Application Guidelines for Ginkgo Biloba Extract in Application Fields and Addition Methods

I. Preface

Based on the physicochemical properties, stability rules and application scenarios of various industries of Ginkgo Biloba Extract (with core active ingredients such as ginkgo flavonoid glycosides and terpene lactones (ginkgolides A/B/C, bilobalide)), this guideline standardizes the addition principles, processes, dosages, operation key points and quality control of the extract in six major fields including food, feed, medicine, cosmetics, agriculture and industry, providing a standardized operational basis for large-scale production.

1.1 Basic Characteristics of Ginkgo Biloba Extract

- **Morphology**: Light yellow to tan powder (conventional extract), microcapsule/microemulsion dosage form (stabilized modification), concentrate (liquid extract), extract (semi-solid).
- **Solubility**: Conventional powder is easily soluble in hot water and ethanol (50%-70%), slightly soluble in cold water and diethyl ether; microcapsules/microemulsions are water-dispersible and suitable for various aqueous and oil-phase systems; concentrates and extracts can be directly dissolved in aqueous or ethanol phases without additional solubilization.
- **Stability**: Sensitive to heat (easy degradation above 85℃), strong light, high temperature and high humidity; most stable at pH 4.5-7.5; microcapsule embedding can significantly improve stability against high temperature, acid and alkali, and reduce the loss of flavonoid glycosides and terpene lactones; avoid long-term contact with strong oxidants, alkaline substances and metal ions.
- **Core Activities**: Antioxidation, improving blood circulation, anti-inflammation, bacteriostasis, neuroprotection, anti-aging, as well as certain flavor modification and auxiliary antiseptic effects.

1.2 General Addition Principles

1. **Dosage Form Matching**: For water-soluble systems (beverages, oral liquids, aqueous phases of skin care products), microcapsules/microemulsions/concentrates are preferred; for oil-soluble systems (greases, oil phases of creams), conventional powder pre-dissolved with ethanol or oil-soluble modified extracts are selected; for solid systems (feed, baking, powders), conventional powder or microcapsules are used to ensure uniform dispersion.

2. **Temperature Control**: Conventional addition temperature ≤65℃; for high-temperature processes (frying, baking, high-temperature sterilization), microcapsule dosage forms are preferred, or low-temperature supplementation is adopted at the later stage of the process to minimize the degradation of ginkgo flavonoid glycosides and terpene lactones.
3. **pH Adaptation**: Prioritize addition in systems with pH 4.5-7.5; stability pre-experiments shall be conducted in advance for strong acid (pH<4.0) and strong alkali (pH>8.0) systems, and buffers (citric acid-sodium citrate, sodium dihydrogen phosphate-disodium hydrogen phosphate) shall be added to adjust pH if necessary.
4. **Compatibility Contraindications**: Avoid direct mixing with strong oxidants (hydrogen peroxide, potassium permanganate) and high-concentration alkaline substances (sodium hydroxide, quicklime); contact with metal ions such as iron and copper is prone to browning, so stainless steel or food-grade plastic equipment shall be used.
5. **Flavor Masking**: At high addition levels, embedding with β-cyclodextrin or sodium octenylsuccinate starch, or compounding with sweeteners (erythritol, steviol glycosides) and natural flavors (mint, citrus extract) can be adopted to mask its natural bitter and astringent taste and slight peculiar smell.
6. **Quality Traceability**: Use extracts conforming to standards such as GB 2760 (food grade), *Catalogue of Feed Additive Varieties* (feed grade), Pharmacopoeia (pharmaceutical grade), *Safety Technical Specifications for Cosmetics* (cosmetic grade), and retain batch inspection reports (contents of flavonoid glycosides and terpene lactones, microorganisms, heavy metals, pesticide residues, solvent residues).

