-23-6.

(65) Sweet Almond Oil (Functional Oil) (Nutritious & Skin-Care Type): Rich in unsaturated fatty acids, with both nutritional and skin-care effects, CAS:8007-69-0.

(66) Gentiooligosaccharide (Functional Oligosaccharides) (Prebiotic Type): Promotes the proliferation of bifidobacteria and inhibits harmful bacteria, suitable for food and beverages, CAS: 68930-74-3.

(67) Raffinose (Natural Oligosaccharides) (Legume-Extracted Type): Present in cottonseeds and sugar beets, regulates intestinal flora and enhances immunity, CAS:585-84-4.

(68) Resistant Starch (Functional Starch) (Sugar Control & Laxative Type): Hard to digest, with dietary fiber properties, assists in sugar control and improves constipation, CAS: 9037-22-3.

(69) Wheat Arabinoxylan (Cereal Dietary Fiber) (Intestinal Barrier Type): Promotes the production of short-chain fatty acids and enhances the intestinal barrier, suitable for meal replacements.

(70) Citrus Pectin (Fruit Fiber) (Lipid-Lowering & Thickening Type): Assists in lowering cholesterol, with thickening effects, suitable for jams and health products, CAS: 9000-69-5.

(71) Flaxseed Gum (Plant Gum) (Dual-Effect Nutritious Type): Contains Omega-3 and fiber, improves intestinal health and enhances satiety, CAS: 9000-28-6.

(72) Chitooligosaccharide (Chitosan Derivative) (Highly Active Type): An enzymatic hydrolysis product of chitosan, with small molecular weight and easy absorption, having both antibacterial and immune-regulating functions, suitable for health products and feed, CAS:7003-39-8.

(73) Alginate (Seaweed Dietary Fiber) (Gel Detoxification Type): High water solubility, assists in intestinal detoxification, suitable for food thickeners, CAS: 9005-38-3.

(74) Glucan (Yeast/Grain Polysaccharide) (Immune-Enhancing Type): Regulates intestinal flora and enhances immunity, suitable for health products, CAS:9013-20-1.

(75) Isomaltooligosaccharide (Functional Oligosaccharides) (Anti-Caries & Sugar-Free Type): Low glycemic index, suitable for sugar-free foods, CAS:13718-94-0.

(76) Arabinogalactan (Plant Polysaccharide) (Dual-Functional Type): Dietary fiber + prebiotic, promotes beneficial bacteria, CAS:9036-66-2.

(77) Rice Bran Fiber (Cereal By-Product Fiber) (Lipid-Regulating Type): Contains minerals, improves constipation and assists in lipid reduction, suitable for cereal foods.

(78) Konjac Dietary Fiber (High-Viscosity Fiber) (Weight-Loss Type): Low-calorie with strong satiety, suitable for weight-loss foods, CAS: 37220-17-0.

(79) Chia Seed Fiber (Superfood Fiber) (Nutrient-Dense Type): Contains Omega-3 and protein, promotes intestinal patency, suitable for meal replacements.

(80) Pumpkin Seed Dietary Fiber (By-Product Fiber) (Mineral-Supplementing Type): Assists intestinal peristalsis, supplements zinc and magnesium, suitable for functional foods.

(81) Long-Chain Fructooligosaccharide (Long-Chain Prebiotic) (Flora-Optimizing Type): Strong prebiotic function, improves intestinal microecology, CAS:25942-29-6.

(82) Soybean Oligosaccharides (Soybean By-Product) (Naturally Suitable Type): Contains stachyose and raffinose, suitable for soybean products.

(83) Bamboo Fiber (Plant Fiber) (Eco-Functional Type): Promotes intestinal peristalsis, suitable for functional foods.

(84) Inulin-Type Fructan (Short-Chain Inulin) (All-Population Type): Easily soluble, suitable for infants and the elderly, CAS: 9005-82-9.

(85) Rye Dietary Fiber (Whole Grain Fiber) (Sugar Control & Satiety Type): Contains β-glucan, assists in sugar control, suitable for meal replacements.

(86) Beet Fiber (Beet By-Product) (Intestinal Cleansing Type): High water absorption, promotes detoxification, suitable for beverages and baking.

(87) Lentinan (Fungal Polysaccharide) (Immune-Activating Type): Activates immune cells, assists in anti-tumor, suitable for health products.

(88) Poria Cocos Polysaccharide (Medicinal and Edible Polysaccharide) (Spleen-Invigorating & Immune Type): Promotes the proliferation of bifidobacteria, suitable for traditional Chinese medicine compound preparations.

(89) Tremella Polysaccharide (Colloidal Polysaccharide) (Lung-Moisturizing & Skin-Care Type): Enhances antioxidant capacity, suitable for lung-moisturizing and beauty products.

(90) Aloe Polysaccharide (Plant Polysaccharide) (Repair & Anti-Inflammatory Type): Promotes wound healing, suitable for skin care products and ointments.

(91) Chinese Yam Polysaccharide (Medicinal and Edible Polysaccharide) (Spleen-Invigorating & Sugar-Lowering Type): Delays sugar absorption, suitable for spleen and stomach conditioning foods.

(92) Barley β-Glucan (Grain Polysaccharide) (Cardiovascular Health Maintenance Type): Lowers LDL-C, suitable for cardiovascular foods.

(93) Lycium Barbarum Polysaccharide (Traditional Chinese Medicine Polysaccharide) (Immune & Anti-Aging Type): Enhances immunity, improves insulin resistance, suitable for traditional Chinese medicine health products.

(94) Auricularia Auricula Polysaccharide (Fungal Polysaccharide) (Lipid-Lowering & Detoxification Type): Binds cholesterol, promotes the excretion of heavy metals, suitable for lipid-lowering foods.

(95) Hericium Erinaceus Polysaccharide (Fungal Polysaccharide) (Stomach-Nourishing Type): Repairs gastric mucosa, inhibits Helicobacter pylori, suitable for stomach-nourishing foods.

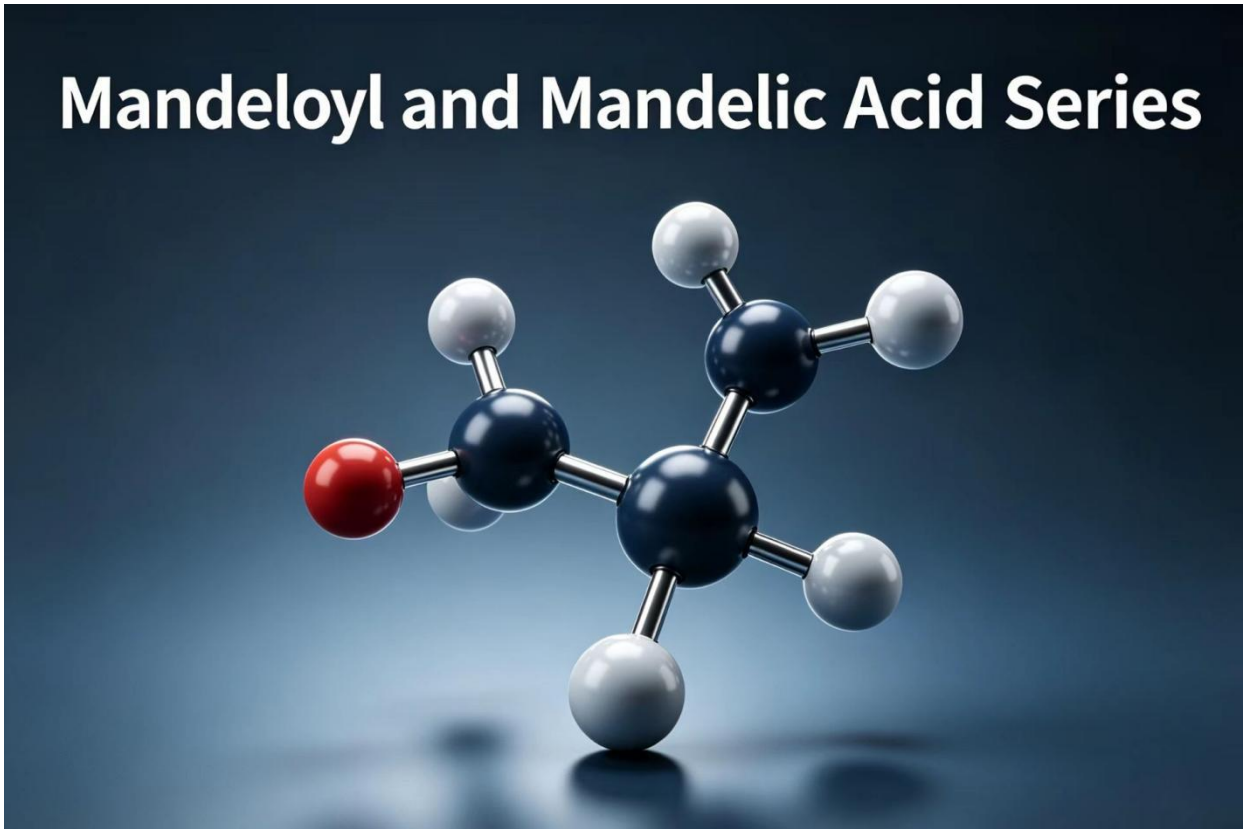
(96) Spirulina Polysaccharide (Algal Polysaccharide) (Immune & Detoxification Type): Enhances immunity, adsorbs heavy metals, suitable for detoxification health products, CAS: 9072-19-9.

(97) Chlorella Polysaccharide (Microalgal Polysaccharide) (Anti-Fatigue Type): Reduces lactic acid accumulation, suitable for sports nutrition supplements.

(98) Fucoidan (Marine Polysaccharide) (Immune & Intestinal Type): Regulates intestinal flora, enhances immunity, suitable for marine functional foods, CAS:9072-19-9.

(99) Carboxymethyl Chitosan (Chitosan Derivative) (Water-Soluble Type): A carboxymethylated derivative of chitosan, highly water-soluble, with both moisturizing and antibacterial functions, suitable for cosmetics and pharmaceutical excipients.

(100) Plant Polyphenols (Natural Antioxidants) (Broad-Spectrum Protective Type): Includes tea polyphenols, grape polyphenols, etc., scavenges free radicals, protects blood vessels, suitable for health products and food additives.



(XXXIV) Mandelyl and Mandelic Acid Series

Mandelyl and mandelic acid compounds are key fine chemical intermediates with α-hydroxyphenylacetic acid structure, widely used in pharmaceutical synthesis (antibacterial, anticholinergic, hypotensive, antitumor drugs, etc.), pesticide R&D (high-efficiency fungicides, herbicides, plant growth regulators) and new material preparation (optically active materials, chiral catalysts, liquid crystal materials). Thanks to their chiral characteristics and functional group diversity, they are indispensable high-value product series in the fine chemical industry.

