Operational Guidelines for the Application Methods of Ginger Extract

I. Overview of Ginger Extract: Characteristics and Application Advantages

1.1 Chemical Composition and Physicochemical Properties

Ginger Extract is mainly derived from the dried rhizome of *Zingiber officinale Rosc.* (Zingiberaceae). Its core active components include gingerols (gingerol, curcumin, shogaol, zingerone), volatile oils (zingiberene, gingerol, citral), phenolic acids, and polysaccharides. Industrial production mainly adopts solvent extraction (water extraction, ethanol extraction) and supercritical CO_2 extraction, complying with GB 2760 *National Food Safety Standard - Standards for the Use of Food Additives*, *Safety and Technical Specifications for Cosmetics* (2022 Edition), and relevant specifications for health food raw materials. Its composition endows the following core physicochemical properties:

1.1.1 Physical Properties

Normally a light yellow to tan powder (or light yellow viscous liquid) with a strong inherent pungent aroma of ginger, no off-flavors or impurities; good water solubility (solubility of powder ≥25g/100mL at 25℃); liquid extract can be directly miscible with polar solvents such as water, ethanol, and propylene glycol, and a small amount of precipitation can be eliminated by homogenization; bulk density of powder is 0.45-0.65g/cm³ with medium fluidity, and dispersibility and fluidity can be significantly improved after compounding with carriers such as maltodextrin and microcrystalline cellulose; particle size is mostly 80-120 mesh, which can be uniformly dispersed in solid, liquid and semi-solid systems with little impact on product appearance and texture, and can impart a natural light yellow color in liquid systems.

1.1.2 Chemical Stability

Optimal stability in the pH range of 4.0-7.0, with the highest retention rate of active components in neutral to weakly acidic environments (pH 5.0-6.0); more than 80% of gingerols can be retained after heating at 90℃ for 30 minutes; gingerols are prone to degradation in alkaline environments (pH > 7.5), resulting in weakened pungent aroma and reduced efficacy, and temperature should be controlled ≤70℃; prolonged heating at high temperatures (> 100℃) accelerates volatilization and degradation of gingerols and volatile oils, so it is recommended to shorten high-temperature residence time during processing; good compatibility with common food and cosmetic additives (preservatives, emulsifiers, pigments) without antagonism; avoid contact with strong oxidants and heavy metal ions to prevent oxidative failure of active components, and avoid long-term coexistence with alkaline substances.

1.1.3 Hygroscopicity and Storage Characteristics

The critical relative humidity of powdered ginger extract is 70%, with medium hygroscopicity at room temperature; it is prone to moisture absorption and caking when ambient humidity > 70%, affecting dispersibility and fluidity; liquid extract contains many volatile oil components, which are easy to volatilize leading to aroma loss and oxidative browning, requiring sealed, light-proof and low-temperature storage; overall sensitive to light, heat and oxygen; long-term exposure to ultraviolet or high-temperature environments will cause gingerol degradation, weakened pungent aroma and deepened color, so light-proof and antioxidant measures should be taken, and sealed storage to reduce volatilization.

1.2 Efficacy and Application Value

Ginger extract has multiple effects such as warming the middle energizer to dispel cold, anti-inflammation, analgesia, anti-oxidation, digestion promotion and skin soothing, making it a high-quality functional raw material for food, cosmetics, health products, medicine and other fields. The core efficacies are as follows:

1.2.1 Skin Care Efficacy

Gingerols have strong anti-inflammatory and analgesic effects, relieving skin redness, swelling and stinging, assisting in repairing skin barrier, suitable for sensitive skin and acne-prone skin; volatile oil components promote skin blood circulation, improving dull complexion and poor qi and blood, assisting in brightening skin tone; antioxidant components scavenge free radicals, inhibit skin lipid oxidation and delay skin aging; meanwhile, it has mild bacteriostatic effect, assisting in improving skin acne problems, suitable for all skin types, especially sensitive skin, acne-prone skin and dull skin.