II. Addition Guidelines for Food Industry

2.1 Applicable Categories and Core Functions

- **Functional Beverages (ginkgo tea, compound fruit and vegetable drinks, anti-aging drinks, blood circulation-improving beverages)**: Antioxidation, supplementing plant active ingredients, focusing on anti-aging and health-preserving concepts, suitable for middle-aged and elderly people and sub-health groups.
- **Baked Foods (pastries, biscuits, bread, meal replacement bars, cereal breakfasts)**: Antioxidation, delaying product aging; functional products can enhance anti-aging and auxiliary metabolism-regulating effects, improving the nutritional value of baked foods.
- **Meat Products/Greases (sausages, marinated products, vegetable oils, fried foods)**: Antioxidation and bacteriostasis, delaying oil rancidity and oxidative browning of meat products, extending product shelf life, and improving product flavor.
- **Dairy Products/Seasonings (yogurt, milk powder, sauces, soy sauce, vinegar)**: Functional enhancement (antioxidation, auxiliary blood circulation regulation) and

flavor modification, replacing part of synthetic antioxidants and preservatives, and enhancing the natural properties of products.

2.2 Dosage Form Selection and Addition Methods

(1) Conventional Ginkgo Biloba Extract Powder (flavonoid glycosides ≥24%, terpene lactones ≥6%)

- **Application**: Baked foods, dairy products, seasonings, solid beverages, suitable for medium and low functional demand scenarios with controllable costs.
- **Addition Methods**:
  - **Solid Systems (baking, milk powder, solid beverages)**: Premix with flour, maltodextrin, whey protein and other powder raw materials (sieved through 80-100 mesh) to ensure no agglomeration, then add to the formula and stir evenly to ensure dispersibility.
  - **Liquid Systems (sauces, yogurt, liquid seasonings)**: Dissolve with purified water at 55-65℃ or 50%-60% ethanol at a material-liquid ratio of 1:5-1:10, stir for 30-40 minutes until completely dispersed, filter to remove impurities, then slowly add to the system and stir continuously for 15-20 minutes until uniform.
  - **Process Nodes**: Dough mixing stage for baking, before yogurt fermentation, late stage of sauce boiling (≤65℃); baking temperature ≤180℃, time ≤20 minutes, avoid long-term high-temperature baking.
- **Reference Dosage**: 0.03%-0.6% for baked foods; 0.15%-2.5% for dairy products; 0.08%-0.4% for seasonings; 1.5%-6% for solid beverages.

(2) Ginkgo Biloba Extract Microcapsules/Microemulsions (embedding rate ≥88%)

- **Application**: High-temperature process foods (frying, high-temperature sterilized beverages), water-soluble beverages, quick-frozen foods, scenarios requiring improved stability and dispersibility of active ingredients, suitable for high-end functional foods.
- **Addition Methods**:
  - **Beverages/Oral Liquids**: Directly add to the aqueous phase, stir for 15-20 minutes without additional solubilization; resistant to short-term sterilization at 80-100℃ (≤15 minutes), active ingredient retention rate ≥85%.
  - **Fried Foods**: Premix with grease (temperature ≤60℃), or spray after frying (spray temperature ≤50℃) to reduce the damage of high temperature to flavonoid glycosides and terpene lactones.
  - **Process Nodes**: Beverage blending stage, cooling stage after frying, before forming of quick-frozen foods; full-process temperature control ≤65℃, avoid strong light exposure.
- **Reference Dosage**: 0.08%-0.6% for functional beverages (target flavonoid glycoside content ≥20mg per serving); 0.02%-0.12% for fried foods; 0.06%-0.25% for

quick-frozen foods; the dosage can be reduced by 10%-20% compared with conventional powder.

(3) Ginkgo Biloba Extract Concentrate (flavonoid glycosides ≥5%)

- **Application**: Liquid beverages, oral liquids, sauces, scenarios requiring rapid dissolution and simplified processes, suitable for large-scale production.
- **Addition Methods**: Directly add to the aqueous phase or sauce system, stir for 10-15 minutes until uniform; can be added synchronously with sweeteners and acidity regulators, adjust pH to 5.0-7.0 to improve stability.
- **Reference Dosage**: 0.15%-1.2% for beverages; 0.6%-2.5% for oral liquids; 0.12%-0.6% for sauces.