(1) Homatropine (CAS: 87-00-3): Anticholinergic drug intermediate, used for synthesizing gastrointestinal spasm relievers and mydriatic drugs, with mature applications.

(2) Sodium 4-hydroxyphenylglycolate (CAS: 69322-01-6): Pharmaceutical and cosmetic raw material with antibacterial activity, used for synthesizing anti-allergy drugs, with stable circulation volume.

(3) 3,4-Dihydroxymandelic acid (CAS: 775-01-9): Adrenergic drug intermediate, used for preparing hypotensive drugs and cardiovascular disease treatment drugs, a rigid demand product.

(4) 2-Cyclohexylmandelic acid (CAS: 50896-04-3): Chiral resolving agent, used for synthesizing new antibacterial drugs and liquid crystal materials, a high-value niche product.

(5) 4-Bromomandelic acid (CAS: 7021-04-7): Pharmaceutical intermediate, used for synthesizing antibiotics, antifungal drugs and chiral catalysts, with

stable demand.

(6) 3-Fluoromandelic acid (CAS: 395-05-1): Key intermediate for fluorinated drugs, used for preparing antitumor and antiviral drugs, with fast-growing demand.

(7) Ethyl (R)-(-)-Mandelate (CAS: 13704-09-1): Chiral pharmaceutical intermediate, used for synthesizing optically active drugs and asymmetric catalytic reactions, with high market activity.

(8) Methoxy(phenyl)acetic acid (CAS: 7021-09-2): Pesticide and pharmaceutical intermediate, used for synthesizing herbicides and central nervous system drugs, a conventional circulation product.

(9) Thiomandelic acid (CAS: 4695-09-4): Antibacterial raw material, used for synthesizing thioether drugs and heavy metal chelating agents, with specific application scenarios.

(10) D-3-Trifluoromethyl-Mandelic acid (CAS: 349-10-0): Fine chemical intermediate for fluorinated compounds, used for preparing high-activity pesticides and anti-tuberculosis drugs, with high added value.

(11) Vanillyl Mandelic acid (CAS: 55-10-7): Adrenaline metabolite detection reagent, used for synthesizing cardiovascular drugs, with stable demand.

(12) DL-4-Hydroxymandelic Acid Monohydrate (CAS: 7198-10-9): Pharmaceutical and fragrance intermediate, used for synthesizing antitussive drugs and food flavors, with wide applications.

(13) (+/-)-m-Methoxymandelic acid (CAS: 21150-12-9): Pharmaceutical intermediate, used for synthesizing anti-inflammatory, analgesic drugs and chiral resolving agents, with steady growth in demand.

(14) Methyl Cyclohexylphenylglycolate (CAS: 10399-13-0): Pesticide intermediate, used for preparing high-efficiency insecticides and plant growth regulators, with great market potential.

(15) 3-Hydroxymandelic Acid (CAS: 17119-15-2): Pharmaceutical intermediate, used for synthesizing antihistamine drugs and antidepressants, with medium circulation volume.

(16) 2-(2-Bromophenyl)-2-hydroxyacetic acid (CAS: 7157-15-5): Chiral pharmaceutical intermediate, used for synthesizing optically active antibiotics and hypotensive drugs, a high-value niche product.

(17) (R)-4-Methylthiomandelic acid (CAS: 109086-16-0): Pharmaceutical intermediate, used for synthesizing lipid-lowering drugs and antithrombotic drugs, a rigid demand product.

(18) 4-Propoxylmandelic acid (CAS: 79694-16-9): Fragrance and pharmaceutical intermediate, used for preparing flavors and antibacterial drugs, with stable demand.

(19) (R)-(-)-2-Chloromandelic acid (CAS: 52950-18-2): Chiral resolving agent, used for synthesizing cephalosporin antibiotics and antifungal drugs, a mainstream industrial product.

(20) D-O-Mandelic acid (CAS: 52950-19-3): Pharmaceutical intermediate, used for synthesizing optically active drugs and catalysts, with stable demand.

(21) 2,3-Difluoromandelic acid (CAS: 207974-19-4): Fluorinated pharmaceutical intermediate, used for preparing antitumor and antiviral drugs, with fast-growing demand.

(22) 4-Methylmandelic acid (CAS: 18584-20-8): Pharmaceutical and dye intermediate, used for synthesizing antipyretic-analgesic drugs and organic pigments, with mature applications.

(23) Sodium Mandelate (CAS: 114-21-6): Antibacterial preservative, used in pharmaceutical preparations, cosmetics and food preservation, with large circulation volume, a core rigid demand product.

(24) Methenamine Mandelate (CAS: 587-23-5): Antibacterial drug raw material, used for treating urinary tract infections, with mature applications and stable demand.

(25) 2,3,6-Trifluoromandelic acid (CAS: 374633-23-5): Fine chemical intermediate for fluorinated compounds, used for synthesizing highly selective pesticides and drugs, with great market potential.

(26) 3-Hydroxy-4-Methoxymandelic Acid (CAS: 3695-24-7): Pharmaceutical intermediate, used for synthesizing cardiovascular drugs and antioxidants, with stable demand.

(27) L-Mandelic acid (CAS: 17199-29-0): Chiral pharmaceutical intermediate, used for synthesizing antibiotics and hypotensive drugs, a core industrial product with extremely large circulation volume.

(28) 2,4,5-Trifluoromandelic acid (CAS: 375369-29-2): Fluorinated pharmaceutical intermediate, used for preparing new antibacterial drugs and herbicides, a high-demand and high-value-added product.

(29) 3,4-Difluoromandelic acid (CAS: 132741-29-8): Fluorinated intermediate, used for synthesizing drugs and liquid crystal materials to improve product stability, with wide applications.

(30) 2,4-Difluoromandelic acid (CAS: 132741-30-1): Pharmaceutical and pesticide intermediate, used for preparing anti-tuberculosis drugs and high-efficiency fungicides, with stable demand.

(31) 2-Fluoro-DL-Mandelic Acid (CAS: 389-31-1): Fluorinated pharmaceutical intermediate, used for synthesizing anti-inflammatory drugs and antitumor drugs, with high market activity.

(32) 3,5-Difluoro Mandelic acid (CAS: 132741-31-2): Fine chemical raw material, used for synthesizing optically active drugs and catalysts, a high-value niche product.

(33) DL-Mandelamide (CAS: 4410-31-5): Pharmaceutical intermediate, used for synthesizing antibacterial drugs and peptide compounds, with steady growth in demand.

(34) 4-Fluoromandelic Acid (CAS: 395-33-5): Fluorinated intermediate, used

for synthesizing drugs, dyes and electronic materials, with wide circulation, a conventional product.

(35) 4-Chloromandelic acid (CAS: 7138-34-3): Pharmaceutical and pesticide intermediate, used for synthesizing antibiotics and herbicides, with large circulation volume, a rigid demand product.

(36) 4-(Trifluoromethyl)Mandelic Acid (CAS: 395-35-7): Fluorinated pharmaceutical intermediate, used for preparing high-activity antitumor and anti-AIDS drugs, a core high-value product.

(37) 4-Chloro-D-Mandelic acid (CAS: 32189-36-9): Chiral pharmaceutical intermediate, used for synthesizing cephalosporin antibiotics, an industrial rigid demand product with strong demand.

(38) 3-Chlorophenylglycolic Acid (CAS: 16273-37-3): Pharmaceutical and dye intermediate, used for synthesizing anti-inflammatory drugs and organic pigments, with mature applications.

(39) 4-Nitro-DL-Mandelic acid (CAS: 10098-39-2): Pharmaceutical intermediate, used for synthesizing antibacterial drugs and drug precursors, with stable demand.

(40) DL-Mandelic Acid Sodium Salt (CAS: 34166-39-7): Antibacterial agent, used for pharmaceutical preparation and cosmetic preservation, as well as a raw material for drug synthesis, with wide application scenarios.

(41) Mandelate ethyl (CAS: 774-40-3): Fragrance and pharmaceutical intermediate,used for preparing flavors and sedative drugs, with stable demand.

(42) (-)-O-Acetyl-D-Mandelic acid (CAS: 51019-43-3): Chiral resolving agent, used for separating optical isomers and synthesizing drugs, a high-value niche product.

(43) L-Mandelic acid methyl ester (CAS: 21210-43-5): Chiral intermediate, used for synthesizing antibiotics and hypotensive drugs, with strong demand, a mainstream product.

(44) 2-Hydroxymandelic acid (CAS: 19022-43-6): Pharmaceutical raw material, used for synthesizing anti-allergy drugs and central nervous system drugs, with stable demand.

(45) (S)-M-Chloromandelic acid (CAS: 32222-43-8): Chiral pharmaceutical intermediate, used for synthesizing optically active drugs and catalysts, a high-value-added product.

(46) 4-Methoxymandelic acid (CAS: 10502-44-0): Pharmaceutical and fragrance intermediate, used for synthesizing anti-inflammatory drugs and flavors, with wide applications and medium circulation volume.

(47) Ethyl 2-(4-Cyanophenyl)-2-Hydroxyacetate (CAS: 847227-46-7): Pharmaceutical intermediate, used for synthesizing antitumor drugs and antiviral drugs, with fast-growing demand and great potential.