1.2.2 Health Care Efficacy

Synergistic effect of gingerols and volatile oils can warm the middle energizer to dispel cold, promote gastrointestinal peristalsis, improve problems such as deficiency-cold of spleen and stomach, indigestion and loss of appetite; inhibit the release of inflammatory factors, with anti-inflammatory and analgesic effects, assisting in relieving joint pain and muscle soreness; meanwhile, it has anti-oxidation and blood lipid regulation effects, assisting in reducing blood viscosity and improving vascular elasticity (intake should be controlled); polysaccharide components enhance body immunity, improve macrophage activity and strengthen body resistance.

1.2.3 Food Functional Properties

It can be used as a natural food additive with flavoring, fresh-keeping and anti-oxidation functions; its unique pungent aroma improves food taste and endows products with natural ginger flavor; gingerols have certain bacteriostatic effect, prolonging food shelf life, suitable for the development of condiments, convenience foods and functional

beverages; meanwhile, it can be used as a natural colorant, endowing food with natural light yellow color, in line with the trend of natural and healthy food.

1.2.4 Medical Auxiliary Efficacy

As a pharmaceutical excipient or auxiliary component, it has the effects of warming the middle energizer to dispel cold, anti-inflammation, analgesia and antiemesis, and can be used in auxiliary treatment preparations for deficiency-cold of spleen and stomach, cold and fever, nausea and vomiting; in oral preparations, it can assist in regulating gastrointestinal function and improve patient tolerance, complying with pharmaceutical-grade excipient standards; in external preparations, it can assist in relieving muscle pain, joint inflammation and skin discomfort.

1.3 Main Application Fields

Relying on the above characteristics and efficacies, ginger extract has been widely used in many fields, and the core application scenarios include:

1.3.1 Cosmetics Field

Covering skin care products (toner, essence, emulsion, cream, facial mask, body lotion), makeup (lipstick, blush, eye shadow), personal washing products (shampoo, hair conditioner, body wash), focusing on anti-inflammatory soothing, skin brightening and barrier repair effects, suitable for all skin types, especially sensitive skin, acne-prone skin and dull skin.

1.3.2 Food Industry

Including condiments (soy sauce, vinegar, sauces, hot pot base), beverages (ginger tea, functional drinks, fruit-flavored drinks, alcoholic beverages), baked goods (bread, cake, biscuits, pastries), convenience foods (instant noodles, self-heating foods, frozen foods), dairy products (yogurt, milk drinks, cheese), with flavoring, fresh-keeping and functional properties, adapting to the trend of mass food and healthy food.

1.3.3 Health Products Field

As a functional component, used in capsules, tablets, granules, oral liquids, solid drinks and other dosage forms, focusing on warming the middle energizer to dispel cold, promoting digestion, anti-inflammation, analgesia and enhancing immune function, and can be compounded with probiotics, vitamins, dietary fiber to improve efficacy.

1.3.4 Medical Field

As an excipient for external preparations (such as analgesic ointment base, skin repair preparations), auxiliary component of oral preparations, or used in foods for special medical purposes, assisting in improving gastrointestinal function, relieving muscle and joint pain and enhancing immunity.

1.3.5 Other Fields

Including feed additives (improving gastrointestinal function of livestock and poultry, enhancing immunity, improving meat flavor), daily necessities (toothpaste, mouthwash, assisting in oral cleaning and relieving oral inflammation), pet food (improving pet gastrointestinal function and enhancing immunity).

II. Application in Cosmetics Field: Production Process and Precautions

The core functions of ginger extract in cosmetics are anti-inflammatory soothing, skin brightening and barrier repair, suitable for various dosage forms. The key is to control addition temperature and pH value, avoid volatilization and degradation of active components (gingerols, volatile oils), ensure product safety, efficacy and stability, while retaining its natural ginger aroma and color.