2.3 Operation Key Points and Quality Control

1. **Temperature Control**: Conventional addition temperature ≤65℃; microcapsule dosage forms are preferred for high-temperature processes; baking temperature ≤180℃, time ≤20 minutes; fried foods shall avoid direct contact with extract above 180℃ to prevent active ingredient degradation.
2. **Uniformity**: Powder shall be sieved before premixing; liquid systems shall be fully stirred; a small amount of emulsifier (Tween-80) can be added if necessary to avoid bitter taste or uneven efficacy caused by excessive local concentration.
3. **Antioxidant Synergy**: Compounding with vitamin C, citric acid and vitamin E can enhance antioxidant effect and prevent extract browning, with compounding dosage of 0.01%-0.04%.
4. **Flavor Balance**: When addition amount >0.4%, compound with sweeteners or natural flavors to mask bitter and astringent taste and slight peculiar smell, improving product palatability; acidity of liquid beverages can be adjusted appropriately to neutralize peculiar smell.
5. **Compliance**: Strictly follow GB 2760; as a homologous material of medicine and food, Ginkgo Biloba Extract shall be used appropriately according to production needs; functional addition shall comply with relevant regulations for health foods, with clear labeling of flavonoid glycoside and terpene lactone contents.

III. Addition Guidelines for Feed Industry

3.1 Applicable Categories and Core Functions

- **Livestock and Poultry Feed (pigs, chickens, ducks, geese)**: Improve immunity and blood circulation, inhibit bacteria and stop diarrhea, replace part of antibiotics, improve meat quality, reduce stress response of livestock and poultry, and enhance production performance.
- **Aquatic Feed (fish, shrimp, crabs)**: Anti-stress, bacteriostasis, promote growth, reduce feed coefficient, improve survival rate and meat texture of aquatic animals,

and enhance intestinal health of aquatic animals.

- **Ruminant Feed (cattle, sheep)**: Regulate rumen microbial balance, improve feed conversion rate, enhance production performance of ruminants, and strengthen stress resistance.

3.2 Dosage Form Selection and Addition Methods

(1) Feed-grade Ginkgo Biloba Extract Powder (flavonoid glycosides ≥10%, terpene lactones ≥3%)

- **Application**: Formula feed, premix, concentrate feed, suitable for conventional livestock, poultry and aquatic feed scenarios with high cost performance.
- **Addition Methods**:
  - Adopt stepwise dilution method (10×→100×→1000×); first mix with vitamin and mineral premix (premix ratio 1:5-1:10), stir evenly, then add to basic feed and mix continuously for 20-30 minutes.
  - **Process Nodes**: Feed mixing stage (normal temperature, ≤35℃), avoid high-temperature granulation; if granulation is required, granulation temperature ≤70℃, post-spraying process is preferred.
- **Reference Dosage**: 0.06%-0.12% for piglets; 0.04%-0.09% for finishing pigs; 0.05%-0.10% for broilers/layers; 0.06%-0.15% for aquatic animals; 0.08%-0.15% for ruminants.

(2) Ginkgo Biloba Extract Microcapsules (embedding rate ≥88%)

- **Application**: High-temperature granulated feed, water-resistant aquatic feed, scenarios requiring improved high-temperature stability and active ingredient utilization rate, suitable for large-scale and intensive breeding.
- **Addition Methods**: Directly add to mixer, or spray after granulation (spray temperature ≤50℃) to avoid damage of flavonoid glycosides and terpene lactones by high granulation temperature, ensuring active ingredient utilization rate ≥80%.
- **Reference Dosage**: Same as conventional powder; microcapsules have higher active ingredient utilization rate, so dosage can be reduced by 10%-20%, adjusted appropriately according to breeding animal species and growth stages.

3.3 Operation Key Points and Quality Control

1. **Uniformity**: Stepwise dilution must be strictly implemented; it is forbidden to directly add high-concentration extract to a large amount of feed to prevent excessive local concentration from affecting palatability or causing animal discomfort (e.g., diarrhea, decreased feed intake).