(48) (R)-(-)-Miandelic acid (CAS: 32222-48-3): Chiral intermediate, used for

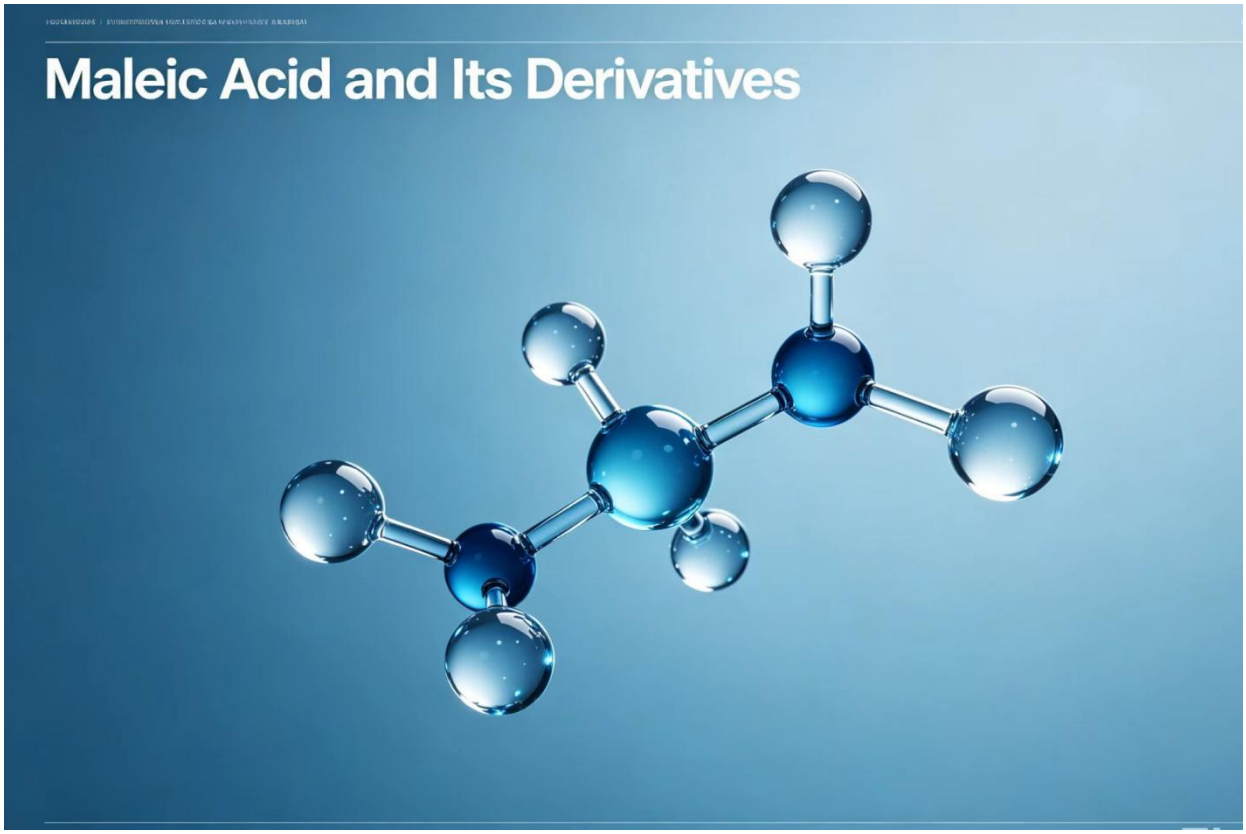
synthesizing optically active drugs and liquid crystal materials, a high-value-added niche product.

(49) alpha-Cyclopentylmandelic acid (CAS: 427-49-6): Pesticide and pharmaceutical intermediate, used for preparing insecticides and antiepileptic drugs, with mature applications and stable demand.

(50) DL-Mandelic acid (CAS: 90-64-2): Chiral resolution raw material, used for synthesizing drugs, flavors and optical materials, with large circulation volume, a basic core raw material.

(51) D-Mandelic acid (CAS: 611-71-2): Chiral pharmaceutical intermediate, used for synthesizing antibiotics and hypotensive drugs, complementary to L-mandelic acid, a core product.

(52) 2-Hydroxy-2-phenylacetic acid (CAS: 1198-84-1): Pharmaceutical and fragrance intermediate, used for synthesizing drugs, flavors and chiral catalysts, with strong market demand.



(XXXV) Maleic Acid and Its Derivatives

Maleic acid and its derivatives are important fine chemical raw materials with a cis-butenedioic acid structure, widely used in pharmaceutical synthesis (antihistamines, antihypertensives, antibacterial drugs, etc.), polymer preparation (resins, copolymers, plastic additives), agrochemicals (herbicides, plant growth regulators), and industrial water treatment (scale inhibitors, corrosion inhibitors). Their unsaturated double bonds and carboxyl functional groups endow them with excellent reactivity, covering market demands across multiple fields.

(1) Acetophenazine Dimaleate (CAS: 5714-00-1): Raw material for antipsychotic drugs, used in the treatment of schizophrenia and mania, a core intermediate for specialized pharmaceuticals in the medical field.

(2) 4-Maleimidobutyric Hydrazide (CAS: 181148-01-6): Biocrosslinker and pharmaceutical intermediate, used in protein modification and peptide synthesis, with stable demand in the biopharmaceutical field.

(3) Maleic Diamide (CAS: 928-01-8): Raw material for polymer synthesis, used in the preparation of polyamide resins and adhesives, a basic intermediate in the chemical materials industry.

(4) 3,4,5,6-Tetrahydrophthalic Anhydride (CAS: 2426-02-0): Raw material for epoxy resin curing agents and plasticizers, used in electronic materials and coating industries, a staple product in industrial production.

(5) Enalapril-D5 Maleate (CAS: 349554-02-5): Isotopically labeled

intermediate for antihypertensive drugs, used in drug metabolism research, a specialized raw material in pharmaceutical R&D.

(6) Prochlorperazine Maleate (CAS: 84-02-6): Raw material for antipsychotic and antiemetic drugs, used in the treatment of schizophrenia and chemotherapy-induced vomiting, widely applied in clinical practice.

(7) Velpatasvir Maleate (CAS: 599179-03-0): Raw material for anti-AIDS drugs, used to inhibit HIV replication, a core intermediate in the antiviral drug field.

(8) Ethyl Hydrogen Maleate (CAS: 3990-03-2): Organic synthesis intermediate, used in the preparation of esters and drug precursors, a commonly used raw material in fine chemicals.

(9) Domperidone Maleate (CAS: 99497-03-7): Raw material for gastrointestinal prokinetic drugs, used in the treatment of indigestion, nausea and vomiting, with high-frequency demand for daily-use pharmaceuticals.

(10) Dexbrompheniramine Maleate (CAS: 2391-03-9): Raw material for antihistamine drugs, used to relieve symptoms of allergic rhinitis and urticaria, a mainstream product in the antiallergic field.

(11) Cinepazide Maleate (CAS: 26328-04-1): Raw material for cerebral vasodilator drugs, used in the treatment of cerebral infarction and cerebral arteriosclerosis, a staple in the cardiovascular and cerebrovascular drug field.

(12) Diethyl Maleate (CAS: 141-05-9): Organic synthesis solvent and intermediate, used in the preparation of fragrances, drugs and resins, a general-purpose raw material in the chemical industry with wide circulation.

(13) Amlodipine Maleate (CAS: 1357024-06-6): Raw material for antihypertensive drugs, used in the treatment of hypertension and angina pectoris, a popular product in the cardiovascular drug field.

(14) Thiothixene Maleate (CAS: 13187-06-9): Raw material for antipsychotic drugs, used in the treatment of schizophrenia and anxiety disorders, an intermediate for specialized pharmaceuticals.

(15) Phenylmaleic Acid (CAS: 148-07-2): Raw material for anti-inflammatory and analgesic drugs, used to relieve rheumatic pain and arthritis, applied in the antipyretic and analgesic field.

(16) 2-Maleimidoacetic Acid (CAS: 25021-08-3): Bioconjugation reagent, used in protein crosslinking and drug carrier modification, with growing demand in the biochemical field.

(17) Polymaleic Acid (CAS: 26099-09-2): Scale inhibitor for water treatment, used in industrial circulating water and boiler water treatment, a staple product in the environmental water treatment field.

(18) Dimethyl Maleate (CAS: 624-48-6): Organic synthesis intermediate, used in the preparation of coatings, adhesives and drugs, with dual applications in chemical and pharmaceutical fields.

(19) Bismaleimidomethyl Ether (CAS: 15209-14-0): Polymer crosslinker, used in the preparation of high-temperature resistant resins and composite materials, a core raw material in the high-end materials field.

(20) Maleic Hydrazide Potassium Salt (CAS: 28382-15-2): Plant growth regulator, used to inhibit excessive plant growth and extend shelf life, with stable demand in the agricultural field.

(21) Enalapril Maleate (CAS: 76095-16-4): Raw material for antihypertensive drugs, used in the treatment of hypertension and heart failure, a first-line clinical drug with strong demand.

(22) Diisooctyl Maleate (CAS: 142-16-5): Raw material for plasticizers and lubricants, used in plastic and rubber processing, a mainstream product in the chemical additives field.

(23) Maleic Acid (CAS: 110-16-7): Basic chemical raw material, used in the preparation of maleic anhydride, esters and polymers, a core intermediate in the chemical industry with large market circulation.

(24) Methyl Vinyl Ether-Maleic Anhydride Copolymer (CAS: 9011-16-9): Water-soluble polymer, used in coatings, adhesives and drug carriers, a raw material for multifunctional materials in multiple fields.

(25) 2,3-Dichloromaleic Anhydride (CAS: 1122-17-4): Organic synthesis intermediate, used in the preparation of heterocyclic compounds and drugs, applied in fine chemicals and pharmaceutical R&D.

(26) (S)-Timolol Maleate (CAS: 26921-17-5): Raw material for intraocular pressure-lowering and antihypertensive drugs, used in the treatment of glaucoma and hypertension, with dual demand in ophthalmic and cardiovascular fields.

(27) Afatinib Maleate (CAS: 439081-18-2): Raw material for antitumor drugs, used in the treatment of non-small cell lung cancer, a popular product in the targeted anticancer drug field.

(28) Pheniramine Maleate (CAS: 132-20-7): Raw material for antihistamine drugs, used to relieve symptoms of allergic rhinitis and conjunctivitis, a commonly used intermediate in the antiallergic field.

(29) 9-Maleimidoacridine (CAS: 49759-20-8): Fluorescent probe reagent, used in biological detection and drug screening, a specialized raw material in scientific research and pharmaceutical R&D.

(30) Monobutyl Maleate (CAS: 925-21-3): Coating additive and organic intermediate, used in the preparation of resins and plasticizers, with stable demand in the chemical additives field.

(31) Diallyl Maleate (CAS: 999-21-3): Polymer crosslinker, used in the preparation of rubber, plastics and ion exchange resins, a core raw material in the material processing field.

(32) Vinpocetine Maleate (CAS: 118909-22-1): Cholinesterase inhibitor, used in the treatment of Alzheimer's disease, a staple intermediate in the

neurological drug field.

(33) Neratinib Maleate (CAS: 915942-22-2): Raw material for antitumor drugs, used in the treatment of breast cancer, with growing demand in the targeted anticancer drug field.

(34) Serotonin Maleate (CAS: 18525-25-2): Neurotransmitter reagent and pharmaceutical intermediate, used in scientific research experiments and drug synthesis, applied in the biomedical field.

(35) Indacaterol Maleate (CAS: 753498-25-8): Raw material for anti-asthmatic drugs, used in the treatment of chronic obstructive pulmonary disease, a mainstream product in the respiratory drug field.

(36) Olaratumab Maleate (CAS: 1208319-27-0): Raw material for antitumor drugs, used in the treatment of advanced solid tumors, a popular intermediate in innovative anticancer drug R&D.

(37) Maleonitrile (CAS: 532-28-5): Organic synthesis intermediate, used in the preparation of heterocyclic compounds and polymers, a basic raw material in the fine chemical field.

(38) Rosiglitazone Maleate (CAS: 155141-29-0): Raw material for hypoglycemic drugs, used in the treatment of type 2 diabetes, a commonly used pharmaceutical intermediate in the endocrine field.

(39) Maleic Anhydride (CAS: 108-31-6): Core chemical raw material, used in the preparation of plastics, resins, coatings and drugs, a pillar product in the chemical industry with strong demand.