2.1 Application in Skin Care Products (Toner, Essence, Emulsion, Cream, Facial Mask)

2.1.1 Production Process

Toner / Essence

1. Pretreatment: Put purified water, glycerin (4%-7%), propylene glycol (2%-4%) into the mixing tank, stir at 55-65℃ for 10-15 minutes to dissolve evenly, then cool to below 45℃;
2. Addition of ginger extract: Add ginger extract (addition amount 2%-6%), stir for 20-25 minutes (rotating speed 400-500rpm) to ensure uniform dispersion without particles or precipitation; a small amount of precipitation can be removed by filtration with 0.22μm filter membrane;
3. Mixing and filtration: Add preservative (phenoxyethanol, 0.3%-0.5%), essence (0.1%-0.2%), adjust pH to 5.0-6.0, filter with 0.22μm filter membrane to remove impurities and micro-particles;
4. Filling: Fill into glass or plastic bottles in a sterile environment, seal and store in light-proof conditions.

Emulsion / Cream

1. Water phase preparation: Purified water, ginger extract (3%-8%), hyaluronic acid (0.1%-0.3%), glycerin, stir and dissolve at 60-65℃, keep warm for standby (temperature maintained at about 60℃);
2. Oil phase preparation: Squalane, stearic acid, emulsifier (Tween-80, 2%-3%), lanolin (1%-2%), heat and melt at 65-70℃, stir evenly and keep warm for standby;

3. Emulsification: Slowly pour oil phase into water phase, stir at high speed (1500-2000rpm) for 15-20 minutes, maintain emulsification temperature at 60-65℃ to ensure uniform emulsification without layering;
4. Cooling and mixing: Cool to below 45℃, add preservative, essence, antioxidant (vitamin E, 0.1%-0.2%), stir for 10-15 minutes, adjust pH to 5.0-6.5, continue cooling to room temperature;
5. Filling: Sterile filling into hoses or glass bottles, sealed packaging and light-proof storage.

Facial Mask (Sheet / Wash-off)

1. Sheet mask: Purified water, ginger extract (5%-15%), glycerin, xanthan gum (0.2%-0.4%), stir and dissolve at 45-55℃, add preservative, essence, panthenol (0.5%-1%), adjust pH to 5.0-6.0, filter and pour into mask cloth, vacuum sealed packaging;
2. Wash-off mask: Ginger extract (8%-20%), vaseline (4%-8%), emulsifier, glycerin, emulsify at 55-60℃, cool to below 35℃, add thickener (sodium carboxymethyl cellulose, 0.3%-0.5%), antioxidant, stir evenly and fill into hoses or wide-mouth bottles.

2.1.2 Precautions

1. Temperature control: Ginger extract should be added below 45℃ to avoid gingerol degradation and volatile oil loss caused by high temperature, losing anti-inflammatory soothing effect and natural ginger aroma; emulsification temperature should not exceed 70℃ to prevent further oxidation and volatilization of active components;
2. pH adaptation: The optimal pH range for skin care products is 5.0-6.5, which can maximize gingerol activity and avoid skin irritation; stability test should be conducted in advance for alkaline (pH > 7.5) systems, and citric acid can be added to adjust pH if necessary;
3. Addition amount control: 2%-8% for ordinary skin care products, 3%-6% for sensitive skin-specific products to avoid skin stinging and redness due to excessive addition; addition amount can be appropriately increased in facial masks (5%-15%), but soothing ingredients such as panthenol and dipotassium glycyrrhizinate should be matched to reduce irritation;
4. Antiseptic and antioxidant: Ginger extract contains natural phenols and volatile oils, easy to breed microorganisms, so sufficient preservatives must be added; meanwhile, antioxidants (vitamin E, tea polyphenols, 0.1%-0.2%) must be added to delay gingerol oxidation and volatile oil loss, preventing product efficacy decline and aroma weakening;
5. Skin type adaptation: Low-sensitization ginger extract (desensitized) should be selected for sensitive skin products, avoiding irritating ingredients such as alcohol and

essence; addition amount can be appropriately increased for acne-prone skin products, matched with acne-removing ingredients such as salicylic acid and tea tree oil to synergistically improve effect;