2. **Temperature Control**: Granulation temperature ≤70℃, post-spraying process shall be adopted if exceeded; storage temperature ≤25℃, sealed and protected from light to prevent active ingredient degradation and avoid high-temperature and high-humidity environment.
3. **Compatibility Safety**: Synergistic use with probiotics and enzyme preparations can improve intestinal health effect and feed conversion rate; avoid direct mixing with strong alkaline additives (quicklime) to prevent active ingredient failure.
4. **Effect Verification**: Regularly detect residual contents of flavonoid glycosides and terpene lactones in feed, monitor intestinal flora and growth performance (daily weight gain, feed-weight ratio) of livestock and poultry; survival rate and feed coefficient shall be detected for aquatic feed, and addition amount shall be optimized according to test results.
5. **Compliance**: Use feed-grade Ginkgo Biloba Extract conforming to *Catalogue of Feed Additive Varieties*, retain manufacturer qualifications and batch inspection reports; it is strictly prohibited to use pharmaceutical-grade or industrial-grade extracts as substitutes.

IV. Addition Guidelines for Pharmaceutical/Healthcare Products Industry

4.1 Applicable Categories and Core Functions

- **Medicines**: Blood circulation-improving drugs, anti-inflammatory preparations, neuroprotective drugs, external ointments, core effects of improving blood circulation, anti-inflammation, bacteriostasis and neuroprotection, used for adjuvant treatment of cardiovascular and cerebrovascular diseases, inflammation relief, etc.
- **Healthcare Products**: Anti-aging, blood circulation-improving, metabolism-regulating and immune-regulating products (capsules, tablets, powders, oral liquids, granules), suitable for middle-aged and elderly people and sub-health groups.

4.2 Dosage Form Selection and Addition Methods

(1) Pharmaceutical-grade Ginkgo Biloba Extract Powder (flavonoid glycosides ≥24%, terpene lactones ≥6%, purity ≥98%)

- **Application**: Capsules, tablets, granules, external ointments, suitable for pharmaceutical preparations and high-end healthcare products with high purity and stable active ingredients.
- **Addition Methods**:
    - **Capsules/Tablets**: Mix with microcrystalline cellulose, lactose and magnesium stearate, adopt dry/wet granulation (granulation temperature ≤50℃), tableting or capsule filling; mixing uniformity complies with GMP specifications.

  - **External Ointments**: Mix with petrolatum, lanolin and glycerin, prepare by low-temperature emulsification (≤45℃) to ensure uniform dispersion of extract without agglomeration, emulsification time 15-20 minutes.
  - **Process Nodes**: Preparation mixing stage, late emulsification stage; avoid high temperature and strong light to prevent active ingredient degradation, and operate in a clean environment throughout the process.
- **Reference Dosage**: 300-800mg Ginkgo Biloba Extract per capsule (flavonoid glycosides ≥72mg, terpene lactones ≥18mg); 200-500mg extract per tablet; 1.5%-6% for external ointments.

(2) Pharmaceutical-grade Ginkgo Biloba Extract Concentrate (flavonoid glycosides ≥10%)

- **Application**: Oral liquids, injections (auxiliary raw materials), scenarios requiring rapid dissolution and high active ingredient content, suitable for liquid pharmaceutical preparations and healthcare products.
- **Addition Methods**:
  - **Oral Liquids**: Dissolve in warm water (40-50℃), add sweeteners and stabilizers (xanthan gum, sodium carboxymethyl cellulose), adjust pH to 5.0-6.5, aseptically filter and fill to ensure sterility.
  - **Injections**: Adopt ethanol solubilization (ethanol concentration 30%-50%), adjust pH to 5.0-6.5, aseptically filter, comply with GMP specifications, and strictly control impurity content.
- **Reference Dosage**: Daily intake of oral liquid 10-25mL (containing 0.6%-2.5% extract); added according to prescription dosage for injections (in accordance with pharmacopoeia and drug production standards).

(3) Stabilized Ginkgo Biloba Extract (flavonoid glycosides ≥15%, modified by embedding)

- **Application**: Long-term healthcare products, high-temperature sterilized preparations (canned healthcare products), with excellent stability, no obvious bitter and astringent taste, and high bioavailability.
- **Addition Methods**: Same as water-soluble powder; resistant to short-term sterilization at 100℃ (≤15 minutes), no additional flavor masking required, can be directly mixed with other raw materials.
- **Reference Dosage**: Daily extract intake 600-1200mg, converted addition amount according to product specifications, ensuring daily flavonoid glycoside intake ≥144mg.