(40) Dexchlorpheniramine Maleate (CAS: 2438-32-6): Raw material for antihistamine drugs, used to relieve allergic symptoms, a high-activity intermediate in the antiallergic field.

(41) Maleic Hydrazide (CAS: 123-33-1): Plant growth regulator and preservative, used in agricultural production and food preservation, with dual demand in agricultural and food industries.

(42) Pyrilamine Maleate (CAS: 59-33-6): Raw material for antihistamine drugs, used in the treatment of allergic diseases, a classic antiallergic pharmaceutical intermediate with stable circulation.

(43) 6-Maleimidohexanoic Hydrazide (CAS: 81186-33-6): Biocrosslinker, used in protein conjugation and drug modification, with growing demand in the biopharmaceutical field.

(44) 4-Phenylacetic Hydrazide Maleate (CAS: 188944-35-6): Bioconjugation reagent, used in antibody drug preparation and biological detection, a high-end biochemical raw material.

(45) Acepromazine Maleate (CAS: 3598-37-6): Raw material for antipsychotic and sedative drugs, used in the treatment of schizophrenia and animal sedation, applied in both pharmaceutical and veterinary fields.

(46) Dibromomaleic Acid (CAS: 608-37-7): Organic synthesis intermediate, used in the preparation of flame retardants and drugs, a specialized raw material

in the fine chemical field.

(47) Rotoxamine Maleate (CAS: 3505-38-2): Raw material for antihistamine drugs, used to relieve symptoms of allergic rhinitis and urticaria, a mainstream intermediate in the antiallergic field.

(48) Levomepromazine Maleate (CAS: 7104-38-3): Raw material for antipsychotic drugs, used in the treatment of schizophrenia and mania, with stable demand in the specialized pharmaceutical field.

(49) Diaminomaleonitrile (CAS: 1187-42-4): Organic synthesis intermediate, used in the preparation of heterocyclic compounds, dyes and drugs, with multiple applications in fine chemicals.

(50) Zinc Maleate (CAS: 7344-42-5): Rubber vulcanization accelerator and preservative, used in rubber processing and industrial corrosion prevention, with stable demand in the chemical additives field.

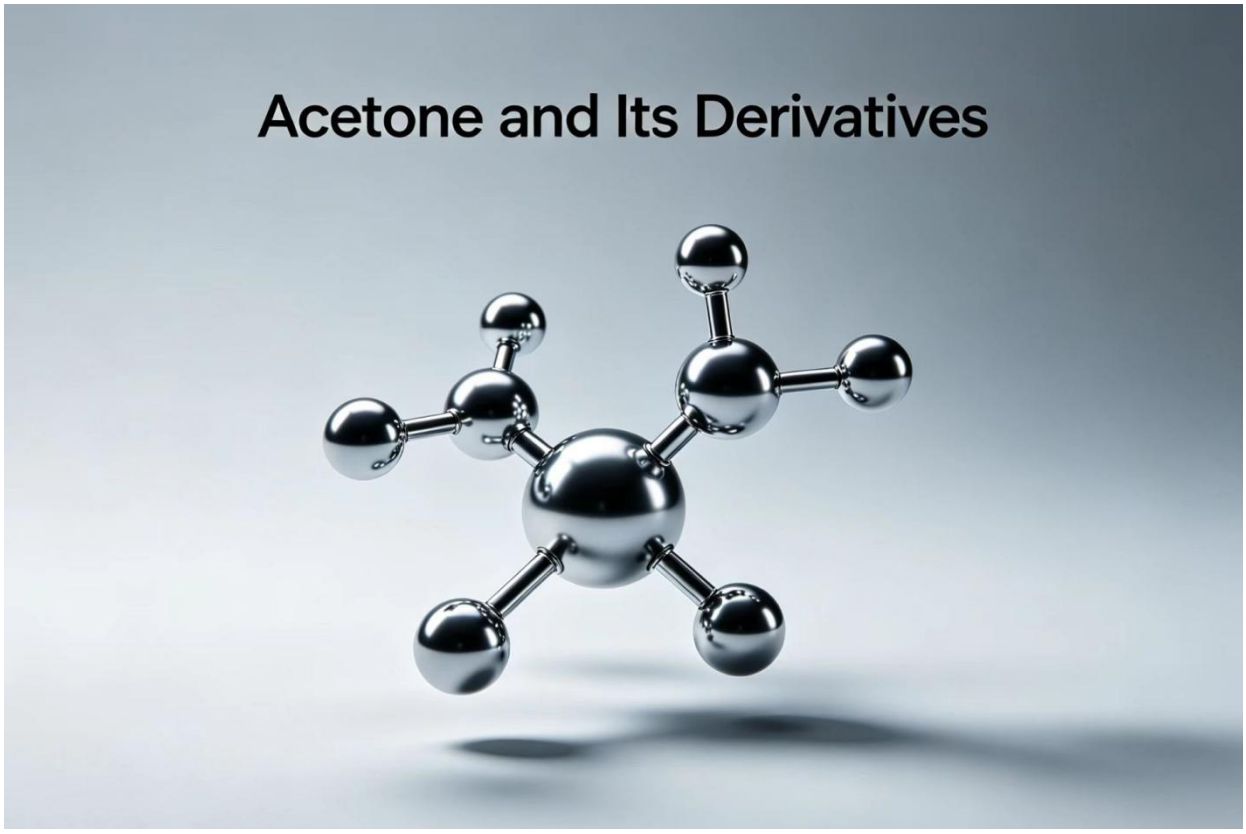
(51) Paroxetine Maleate (CAS: 64006-44-6): Raw material for antidepressant drugs, used in the treatment of depression and obsessive-compulsive disorder, a core intermediate in the neurological drug field with strong demand.

(52) Pramipexole Maleate (CAS: 179386-44-8): Dopamine receptor agonist, used in the treatment of Parkinson's disease, a staple product in the neurological drug field.

(53) Sodium Maleate (CAS: 371-47-1): Food additive and buffer, used in food processing and industrial production, with dual applications in food and chemical fields.

(54) Methysergide Maleate (CAS: 129-49-7): Raw material for antimigraine drugs, used in the treatment of migraine and cluster headache, with stable demand in the specialized pharmaceutical field.

(55) Methyl Maleate (CAS: 3052-50-4): Organic synthesis intermediate, used in the preparation of fragrances, drugs and resins, a commonly used raw material in the fine chemical field.



(XXXVI) Acetone and Acetone Derivatives Series

Acetone and its derivatives are important organic chemical raw materials with carbonyl/hydroxyl structures, widely used in pharmaceutical synthesis (intermediates for antibacterial, antitumor, and antiviral drugs), pesticide R&D (high-efficiency fungicides and herbicides), new material preparation (catalysts, liquid crystal materials, polymer monomers), and fine chemicals (solvents, additives, reagents). With structural diversity and reactivity, they are indispensable core product series in industrial production.

(1) Methyl p-Chlorophenylpyruvate (CAS: 53101-00-1): Pharmaceutical intermediate, used for synthesizing antibacterial drugs, anti-inflammatory drugs, and lipid-lowering drugs, with stable market demand.

(2) Cerium Acetyl Acetonate (CAS: 15653-01-7): Organometallic catalyst, used for polymer polymerization reactions, organic synthesis catalysis, and material surface modification, a high-value-added product.

(3) Zirconium Hexafluoroacetylacetonate (CAS: 19530-02-0): High-temperature resistant material intermediate, used for preparing OLED devices, aerospace coatings, and fluorochemical products, with specific application scenarios.

(4) Sodium Acetylacetonate (CAS: 86891-03-4): Organic synthesis reagent, used for refined pharmaceutical synthesis, pesticide intermediate preparation, and coordination chemistry research, with stable circulation volume.

(5) Bis(1-phenyl-isoquinoline)(Acetylacetonato)iridium(III) (CAS: 435294-03-4): Core intermediate for optoelectronic materials, used in OLED light-emitting device manufacturing, with great market potential and fast-growing

demand.

(6) Propionyl Chloride (CAS: 79-03-8): Organic synthesis raw material, used for preparing esters, amides, and ketones, a rigid demand product in the pharmaceutical, pesticide, and dye industries, with large circulation volume.

(7) 1,1,3-Trichloroacetone (CAS: 921-03-9): Pharmaceutical and pesticide intermediate, used for synthesizing herbicides, antibacterial drugs, and organic synthesis intermediates, with stable demand.

(8) 1,2:3,5-Di-O-Isopropylidene-alpha-D-Xylofuranose (CAS: 20881-04-3): Pharmaceutical intermediate, used for synthesizing antiviral drugs, sugar derivatives, and bioactive molecules, with mature applications.

(9) Diacetonamine (CAS: 625-04-7): Organic synthesis raw material, used for preparing rubber accelerators, pharmaceutical intermediates, and corrosion inhibitors, a conventional circulation product.

(10) 3-Oxopentanedioic acid (CAS: 542-05-2): Pharmaceutical and dye intermediate, used for synthesizing antitumor drugs, organic pigments, and fragrances, with high market activity.

(11) Magnesium Trifluoroacetylacetonate (CAS: 314075-05-3): Fluorine-containing catalyst raw material, used for fluorochemical synthesis, pharmaceutical intermediate preparation, and material surface treatment, with high added value.

(12) Molybdenyl Acetylacetonate (CAS: 17524-05-9): Organometallic catalyst, used for petroleum chemical hydrogenation reactions, polymer material synthesis, and environmental protection catalysts, with steady growth in demand.

(13) Acetone Oxime (CAS: 127-06-0): Industrial oxygen scavenger, widely used in boiler water treatment, also used for pharmaceutical synthesis, rubber antioxidants, and organic synthesis intermediates, with large market circulation volume.

(14) Magnesium Trifluoroacetylacetonate hydrate (CAS: 652154-06-8): Fine chemical intermediate, used for fluorine-containing drug synthesis, liquid crystal material preparation, and catalyst ligands, with fast-growing demand.

(15) keto-Phenylpyruvic acid (CAS: 156-06-9): Pharmaceutical intermediate, used for synthesizing amino acid drugs,biological reagents, and food additives, a rigid demand product.

(16) Bismuth Hexafluoroacetylacetonate (CAS: 141364-06-9): Catalyst and pharmaceutical raw material, used for organic synthesis reaction catalysis, antibacterial preparation, and material flame retardant treatment, a high-value niche product.

(17) Potassium Phosphoenolpyruvate (CAS: 4265-07-0): Biochemical raw material, used for enzyme preparation production, pharmaceutical intermediate synthesis, and biological diagnostic reagents, with wide applications.

(18) Magnesium Acetylacetonate dihydrate (CAS: 68488-07-3): Catalyst and

stabilizer, used for polymer material polymerization, pharmaceutical synthesis, and coating additives, with stable circulation.

(19) Tris(acetylacetonato)erbium (CAS: 14553-08-3): Rare earth organic compound, used for optical material preparation, catalyst ligands, and laser crystal raw materials, a high-value niche product.

(20) Aminoacetone (CAS: 298-08-8): Pharmaceutical intermediate, used for synthesizing central nervous system drugs, antihistamine drugs, and organic synthesis intermediates, with stable demand.

(21) Praseodymium (III) 2,4-Pentanedionate (CAS: 14553-09-4): Rare earth catalyst, used for organic synthesis reactions, new material preparation, and optical device raw materials, with great market potential.

(22) Acetol (CAS: 116-09-6): Pharmaceutical and fragrance intermediate, used for synthesizing antitussive drugs, flavors and fragrances, and organic synthesis raw materials, with mature applications.

(23) Titanium Acetylacetonate (CAS: 97281-09-9): Polymer coupling agent, used for coating modification, plastic reinforcement, and composite material preparation, improving product adhesion and stability.

(24) Tin(IV) bis(acetylacetonate) DibroMide (CAS: 16894-10-3): Organotin catalyst, used for polyurethane synthesis, pharmaceutical intermediate preparation, and rubber vulcanization accelerators, with stable demand.

(25) Methyl Trifluoropyruvate (CAS: 13089-11-7): Key intermediate for fluorine-containing drugs, used for preparing antitumor and antiviral drugs, a high-demand and high-value-added product.

(26) Lanthanum Acetylacetonate hydrate (CAS: 64424-12-0): Rare earth catalyst, used for organic synthesis reactions, optical material preparation, and polymer polymerization catalysis, with medium circulation volume.

(27) Diethyl ethylmalonate (CAS: 133-13-1): Pharmaceutical and pesticide intermediate, used for synthesizing antibiotics, herbicides, and central nervous system drugs, a rigid demand product.

(28) Ethyl 3-Cyano-2-Oxopropanoate (CAS: 53544-13-1): Pharmaceutical intermediate, used for synthesizing antiviral drugs, antibacterial preparations, and bioactive molecules, with fast-growing demand.

(29) Calcium Pyruvate (CAS: 52009-14-0): Food additive and pharmaceutical raw material, used for calcium supplement preparations, sports nutrition supplements, and biochemical intermediates, with wide market circulation.

(30) Zinc Acetylacetonate hydrate (CAS: 14363-15-6): Catalyst and stabilizer, used for rubber vulcanization, pharmaceutical synthesis, and coating anticorrosion treatment, with wide applications.

(31) 2-Amino-4,6-dimethyl-Pyrimidine (CAS: 767-15-7): Organic synthesis raw material, used for preparing pharmaceutical intermediates, rubber accelerators, and dyes, with stable demand.

(32) Hexachloroacetone (CAS: 116-16-5): Pesticide and chemical intermediate,

used for synthesizing herbicides, organochlorine compounds, and flame retardant materials, a conventional circulation product.

(33) Nickel(II) Acetylacetonate Dihydrate (CAS: 14363-16-7): Organometallic catalyst, used for organic synthesis reactions, polymer polymerization, and electroplating additives, with stable demand.

(34) Cupric Acetylacetonate (CAS: 13395-16-9): Catalyst and pigment raw material, used for organic synthesis catalysis, coating coloring, and electronic material preparation, with high market activity.

(35) Ferrous Acetylacetonate (CAS: 14024-17-0): Catalyst and reducing agent, used for organic synthesis reactions, polymer material preparation, and metallurgical additives, a high-value niche product.

(36) 3-Chloropyruvic Acid (CAS: 3681-17-2): Pharmaceutical intermediate, used for synthesizing antitumor drugs, antibacterial drugs, and bioactive molecules, a rigid demand product.

(37) Pyruvic acid (CAS: 127-17-3): Pharmaceutical and biochemical raw material, used for synthesizing antibiotics, vitamins, and food additives, with large market circulation volume, a core product.

(38) Acetonate dihydrate (CAS: 203863-17-6): Fluorine-containing fine chemical intermediate, used for fluorochemical synthesis, catalyst ligands, and material surface treatment, with fast-growing demand.

(39) Ethyl Trifluoropyruvate (CAS: 13081-18-0): Fluorine-containing pharmaceutical intermediate, used for preparing antitumor and antiviral drugs, a core high-value-added product.

(40) Ferric Acetylacetonate (CAS: 14024-18-1): Catalyst and pigment raw material, used for organic synthesis catalysis, coating coloring, and polymer polymerization, with wide applications.

(41) Neodymium Hexafluoroacetylacetonate dihydrate (CAS: 47814-18-6): Rare earth organic compound, used for optical materials, catalyst ligands, and laser crystal raw materials, with high added value.

(42) Dibutyltin Bis(acetylacetonate) Liquid (CAS: 22673-19-4): Organotin catalyst, used for polyurethane foam synthesis, coating curing, and plastic modification, with stable demand.

(43) Acetone Semicarbazone (CAS: 110-20-3): Organic synthesis reagent, used for pharmaceutical intermediate preparation, dye synthesis, and analytical chemistry reagents, with stable circulation volume.

(44) Acetylacetone Cobalt(II) dihydrate (CAS: 67378-21-6): Organometallic catalyst, used for organic synthesis reactions, polymer polymerization, and battery material raw materials, with great market potential.

(45) 1,1,1,5,5,5-Hexafluoroacetylacetone (CAS: 1522-22-1): Fluorine-containing chemical raw material, used for preparing fluorine-containing catalysts, pharmaceutical intermediates, and fluoropolymers, a core raw material.

(46) Europium acetylacetonate (CAS: 18702-22-2): Rare earth luminescent material intermediate, used for OLED devices, fluorescent probes, and laser materials, a high-value product.

(47) Isopropenyl acetate (CAS: 108-22-5): Organic synthesis raw material, used for preparing ester compounds, pharmaceutical intermediates, and fragrances, with wide market circulation.

(48) Methyl pyruvate (CAS: 600-22-6): Pharmaceutical and fragrance intermediate, used for synthesizing antibiotics, flavors, and organic synthesis raw materials, with stable demand.

(49) Iron (III) Trifluoroacetylacetonate (CAS: 14526-22-8): Fluorine-containing catalyst, used for fluorochemical synthesis, pharmaceutical intermediate preparation, and material surface treatment, with high added value.

(50) Ethyl bromopyruvate (CAS: 70-23-5): Pharmaceutical intermediate, used for synthesizing antitumor drugs, antibacterial drugs, and bioactive molecules, a rigid demand product.

(51) Dimethyl diethylmalonate (CAS: 27132-23-6): Pharmaceutical and pesticide intermediate, used for synthesizing antibiotics, herbicides, and organic synthesis intermediates, a conventional circulation product.

(52) Ropinirole Impurity 1 (CAS: 91374-24-2): Pharmaceutical intermediate, used for synthesizing anti-Parkinson's drugs and central nervous system drugs, a high-value niche product.

(53) ethyl Dimethylpyruvate (CAS: 20201-24-5): Organic synthesis raw material, used for preparing pharmaceutical intermediates, fragrances, and dyes, with stable demand.

(54) Erbium(III) Acetylacetonate hydrate (CAS: 70949-24-5): Rare earth organic compound, used for optical materials, catalyst ligands, and laser crystal raw materials, with great market potential.

(55) Sodium Pyruvate (CAS: 113-24-6): Pharmaceutical and food additive, used for calcium supplement preparations, sports nutrition supplements, and biochemical intermediates, with strong market demand.

(56) Cerium:(Z)-5,5,5-Trifluoro-4-Hydroxypent-3-en-2-One (CAS: 63356-25-2): Fluorine-containing rare earth catalyst, used for fluorochemical synthesis, pharmaceutical intermediate preparation, and material surface treatment, with high added value.

(57) Bis(1,2-diphenyl-1H-benzimidazol-C2,N)(acetylacetonate)iridium(III) (CAS: 725251-25-2): Core luminescent material intermediate for OLEDs, used in high-end display device manufacturing, with fast-growing market demand.

(58) Ethyl 3,3-dibromo-2-Oxopropanoate (CAS: 76179-25-4): Pharmaceutical intermediate, used for synthesizing antitumor drugs, antibacterial drugs, and organic synthesis intermediates, a rigid demand product.

(59) Palladium(II) Acetylacetonate (CAS: 32216-25-4): Precious metal

catalyst, used for organic synthesis catalysis, pharmaceutical intermediate preparation, and electroplating industry, a core high-value product.

(XXXVII) Lactic Acid Series

Taking lactic acid as the core raw material, a variety of derivatives are produced through esterification, salinization and chelation processes. The products are safe, mild and widely applicable. They are commonly used in food seasoning and preservation, pharmaceutical accessories, daily chemical skin care and industrial raw material processing. With complete product ranges and stable supply, they fully meet the production demands of various industries.

(1) D-Ethyl Lactate (CAS: 7699-00-5): Industrial grade, optical purity ≥98%; used for synthesizing chiral compounds and biodegradable materials, suitable for fine chemical and new material fields.

(2) Sodium Lactate (CAS: 72-17-3): Food grade/industrial grade, content ≥ 98%; used as preservative and moisturizer in food (meat products, pastries), used for fluid replacement in pharmaceutical grade, and as antifreeze and corrosion inhibitor in industrial applications.

(3) N-Butyl Lactate (CAS: 138-22-7): Industrial grade/food grade, purity ≥ 98%, excellent solubility; used as coating solvent and printing ink thinner, and as flavor enhancer in food.

(4) Menthyl Lactate (CAS: 17162-29-7): Food grade/cosmetic grade, purity ≥ 98%, cool feeling; used as cooling agent in food (chewing gum, beverages) and in skin care products and toothpaste for flavoring in daily chemical products.

(5) Potassium DL-Lactate (CAS: 996-31-6): Food grade/industrial grade, content ≥98%; used as electrolyte supplement in food (sports drinks, dairy

products) and as corrosion inhibitor and moisturizer in industrial applications.

(6) Zinc Lactate (CAS: 5590-32-9): Food grade/feed grade, zinc content ≥22%; nutritional fortifier (children's complementary food, health products), used for zinc supplementation in livestock, poultry and aquatic products in feed grade to improve immunity.

(7) L-Lactic Acid (CAS: 79-33-4): Dual specifications of food grade/pharmaceutical grade, purity ≥98%, natural source, biodegradable; used as acidulant and preservative in food (suitable for beverages, dairy products, meat products), as formulation excipient and skin care raw material in pharmaceutical grade, and as green solvent in industrial applications.

(8) 2-Mercaptopropionic Acid (CAS: 79-42-5): Industrial grade/pharmaceutical grade, purity ≥97%; used as cosmetic perm agent, metal surface treatment agent, and for pharmaceutical intermediate synthesis.