4.3 Operation Key Points and Quality Control

1. **GMP Specifications**: Production environment cleanliness Grade D or above, special equipment to avoid cross-contamination; operators shall meet pharmaceutical production employment requirements, wear clean clothes and gloves, and strictly implement aseptic operations.
2. **Stability**: High-purity extracts shall be stored in light-proof, sealed and low-temperature (2-8℃) conditions; stabilized dosage forms can be stored at room temperature with shelf life ≥24 months; regularly detect active ingredient content during storage to ensure compliance with standards.
3. **Content Control**: Detect contents of ginkgo flavonoid glycosides (HPLC method) and terpene lactones (HPLC method) for each batch, deviation ≤±5%; pharmaceutical-grade extracts shall be tested for heavy metals (Pb≤2mg/kg, As≤1mg/kg, Hg≤0.1mg/kg), microorganisms (sterility/limit test), solvent residues (ethanol≤0.5%), complying with pharmacopoeia standards.
4. **Safety**: Avoid excessive combined use with anticoagulant drugs (warfarin, aspirin) to prevent bleeding risk; clearly specify inappropriate groups (pregnant women, lactating women, children, patients with hemorrhagic diseases) in product instructions.
5. **Efficacy Verification**: Healthcare products shall complete animal experiments and human food trials to ensure anti-aging and blood circulation-improving effects meet standards; drugs shall comply with pharmacopoeia standards and complete clinical verification to ensure efficacy and safety.

V. Addition Guidelines for Cosmetics Industry

5.1 Applicable Categories and Core Functions

- **Skin Care Products**: Antioxidation, anti-aging, soothing sensitivity, improving skin dullness, lightening fine lines (creams, essences, facial masks, toners, emulsions), enhancing skin luster and elasticity, suitable for all skin types.
- **Hair Care Products**: Nourish scalp, inhibit bacteria and control oil, reduce hair loss, improve dry hair (shampoos, conditioners, scalp essences), enhance hair smoothness and relieve scalp sensitivity.
- **Makeup Products**: Natural antioxidation and antiseptic (lipsticks, foundations, eye shadows), extending makeup shelf life, reducing the use of chemical preservatives and lowering skin irritation risk.

5.2 Dosage Form Selection and Addition Methods

(1) Cosmetic-grade Ginkgo Biloba Extract Powder (flavonoid glycosides ≥5%, non-irritating modification)

- **Application**: Creams, emulsions, shampoos, conditioners, suitable for mid-to-low end skin care and hair care products with controllable costs and high safety.
- **Addition Methods**:
  - **Oil-phase Systems (creams, emulsions)**: After oil phase preparation, cool to 45-50℃, add extract dissolved in aqueous phase, homogenize for 3-5 minutes (rotating speed 2000-3000r/min) to ensure uniform dispersion.
  - **Aqueous-phase Systems (shampoos, toners)**: Pre-dissolve with propylene glycol and glycerin, add to aqueous phase (≤40℃), stir for 20-30 minutes until uniform; a small amount of solubilizer can be added to improve solubility.
  - **Process Nodes**: Late emulsification stage, batching stage; avoid high temperature (>50℃) causing active ingredient degradation, and operate in light-proof environment throughout the process.
- **Reference Dosage**: 0.15%-3.5% for skin care products (anti-aging essence ≥2.5%); 0.6%-2.5% for shampoos; 0.15%-2.5% for mask essence; 0.5%-2% for conditioners.

(2) Ginkgo Biloba Extract Microemulsion/Nanoemulsion (water-soluble, easily absorbable)

- **Application**: Essences, toners, facial masks, high-end hair care products, scenarios requiring improved skin absorption efficiency and enhanced efficacy, suitable for high-end cosmetics.
- **Addition Methods**: Directly add to aqueous phase and stir evenly without additional solubilization; with strong stability, can be compounded with hyaluronic acid, ceramide and vitamin E to enhance anti-aging and soothing effects.
- **Reference Dosage**: Same as conventional powder; microemulsion has higher bioavailability, so dosage can be reduced by 20%-30%, adjusted according to product efficacy positioning.