(9) Ethyl L(-)-Lactate (CAS: 687-47-8): Pharmaceutical grade/food grade, optical purity ≥99%; used for high-end flavor blending and pharmaceutical intermediate synthesis, suitable for food flavor and pharmaceutical chemical fields.

(10) D-Lactic Acid (CAS: 10326-41-7): Pharmaceutical grade/industrial grade, high optical purity ≥99%; used for synthesizing biodegradable materials (poly-D-lactic acid) and pharmaceutical intermediates, suitable for high-end formulation and new material fields.

(11) Lithium Lactate (CAS: 867-55-0): Pharmaceutical grade/industrial grade, content ≥99%; used as battery material raw material and pharmaceutical intermediate, suitable for new energy and pharmaceutical fields.

(12) Sodium L-Lactate (CAS: 867-56-1): Pharmaceutical grade/food grade, content ≥99%, high biocompatibility; used for high-end food preservation and pharmaceutical rehydration formulations, suitable for health food and pharmaceutical fields.

(13) Ethacridine Lactate (CAS: 1837-57-6): Pharmaceutical grade, purity ≥ 99%; used for external disinfection and preservation (skin wounds, mucosal disinfection), suitable for medical and health fields.

(14) N-Propyl L-Lactate (CAS: 53651-59-7): Pharmaceutical grade, optical purity ≥98%; used as pharmaceutical intermediate and special solvent, suitable for high-end chemical and formulation fields.

(15) Isobutyl Lactate (CAS: 585-24-0): Industrial grade, purity ≥97%, low volatility; used as coating and adhesive solvent, suitable for industrial manufacturing fields.

(16) Ethyl Lactate (CAS: 97-64-3): Food grade/industrial grade, purity ≥99%, fruity odor; used as flavor and fragrance in food (white wine, fruit juice flavoring), and as solvent (coating, adhesive) and extractant in industrial applications.

(17) Methyl Lactate (CAS: 547-64-8): Industrial grade/food grade, purity ≥ 99%, low toxicity and environmental friendliness; used as coating solvent, ink thinner and food flavor carrier, suitable for fine chemical and food additive fields.

(18) Lactobionic Acid (CAS: 96-82-2): Food grade/cosmetic grade, purity ≥ 98%; used as moisturizer in daily chemicals (skin care products, shampoo) and as antioxidant and stabilizer in food.

(19) DL-Lactic Acid (CAS: 598-82-3): Industrial grade/food grade, purity ≥ 95%, controllable cost; widely used in leather tanning, textile printing and dyeing, food processing (baking, jam flavoring), and as basic raw material for preparing lactic acid esters and salts.

(20) (+)-Methyl D-Lactate (CAS: 17392-83-5): Industrial grade/pharmaceutical grade, optical purity ≥98%; used for synthesizing polylactic acid materials and special chemicals, suitable for new material and high-end chemical fields.

(21) Calcium Lactate (CAS: 814-80-2): Food grade/pharmaceutical grade, calcium content ≥13%; dietary supplement (calcium tablets, infant food addition), used as stabilizer and coagulant in food (tofu, jelly).

(22) Ferrous Lactate (CAS: 5905-52-2): Food grade/pharmaceutical grade, iron content ≥18%; high-efficiency iron supplement (oral preparations for pregnant women and children), no constipation side effects, suitable for people with gastrointestinal sensitivity.

(23) Manganese Lactate (CAS: 51877-53-3): Feed grade/industrial grade, manganese content ≥18%; used for manganese supplementation in livestock and poultry in feed, and as catalyst and coating desiccant in industrial applications.

(24) Zinc Lactate (CAS: 16039-53-5): Feed grade, zinc content ≥21%; used for adding to livestock, poultry and aquatic feed to improve growth performance and disease resistance.

(25) Bismuth Lactate (CAS: 6591-53-3): Pharmaceutical grade, bismuth content ≥58%; used as gastrointestinal mucosal protective agent and antibacterial preparation, suitable for pharmaceutical fields.

(26) Magnesium Lactate (CAS: 26867-84-5): Food grade/pharmaceutical grade, magnesium content ≥10%; dietary supplement (effervescent tablets, chewable tablets), participates in neuromuscular regulation, improves sleep, and is used as stabilizer in food.

(27) Aluminum Lactate (CAS: 18917-91-4): Industrial grade, content ≥98%; used as water treatment flocculant and cosmetic astringent, suitable for environmental protection and daily chemical fields.

(28) Methyl (S)-(-)-Lactate (CAS: 27871-49-4): Pharmaceutical grade, optical purity ≥98%; used for pharmaceutical intermediate synthesis and chiral reagent, suitable for high-end pharmaceutical and fine chemical scenarios.

(29) Magnesium L-Lactate Hydrate (CAS: 1220086-24-7): Pharmaceutical grade, magnesium content ≥9%; used for pharmaceutical formulations and nutritional supplements, suitable for high-end health product fields.

(30) Polylactic Acid (CAS: 26023-30-3): Biodegradable material with controllable molecular weight; used for disposable tableware, medical sutures, 3D printing consumables, suitable for environmental protection materials and pharmaceutical fields.

(31) Strontium Dilactate (CAS: 29870-99-3): Pharmaceutical grade/food grade, strontium content ≥20%; dietary supplement (bone health products), suitable for health product fields.

(32) Ammonium Lactate (CAS: 515-98-0): Industrial grade/food grade, content ≥97%; used as fertilizer additive and food acidulant, and for water treatment and coating auxiliary in industrial applications.

(XXXVIII) Other Chelating and Related Series Products

The current chelating and related products cover a diverse range of types, including natural polyphenol derivatives, organophosphate complexes, inorganic halides, etc. They integrate natural and synthetic products, as well as single-component and compound systems, capable of meeting the needs of different scenarios. These products feature prominent core characteristics: they can efficiently form stable complexes with metal ions, while possessing advantages such as flexibly adjustable chelating capacity and biodegradability of some products, balancing performance and environmental friendliness. With a wide range of applications, they not only

serve people's livelihood scenarios such as food color protection, agricultural nutrition enhancement, and pharmaceutical heavy metal detoxification, but also support professional fields such as industrial water treatment anti-scaling and metallurgical metal purification, demonstrating strong functional practicality.

I. Carbohydrates and Derivatives Series

(1) Polydextrose(CAS: 68424-04-4): Used as a low-calorie bulking agent, thickener, and stabilizer in the food industry, commonly applied in beverages, pastries, candies, and other products; also serves as a dietary fiber supplement in health foods.

(2) Calcium D-xylonate hydrate (CAS: 72656-08-7): Frequently used as a food nutrition fortifier to supplement calcium and xylonic acid; also functions as a pharmaceutical intermediate for drug synthesis or a mild conditioning ingredient in cosmetics.

(3) D-Galactose (Plant-sourced, CAS: 59-23-4): A raw material for energy metabolism in organisms, used in pharmaceutical intermediate synthesis and biological reagent preparation; can be employed as a sweetener in food and a formulation component in health products.

(4) Fructose (CAS: 57-48-7): A major sweetener in the food industry, applied in beverages, candies, and baked goods with high sweetness and flavor-enhancing properties; can be foliar-sprayed in agriculture to improve fruit sweetness and quality.

(5) D-Arabinose (CAS: 10323-20-3): Used as a low-calorie sweetener in sugar-free foods; applied in antiviral drug synthesis in the pharmaceutical field and as a biochemical reagent.

(6) L-Arabinose (CAS: 5328-37-0): Inhibits sucrose absorption, suitable for weight-loss and blood sugar-lowering food formulations; also serves as a pharmaceutical intermediate for drug synthesis and biological research.

(7) L-(+)-Arabinose (CAS: 87-72-9): Primarily used as a biochemical reagent for carbohydrate metabolism research; also acts as a pharmaceutical intermediate in drug molecule synthesis and can be added in small amounts as a functional ingredient in food.

(8) D-Mannose (CAS: 3458-28-4): Used in the prevention and auxiliary treatment of urinary tract infections in medicine; serves as a sweetener in low-sugar foods and a moisturizer in cosmetics.

(9) Tagatose (CAS: 87-81-0): A low-calorie sweetener with a taste close to sucrose, applied in beverages, candies, dairy products, and other foods; possesses blood sugar-regulating and gut health-improving functions for use in health foods.

(10) Isomaltulose (CAS: 13718-94-0): Used as a sweetener in the food industry for candies, chocolates, and beverages, featuring good stability and anti-caries properties; also serves as an energy supplement in sports foods.

(11) α-Methyl-D-galactoside (CAS: 3396-99-4): Mainly used as a pharmaceutical intermediate for drug molecule synthesis and a biochemical reagent for carbohydrate-related research.

(12) Tri-O-acetyl-D-glucal (CAS: 4098-06-0): An organic synthesis intermediate widely used in carbohydrate derivative preparation and drug synthesis, particularly critical in antiviral and antibiotic synthesis.

(13) Tetra-O-acetyl-D-glucose (CAS: 10343-06-3): An important carbohydrate chemical intermediate for drug synthesis, functional material preparation, and glycosylation reactions, applied in the fine chemical industry.

(14) o-Nitrophenyl-β-D-galactopyranoside (CAS: 369-07-3): Commonly used as a biochemical reagent for β-galactosidase activity detection; also serves as a pharmaceutical intermediate in antibiotic and antiviral drug synthesis.

(15) Hexa-O-acetyl-D-cellobial (CAS: 67314-36-7): A carbohydrate chemical synthesis intermediate for complex carbohydrate preparation and drug molecule modification, widely used in pharmaceutical and fine chemical fields.

(16) Sodium calcium lactobionate (CAS: 5001-51-4): Used as a calcium supplement and stabilizer in the food industry for dairy products and infant foods; also functions as a pharmaceutical excipient to regulate drug formulation stability.

(17) D-Cellobial (CAS: 490-51-7): An organic synthesis intermediate for carbohydrate derivative synthesis and drug development, particularly effective in antibacterial and antitumor drug synthesis.

(18) α-Methyl-D-rhamnoside (CAS: 14917-55-6): Mainly used as a pharmaceutical intermediate for natural product synthesis and drug molecule modification; also serves as a biological reagent for carbohydrate metabolism mechanism research.

(19) α-D-Galactose pentaacetate (CAS: 4163-59-1): A carbohydrate chemical intermediate for glycoside compound synthesis and drug development, also used as an organic synthesis raw material in fine chemical product preparation.

(20) β-D-Galactose pentaacetate (CAS: 4163-60-4): An important organic synthesis intermediate for drug synthesis and carbohydrate derivative preparation, widely applied in pharmaceutical and biochemical fields.

(21) D-Cellobiose (CAS: 528-50-7): A biochemical reagent for carbohydrate metabolism research and enzyme activity detection; also serves as a pharmaceutical intermediate in antibacterial/antitumor drug synthesis and functional material preparation.