5.3 Operation Key Points and Quality Control

1. **Irritation Control**: Cosmetic-grade extracts shall remove bitter and irritating ingredients, or control addition amount ≤3.5% to avoid mucosal irritation; addition amount ≤0.8% for sensitive skin products, skin irritation test (patch test) shall be conducted in advance to ensure no irritation.
2. **Compatibility Safety**: Avoid direct mixing with high-concentration vitamin C and fruit acids to prevent oxidative decomposition; compounding with niacinamide, vitamin E and hyaluronic acid can synergistically enhance antioxidant, anti-aging and soothing effects.
3. **Stability**: Add antioxidants (vitamin E, BHT), store products in light-proof and sealed conditions to prevent oxidation and browning of active ingredients; regularly

detect product stability to ensure stable efficacy within shelf life.

4. **Compliance**: Comply with *Safety Technical Specifications for Cosmetics*, test heavy metals, microorganisms and irritation, no prohibited ingredients; label "Ginkgo Biloba Extract" and addition amount; flavonoid glycoside content shall be labeled if efficacy is claimed.
5. **Efficacy Verification**: Complete in vitro antioxidant, anti-aging and cytotoxicity tests to ensure product safety and effectiveness; skin care products shall conduct human skin efficacy tests to verify anti-aging and soothing effects.

VI. Addition Guidelines for Agriculture Industry

6.1 Applicable Scenarios and Core Functions

- **Pesticides**: Control bacterial and fungal diseases (citrus canker, cucumber powdery mildew, rice sheath blight, tomato gray mold), as natural bacteriostats, reduce the use of chemical pesticides and lower pesticide residues.
- **Fertilizers/Soil Treatment**: Improve soil, inhibit soil-borne diseases, promote crop root growth, enhance crop stress resistance (drought resistance, disease and pest resistance, lodging resistance), improve crop quality and yield.
- **Seed Treatment**: Sterilize, promote germination, improve emergence rate, enhance seedling stress resistance, reduce seedling diseases.

6.2 Dosage Form Selection and Addition Methods

(1) Ginkgo Biloba Extract Microemulsion (6%, complying with agricultural industry standards)

- **Application**: Foliar spraying, root irrigation, soil treatment, suitable for disease control and growth regulation of various crops, with good dispersibility and quick effect.
- **Addition Methods**:
    - **Foliar Spraying**: Dilute 600-1200 times, spray at the early stage of disease, evenly cover leaf backs and stems, interval 7-10 days, apply 2-3 times continuously; dilution ratio can be adjusted according to disease severity.
    - **Root Irrigation**: Dilute 400-800 times, irrigate 500-1000ml per plant to control soil-borne diseases such as bacterial wilt and root rot, interval 10-15 days, irrigate 2 times continuously.
    - **Soil Treatment**: Dilute 300-500 times, flush with water or mix with soil and broadcast, dosage 40-60ml/mu, improve soil environment and inhibit soil-borne

diseases.

- **Reference Dosage**: 40-60ml/mu of 6% microemulsion for foliar spraying; dosage for root irrigation and soil treatment can be increased appropriately, adjusted according to crop species and soil conditions.

(2) Ginkgo Biloba Extract Powder/Granules

- **Application**: Soil treatment, seed dressing, suitable for large-scale agricultural production scenarios, convenient for use and storage.
- **Addition Methods**:
  - **Seed Dressing**: Mix powder with seeds at a ratio of 1:50-1:100, stir evenly and dry in shade (avoid exposure), then sow to improve seed germination rate and stress resistance.
  - **Soil Broadcasting**: Mix granules with fine soil, broadcast evenly and tillage, dosage 1.5-2.5kg/mu, inhibit soil-borne diseases and improve soil structure.
- **Reference Dosage**: 0.6%-1.2% for seed dressing; 1.5-2.5kg/mu for soil broadcasting, adjusted according to crop species and planting density.

6.3 Operation Key Points and Quality Control

1. **Application Timing**: Prevention-oriented, apply at the early stage of disease; avoid application under high temperature (>35℃) and strong light, the best time is early morning or evening to reduce active ingredient degradation and improve efficacy.
2. **Compounding Synergy**: Compounding with kasugamycin and copper preparations can reduce chemical pesticide dosage by 30%-50% and improve control effect by more than 20%; compounding with organic fertilizers can enhance soil improvement effect.
3. **Safety Interval**: 7-10 days for vegetables, 15-20 days for fruit trees, 10-15 days for food crops; avoid excessive pesticide residues, and strictly comply with safety interval requirements before harvest.
4. **Compliance**: Use registered pesticide-grade Ginkgo Biloba Extract complying with *Regulations on Pesticide Administration*, retain registration certificates and batch inspection reports; it is strictly prohibited to use non-agricultural-grade extracts.
5. **Storage**: Microemulsion shall be sealed and stored in a cool place, avoid exposure and high temperature; powder/granules shall be moisture-proof and anti-caking, stored in a dry and ventilated place, shelf life ≥12 months.

VII. Addition Guidelines for Industry

7.1 Applicable Scenarios and Core Functions

- **Water Treatment**: Sterilization and algae removal for industrial circulating water and heating pipe networks, inhibit microbial growth, replace part of chemical fungicides (such as chlorine preparations) and reduce water pollution.
- **Leather/Papermaking/Textile**: Anti-mildew, antiseptic and antibacterial, extend product shelf life, improve product durability and quality of leather, paper and textiles.
- **Coatings/Plastics**: Natural antioxidation and bacteriostasis, improve product weather resistance, reduce the use of chemical additives and slow down product aging.

7.2 Dosage Form Selection and Addition Methods

(1) Ginkgo Biloba Extract Antiseptic Solution (oil-soluble/water-soluble)

- **Application**: Leather tanning, papermaking pulp, textile dyeing and finishing, coating formulations, core antiseptic and bacteriostatic effects, suitable for large-scale industrial production.
- **Addition Methods**:
    - **Leather**: Add to tanning solution, dosage 0.15%-0.6%, soak for 24-48 hours, stir evenly to improve leather antibacterial property and durability, prevent mildew.
    - **Papermaking**: Add to pulp, dosage 0.15%-1.2%, stir evenly before papermaking to prevent paper mildew and moth-eaten, extend paper shelf life.
    - **Coatings**: Add to formula, dosage 0.15%-0.6%, mix at room temperature, stir for 15-20 minutes until uniform to improve coating weather resistance and bacteriostasis.
- **Reference Dosage**: 0.15%-0.6% for leather; 0.15%-1.2% for papermaking; 0.15%-0.6% for coatings, adjusted according to product antiseptic requirements.

(2) Ginkgo Biloba Extract Antioxidant (powder/oily)

- **Application**: Plastics, rubber, grease industry, replace part of synthetic antioxidants (such as BHT, BHA), delay product aging and improve service life.
- **Addition Methods**: Premix with raw materials, add at extrusion/injection molding/refining stage, stir evenly to ensure dispersibility, avoid excessive local concentration affecting product quality.
- **Reference Dosage**: 0.02%-0.6%, adjusted according to product antioxidant requirements; dosage can be increased appropriately for grease industry.

(3) Ginkgo Biloba Extract Water Treatment Agent

- **Application**: Industrial circulating water, heating pipe networks, sterilization and algae removal, inhibit microbial growth, prevent pipeline blockage and corrosion.
- **Addition Methods**: 30-120g per ton of water, dissolve in warm water and add to the system at one time; supplement proportionally during water replenishment to ensure stable concentration, regularly detect water microbial content and adjust addition amount.
- **Operation Key Points**: Sealed operation, avoid direct inhalation and skin contact; store in a cool and ventilated place to prevent leakage and deterioration.

7.3 Operation Key Points and Quality Control

1. **Concentration Control**: Precisely add according to process requirements, avoid excessive dosage causing odor residue and cost increase, or insufficient dosage affecting antiseptic and antioxidant effects; regularly detect extract residue in products to optimize addition parameters.
2. **Equipment Protection**: Use stainless steel and plastic equipment, avoid contact with metals such as copper and iron to prevent extract browning and failure, and avoid equipment corrosion.
3. **Environmental Protection Requirements**: Industrial wastewater shall be discharged after treatment in compliance with environmental protection standards; leather, papermaking and other industries shall ensure extract residues comply with industry specifications to avoid environmental pollution.
4. **Stability**: Industrial extracts shall be stored in a cool and dry place, sealed and moisture-proof, avoid high temperature and strong light, shelf life ≥12 months; regularly detect active ingredient content during storage to ensure compliance with use requirements.