(22) 1,2,3,4,6-Penta-O-acetyl-α-D-mannose (CAS: 4163-65-9): A carbohydrate chemical synthesis raw material for complex carbohydrate preparation and drug molecule modification, important in pharmaceutical and fine chemical fields.

(23) Thymidine (CAS: 533-67-5): A biochemical reagent for nucleic acid-related research and biological experiments; also acts as a pharmaceutical intermediate in antiviral drug synthesis.

(24) α-D-Glucose pentaacetate (CAS: 604-68-2): An organic synthesis intermediate for glycosylation reactions and drug synthesis, particularly critical in carbohydrate drug development and fine chemical product preparation.

(25) D-Galactal (CAS: 21193-75-9): A carbohydrate chemical intermediate for carbohydrate derivative synthesis and drug molecule modification, widely used in pharmaceutical and biochemical fields.

(26) 2-Deoxy-D-galactose (CAS: 1949-89-9): A biochemical reagent for carbohydrate metabolism research and enzymology experiments; also serves as a pharmaceutical intermediate in antitumor/antiviral drug synthesis.

(27) L-Ribose (CAS: 24259-59-4): A biochemical reagent for nucleic acid synthesis research and biological experiments; used in antiviral/antitumor drug synthesis in the pharmaceutical field and as a health product raw material.

(28) D-Ribose (CAS: 50-69-1): Used as an energy supplement in sports drinks and health products; applied in cardiovascular disease auxiliary treatment drug synthesis in the pharmaceutical field and as a biological reagent for nucleic acid research.

(29) L-(-)-Xylose (CAS: 609-06-3): Used as a low-calorie sweetener in sugar-free foods; serves as a pharmaceutical intermediate for drug synthesis and biological research, and a conditioning ingredient in cosmetics.

(30) D-Raffinose (CAS: 17629-30-0): Acts as a prebiotic to regulate gut health in food, and for sweetness enhancement and quality improvement in beverages, dairy products, and pastries; used as a biological reagent and pharmaceutical excipient in the pharmaceutical field.

(31) D-Trehalose (CAS: 6138-23-4): Used as a humectant and stabilizer in the food industry to extend the shelf life of candies, baked goods, and dairy products; serves as a moisturizing ingredient in cosmetics and a biological preparation protectant in medicine.

(32) Arabinogalactan (CAS: 9036-66-2): Used as a thickener and stabilizer in beverages, dairy products, and meat products; functions as a pharmaceutical excipient to improve drug solubility and stability, and as a dietary fiber supplement.

(33) L-Rhamnose (CAS: 10030-85-0): Used as a sweetener and flavor enhancer in beverages and candies; serves as a pharmaceutical intermediate for drug synthesis and biological reagent preparation, and a conditioning ingredient in cosmetics.

(34) Calcium gluconolactate (CAS: 12569-38-9): A food nutrition fortifier for calcium supplementation in dairy products, infant foods, and health products; used in calcium supplement formulations and as a pharmaceutical excipient in the pharmaceutical field.

(35) D-Arabitol (CAS: 488-82-4): Used as a sweetener and humectant in sugar-

free foods and beverages; serves as a moisturizing ingredient in cosmetics and a pharmaceutical intermediate/biological reagent in the pharmaceutical field.

II. Functional Raw Materials and Chemical Intermediates Series

(36) Sucralose (CAS: 56038-13-2): A high-potency, low-calorie sweetener in the food industry, widely applied in various low-sugar and sugar-free foods such as beverages, candies, baked goods, and dairy products.

(37) Fructose diphosphate sodium (CAS: 488-69-7): Used in the auxiliary treatment of myocardial ischemia, cerebral infarction, and other diseases in medicine to supplement energy and improve cellular metabolism; also serves as a health product raw material for sports nutrition supplementation.

(38) Calcium β-hydroxy-β-methylbutyrate (HMB Calcium, CAS: 135236-72-5): A nutrition fortifier for health products and sports nutrition foods to support muscle growth and recovery; also used as a feed additive to improve livestock and poultry growth performance.

(39) Conjugated linoleic acid ethyl ester (MF: C20H36O2, MW: 308.5): A health product raw material for blood lipid regulation and weight management; also serves as a food additive to improve food lipid structure in functional foods.

(40) Conjugated linoleic acid triglyceride (N/V): A functional oil raw material for health products and functional foods with blood lipid-regulating and immunity-enhancing effects; also used as a food additive to improve food taste and nutritional value.

(41) Capsaicin (CAS: 404-86-4): Used in analgesic drugs and topical anti-inflammatory preparations in medicine; serves as a spicy flavoring agent in condiments and snack foods; also used as a pesticide raw material for insect repellent and pest control.

(42) Carboxylic acid (CAS: 141-82-2): A food additive used as an antioxidant and preservative to extend the shelf life of oils, meat products, and beverages; serves as a pharmaceutical intermediate for drug synthesis in the pharmaceutical field.

(43) Carboxylic acid (CAS: 156-80-9): A food antioxidant and preservative applied in oils, pastries, meat products, etc.; serves as a pharmaceutical intermediate for drug synthesis and fine chemical product preparation.

(44) 1-Piperonylpiperazine (CAS: 32231-06-4): A pharmaceutical intermediate mainly used in antihistamine and psychotropic drug synthesis; also serves as a fine chemical raw material for pesticide and dye preparation.

(45) Butyrobetaine hydrochloride (CAS: 6249-56-5): A chemical intermediate for drug synthesis and surfactant preparation; also used as a feed additive to improve livestock and poultry growth performance and immunity.

(46) Betaine salicylate (CAS: 17671-53-3): A cosmetic raw material for skin care and hair care products with moisturizing and conditioning effects; used

in topical anti-inflammatory preparations and as a pharmaceutical excipient in the pharmaceutical field.

(47) Betaine monohydrate (CAS: 590-47-6): A food nutrition fortifier for health products and sports drinks to regulate body osmotic pressure; serves as a moisturizing ingredient in cosmetics and a feed additive to improve livestock and poultry growth performance.

(48) Betaine hydrochloride (CAS: 590-46-5): A feed additive for livestock and aquatic breeding to improve growth performance and feed utilization rate; serves as a pharmaceutical intermediate for drug synthesis and a food excipient.

(49) Betaine (CAS: 107-43-7): A food nutrition fortifier and flavoring agent for beverages, health products, and meat products; serves as a cosmetic moisturizer, feed additive, and pharmaceutical excipient to improve drug stability.

(50) Betaine nitrate (CAS: 93778-42-8): A feed additive for livestock breeding to improve growth performance and disease resistance; also used as a chemical raw material for fine chemical product preparation.

(51) Thiotaurine (CAS: 6708-36-7): An aquatic feed additive to promote fish and shrimp growth and stress resistance; also serves as a chemical intermediate for surfactant and drug synthesis.

(52) Methyl D-mandelate (CAS: 20698-91-3): A pharmaceutical intermediate for antibacterial and antiviral drug synthesis; also serves as a fine chemical raw material for fragrance and dye preparation.

(53) Ethyl DL-mandelate (CAS: 4358-88-7): An organic synthesis intermediate for drug synthesis and fragrance preparation; also used as a fine chemical raw material in dye and cosmetic additive synthesis.

(54) D-4-Methoxymandelic acid (CAS: 20714-89-0): A pharmaceutical intermediate for cardiovascular and antibacterial drug synthesis; also serves as a fine chemical raw material for fragrance and dye preparation.

(55) p-Methoxymandelic acid (CAS: 10502-44-0): A pharmaceutical intermediate for drug synthesis and molecular modification; serves as a fine chemical raw material for fragrance and cosmetic additive preparation, and as an organic synthesis reagent.

(56) DL-Mandelic acid (CAS: 611-72-3): A pharmaceutical intermediate for antibacterial and antiviral drug synthesis; serves as a fine chemical raw material for fragrance and dye preparation, and as a chiral resolution reagent.

(57) Mandelic acid (CAS: 611-71-2): A pharmaceutical intermediate for drug synthesis and organic synthesis; serves as a fine chemical raw material for fragrance and dye preparation, and as a cosmetic additive.

(58) Mandelic acid hydrazide (CAS: 2443-66-5): An organic synthesis intermediate for drug synthesis and dye preparation; also used as a chemical

reagent for organic reaction research.

(59) L-p-Chloromandelic acid (CAS: 76496-63-4): A pharmaceutical intermediate for chiral drug synthesis and antibacterial drug preparation; serves as a fine chemical raw material for fragrance and dye synthesis.

(60) 4-Chloro-D-mandelic acid (CAS: 32189-36-9): A pharmaceutical intermediate for chiral drug synthesis and antiviral drug preparation; serves as a fine chemical raw material for organic synthesis and dye preparation.

(61) p-Chloromandelic acid (CAS: 7138-34-3): A pharmaceutical intermediate for drug synthesis and molecular modification; serves as a fine chemical raw material for fragrance and dye preparation, and as an organic synthesis reagent.

(62) L-Mandelic acid (CAS: 17199-29-0): A pharmaceutical intermediate for chiral drug synthesis and antibacterial drug preparation; serves as a fine chemical raw material for fragrance and cosmetic additive synthesis, and as a resolution reagent.

(63) R(-)-o-Chloromandelic acid (CAS: 52950-18-2): A pharmaceutical intermediate for chiral drug synthesis and antiviral drug preparation; serves as a fine chemical raw material for organic synthesis and dye preparation.

(64) D-o-Chloromandelic acid (CAS: 52950-19-3): A pharmaceutical intermediate for chiral drug synthesis and antibacterial drug preparation; serves as a fine chemical raw material for organic synthesis and fragrance preparation.

(65) DL-Phenylephrine hydrochloride (CAS: 154-86-9): A pharmaceutical raw material for vasoconstrictor and antihypertensive drug preparation, suitable for the treatment of hypotension, anaphylactic shock, and other conditions.

(66) Phenylephrine hydrochloride (CAS: 61-76-7): A pharmaceutical raw material for antihypertensive and mydriatic drug preparation, used in the treatment of hypotension, eye inflammation, etc.; also serves as an emergency drug for the auxiliary treatment of anaphylactic shock.

(67) DL-Epinephrine (CAS: 329-65-7): A pharmaceutical raw material for emergency drugs to treat cardiac arrest and anaphylactic shock; also used to relieve acute bronchial asthma attacks, with antihypertensive and bronchodilator effects.

(68) Norepinephrine hydrochloride (CAS: 329-56-6): A pharmaceutical raw material for antihypertensive drug preparation, used in the treatment of severe hypotension and septic shock; also serves as an emergency drug for the auxiliary treatment of cardiac arrest.

(69) Phenylephrine bitartrate (CAS: 17162-39-9): A pharmaceutical raw material for antihypertensive and mydriatic drug preparation, suitable for hypotension and eye examination mydriasis; also used for the auxiliary treatment of anaphylactic shock.