VIII. Storage and Transportation Specifications

1. **Storage Conditions**: Sealed, light-proof, cool and dry place, temperature ≤25℃, humidity ≤60%; high-purity pharmaceutical-grade extracts shall be refrigerated at 2-8℃; microcapsule and microemulsion dosage forms can be stored at room temperature, avoid high-temperature and high-humidity environment. Shelf life of conventional powder ≥24 months, shelf life of concentrates, microemulsions and antiseptic solutions ≥12 months.
2. **Packaging Requirements**: Powder packed in aluminum foil bags and cardboard drums lined with polyethylene bags, moisture-proof and leak-proof; concentrates and microemulsions packed in fluorinated barrels and aluminum cans; industrial antiseptic solutions packed in corrosion-resistant plastic drums or iron drums; all packages shall be labeled with product name, specification, active ingredient content, batch number, production date and shelf life.
3. **Transportation Requirements**: Avoid exposure, rain and high temperature; liquid extracts (concentrates, microemulsions, antiseptic solutions) shall be operated in

accordance with liquid cargo transportation specifications to prevent leakage; prohibited from mixed transportation with toxic and harmful substances, strong oxidants and alkaline substances, keep ventilation during transportation.

4. **Batch Management**: Label production date, shelf life, active ingredient content and batch number for each batch, implement the first-in first-out principle, retain use records and inspection reports of each batch for traceability.

IX. Quality Inspection and Abnormality Handling

9.1 Mandatory Inspection Items

- **Content Detection**: Ginkgo flavonoid glycosides (HPLC method), terpene lactones (HPLC method), implemented in accordance with corresponding industry standards to ensure active ingredient content meets standards.
- **Physicochemical Indicators**: Moisture, ash, pH, solubility, heavy metals (lead, arsenic, mercury), solvent residues (ethanol, methanol), pesticide residues (food/pharmaceutical/agricultural grade), complying with corresponding national/industry standards.
- **Microbial Indicators**: Total bacterial count, mold, yeast, pathogenic bacteria (food/pharmaceutical/cosmetic grade), complying with corresponding national/industry standards; industrial-grade extracts shall be tested for microbial limit to avoid contamination.
- **Stability**: Accelerated test (40℃, 75% RH), detect active ingredient retention rate to ensure stable product efficacy within shelf life, retention rate ≥80%.

9.2 Abnormality Handling

1. **Active Ingredient Degradation**: Causes (high temperature, light, inappropriate pH, mixing with contraindicated substances); Treatments (adjust addition temperature to ≤65℃, light-proof storage, adjust pH to 4.5-7.5, replace stabilized dosage forms, avoid contact with strong oxidants and alkaline substances).
2. **Poor Uniformity**: Causes (no premixing, improper dilution, insufficient stirring); Treatments (stepwise dilution after powder sieving, increase stirring time and rotating speed, use emulsifiers or dispersants to ensure uniform dispersion).
3. **Abnormal Flavor/Odor (bitterness, peculiar smell)**: Causes (excessive addition amount, no flavor masking, insufficient extract purity); Treatments (reduce dosage, microcapsule embedding, compound with sweeteners/flavors, replace high-purity extracts).
4. **Compatibility Failure**: Causes (mixing with strong oxidants and alkaline substances); Treatments (adjust formula addition sequence, add contraindicated ingredients separately, replace compatible raw materials to avoid direct contact).

5. **Product Browning**: Causes (contact with metal ions, high temperature, light); Treatments (use stainless steel/plastic equipment, reduce processing temperature, light-proof storage, add antioxidants to inhibit browning).

X. Supplementary Provisions

1. This guideline is a professional operation specification; enterprises can optimize and adjust addition amount and process parameters according to their own product characteristics, process equipment, regulatory requirements, combined with laboratory and pilot tests to ensure product quality and efficacy.
2. The optimal range of Ginkgo Biloba Extract addition amount shall be determined through laboratory tests, and large-scale production shall be carried out after verifying stability and efficacy via pilot tests to avoid batch quality problems and reduce production costs.
3. Matters not covered in this guideline shall be implemented in accordance with relevant national standards, regulations and product instructions of Ginkgo Biloba Extract manufacturers.