(70) Epinephrine hydrochloride (CAS: 55-31-2): An emergency pharmaceutical

raw material for rescuing cardiac arrest and anaphylactic shock; also used to relieve acute bronchial asthma attacks and local hemostasis, with antihypertensive and bronchodilator effects.

(71) Adrenalone (CAS: 50-22-6): A pharmaceutical intermediate for adrenaline-type drug synthesis; also serves as a biological reagent for hormone metabolism research.

(72) DL-Carnitine amide chloride (CAS: 5261-99-4): A pharmaceutical intermediate for nutrition drugs and metabolic regulation drug synthesis; also used as a fine chemical raw material for organic synthesis.

(73) L-Carnitine fumarate (CAS: 90471-79-7): A nutrition fortifier for health products and sports nutrition foods to support energy metabolism and fat breakdown; also used as a feed additive to improve livestock and poultry growth performance.

(74) DL-Carnitine (CAS: 406-76-8): A nutritional supplement for health products and food to regulate fat metabolism; serves as a feed additive to enhance growth performance and feed utilization rate of livestock, poultry and aquatic products.

(75) L-Carnitine tartrate (CAS: 36687-82-8): A nutrition fortifier for health products, sports drinks and infant foods to promote fat metabolism and energy supplementation; used as a feed additive to improve livestock and poultry growth performance.

(76) Propionyl L-carnitine hydrochloride (CAS: 119793-66-7): A pharmaceutical raw material for cardiovascular disease and male reproductive health drug preparation; serves as a health product raw material to improve energy metabolism and endurance.

(77) L-Carnitine hydrochloride (CAS: 10017-44-4): A nutrition fortifier for health products and sports nutrition foods to promote fat breakdown and energy supplementation; used as a feed additive to enhance growth performance and disease resistance of livestock, poultry and aquatic products.

(78) DL-Carnitine orotate (CAS: 32543-38-7): A nutritional supplement for health products and sports foods, combining the effects of carnitine and orotic acid to regulate metabolism and boost immunity; serves as a feed additive to improve livestock and poultry growth performance.

(79) Propionylcarnitine (CAS: 17298-37-2): A pharmaceutical raw material for auxiliary treatment drug synthesis of neurodegenerative diseases and cardiovascular diseases; serves as a health product raw material to improve energy metabolism and cognitive function.

(80) Magnesium carnitine citrate (CAS: 214708-32-4): A nutritional complex for health products to supplement carnitine and magnesium, regulating metabolism and neuromuscular function; also used as a food additive to improve nutritional ratio.

(81) Glycine propionyl carnitine hydrochloride (CAS: 423152-20-9): A health

product raw material for sports nutrition and anti-fatigue products to enhance energy metabolism and endurance; serves as a pharmaceutical intermediate for cardiovascular drug synthesis.

(82) L-Carnitine orotate (CAS: 160468-17-7): A nutrition fortifier for health products and sports foods, combining the effects of carnitine and orotic acid to promote fat metabolism and immunity enhancement; used as a feed additive to improve livestock and poultry growth performance.

(83) L-Carnitine (Feed grade, CAS: 541-15-1): A feed additive for livestock and aquatic breeding to improve feed utilization rate, promote growth and fat metabolism, and enhance meat quality.

(84) Magnesium L-carnitine citrate (CAS: 134620-06-7): A nutritional composite raw material for health products to supplement carnitine and magnesium, regulating energy metabolism and bone health; also used as a food additive to optimize nutritional structure.

III. Chelating and Related Series Products

Chelating and related products cover a diverse range of types, including natural polyphenol derivatives, organophosphate complexes, inorganic halides, etc. They integrate natural and synthetic products, as well as single-component and compound systems, capable of meeting the needs of different scenarios. These products feature prominent core characteristics: they can efficiently form stable complexes with metal ions, while possessing advantages such as flexibly adjustable chelating capacity and biodegradability of some products, balancing performance and environmental friendliness. With a wide range of applications, they not only serve people's livelihood scenarios such as food color protection, agricultural nutrition enhancement, and pharmaceutical heavy metal detoxification, but also support professional fields such as industrial water treatment anti-scaling and metallurgical metal purification, demonstrating strong functional practicality.

(85) Magnesium threonate (CAS: 778571-57-6): An organic magnesium chelate, featuring high absorption rate and low gastrointestinal irritation as basic advantages, with a key characteristic of crossing the blood-brain barrier, enabling magnesium supplementation in the brain; similar products include magnesium gluconate and magnesium lactate, suitable for magnesium nutrition supplementation in different scenarios.

(86) Small peptide chelated organic trace elements: Chelating copper, iron and other trace elements with small peptides as chelating ligands, core advantages include fast absorption rate and high bioavailability, which can quickly meet the body's demand for trace elements; similar products such as amino acid chelated copper and amino acid chelated iron are widely used in nutrition enhancement fields due to their good bioavailability.

(87) Hydroxycarboxylic acid chelating agents: Typical representatives include citric acid and gluconic acid, with molecular structures containing hydroxyl

and carboxyl groups, moderate chelating capacity and complete biodegradability, being environmentally friendly; mainly used in environmental water treatment (removing metal ions from water), agricultural soil remediation (improving the form of metal ions in soil) and other fields.

(88) Iminodisuccinic acid (IDS): An important category of hydroxycarboxylic acid chelating agents, with both hydrophilicity and coordination capacity, core characteristics include low affinity for hardness ions such as calcium and magnesium, still able to stably function in hard water environments, and certain biodegradability; suitable for water treatment, cleaning and other scenarios in hard water areas.

(89) Hydroxyethyl ethylenediaminetriacetic acid (HEDTA): A modified chelating agent formed by substituting part of the amino groups with hydroxyl groups, with moderate chelating capacity; compared with traditional EDTA, it is partially biodegradable, imposing less burden on the environment; commonly used in light industry cleaning, textile printing and dyeing (preventing metal ions from affecting dyeing effects) and other fields.

(90) Sugar alcohol chelated products: Formed by chelating sugar alcohols (mannitol, sorbitol, xylitol, glycerol) with medium and trace elements such as calcium, boron and zinc in a specific ratio, core characteristics include weak chelating stability, fast release rate of trace elements, and sugar alcohols can carry mineral nutrients to transport in the phloem of plants, enabling rapid absorption and utilization by crops; they are high-quality fast-acting foliar fertilizer raw materials in the agricultural field, with common products such as sugar alcohol calcium, sugar alcohol boron and sugar alcohol zinc.

(91) Nitrilotriacetic acid (NTA): Containing three carboxyl groups and one amino group in the molecule, with strong chelating capacity, able to efficiently chelate metal ions such as calcium, magnesium and iron; mainly used in water softening (reducing water hardness), detergent formulation (enhancing decontamination capacity), metal ion stabilizer in fertilizers (preventing nutrient failure) and other fields.

(92) Nitrilotriacetic acid (NTA): Similar chelating capacity to EDTA (ethylenediaminetetraacetic acid), with better performance in specific scenarios; for example, in metal surface treatment processes, it can efficiently clean rust and dirt on metal surfaces, while inhibiting secondary oxidation of metals, ensuring the cleanliness and stability of metal surfaces.

(93) Silicate: A typical inorganic chelating agent, represented by sodium silicate; by reacting with calcium and magnesium ions in water, it can effectively inhibit their reaction with other substances to form scale; mainly used in cooling water systems and boiler water systems as anti-scaling and corrosion-inhibiting additives to extend equipment service life.

(94) Polyphosphate: A commonly used inorganic chelating agent, representative

products include sodium tripolyphosphate and sodium hexametaphosphate; among them, sodium tripolyphosphate is widely used in the detergent industry to enhance cleaning effect by chelating calcium and magnesium ions in water; sodium hexametaphosphate is mostly used in the food industry to prevent food discoloration and deterioration caused by metal ions, extending food shelf life.

(95) Polyacrylic acid: A polymer chelating agent with a large number of carboxyl groups in the molecular chain, weak chelating capacity of a single molecule, requiring high dosage to achieve the expected effect; chelating performance can be enhanced through cross-linking modification; due to its good water solubility and metal binding capacity, it is mainly used in advanced treatment of heavy metal wastewater to adsorb residual heavy metal ions in water.

(96) Polyethyleneimine: A polymer chelating agent containing a large number of amino groups, forming stable complexes with metal ions through amino groups, with moderate chelating capacity; due to its special molecular structure, it is mainly used in special industrial fields (such as high-end material preparation) and scientific research experiments to meet the metal ion chelating needs in specific scenarios.

(97) Aminotris(methylenephosphonic acid) (ATMP): A phosphoric acid-based polymer chelating agent with good chelating capacity for metal ions such as calcium, magnesium and iron, able to effectively prevent these metal ions from depositing and scaling or causing corrosion on the surface of pipelines and equipment; widely used in industrial water treatment (such as circulating water systems), equipment maintenance and other fields.

(98) Dimercaptopropanesulfonic acid (DMSA):A clinically commonly used oral heavy metal chelating agent; the sulfhydryl groups in the molecule can specifically bind to heavy metal ions such as lead and mercury in the body to form stable and easily excreted complexes; mainly used in the treatment of heavy metal poisoning diseases such as lead poisoning and mercury poisoning, with convenient oral administration.

(99) Dimercaprol: A potent injectable heavy metal chelating agent with extremely strong chelating capacity for heavy metal ions such as mercury, arsenic and antimony; it can quickly enter the body through injection to bind with heavy metals; mainly used in emergency treatment of acute mercury poisoning and arsenic poisoning, and is an important antidote in clinical first aid.

(100) Fulvic acid: A natural humic acid organic substance with strong chelating and complexing capacity, able to form stable complexes with various metal ions (such as iron, zinc and copper) in soil; on the one hand, it improves soil structure and reduces the bioavailability of heavy metal ions; on the other hand, it can promote plants' absorption of nutrient elements; widely used as an agricultural soil amendment and crop growth promoter.

(101) 1-Hydroxyethylidene-1,1-diphosphonic acid (HEDP): A typical phosphate ester chelating agent with strong chelating capacity for metal ions such as calcium, magnesium, iron and zinc, and high temperature resistance and oxidation resistance, still able to stably function in high-temperature water environments; mainly used in anti-scaling and corrosion inhibition of industrial circulating water systems and boiler water systems, and also in metal surface treatment (such as rust removal and rust prevention).

(102) Ethylenediaminetetramethylenephosphonic acid (EDTMP): A polydentate phosphate ester chelating agent, the complexes formed by chelating metal ions have extremely high stability, especially effective for difficult-to-handle metal ions such as barium and strontium; widely used in oilfield water treatment (preventing formation scaling), advanced anti-scaling of industrial circulating water, and also has certain corrosion inhibition performance.