6. Aroma and color control: Ginger extract has natural ginger aroma, excessive addition may lead to too strong aroma affecting product experience; addition amount can be adjusted according to product needs, or neutralized with light fragrance essence; its light yellow color has little impact on product appearance, and addition amount can be adjusted according to product tone requirements.

2.2 Application in Personal Washing Products (Shampoo, Hair Conditioner, Body Wash)

2.2.1 Production Process

Shampoo

1. Pretreatment: Purified water, sodium laureth sulfate (AES, 14%-19%), cocamidopropyl betaine (CAB, 4%-7%), stir and dissolve at 55-60℃ to form a basic system, cool to below 45℃;
2. Addition of ginger extract: Add ginger extract (3%-8%), stir for 20-25 minutes, add humectant (panthenol, 2%-3%), hair care ingredients (hydrolyzed keratin, 0.5%-1%);
3. Mixing: Adjust pH to 5.5-6.5, add preservative, essence, thickener (hydroxyethyl cellulose, 0.3%-0.5%), stir evenly to ensure no particles or layering in the system;
4. Filtration and filling: Filter with 100-mesh sieve to remove impurities, sterile filling into plastic bottles, sealed packaging.

Hair Conditioner

1. Basic system preparation: Purified water, cetearyl alcohol (5%-8%), emulsifier (cetearyl trimethyl ammonium chloride, 2%-3%), heat and melt at 60-65℃, stir evenly and cool to below 45℃;
2. Addition of ginger extract: Add ginger extract (4%-9%), glycerin, hair care oil (1%-2%), stir for 15-20 minutes to ensure uniform dispersion;
3. Finalization: Adjust pH to 5.0-6.0, add preservative and essence, stir until the system is uniform and smooth, cool to room temperature and fill.

Body Wash

1. Basic system preparation: Purified water, AES (12%-17%), CAB (3%-6%), stir and dissolve at 55℃, add ethylene glycol distearate (pearlizer, 2%-3%), keep warm for 25-30 minutes to form a pearlescent system;

2. Addition of ginger extract: Cool to below 40℃, add ginger extract (2%-6%), stir for 15 minutes, add humectant and preservative;
3. Finalization: Adjust pH to 5.5-6.5, stir until the system is uniform with obvious pearlescence, cool to room temperature and fill.

2.2.2 Precautions

1. Surfactant compatibility: Ginger extract has good compatibility with anionic and non-ionic surfactants; avoid compatibility with high-concentration cationic surfactants to prevent precipitation and layering;
2. Foam control: Ginger extract has little effect on foam volume; if foam is insufficient, appropriately increase AES dosage (1%-2%) or add foam enhancer (such as cocamide DEA);
3. Stability test: Layering and aroma weakening may occur during long-term storage of washing products; thickeners should be added to improve stability, and antioxidants to delay oxidation and volatilization; storage temperature controlled at 5-35℃, avoid direct sunlight;
4. Irritation control: Addition amount of ginger extract in shampoo and body wash should be ≤8% to avoid stimulating scalp and skin; dipotassium glycyrrhizinate (0.1%-0.2%) and panthenol can be matched to enhance soothing effect and reduce allergy risk;
5. Hair care efficacy optimization: Hair conditioner can be matched with hydrolyzed keratin and hair care oil to synergize with ginger extract, improve scalp environment, repair damaged hair and reduce dryness and split ends; shampoo can be matched with ginger essential oil to enhance ginger aroma and hair care effect.

2.3 Application in Other Cosmetics (Makeup, Hand Cream)

2.3.1 Makeup (Lipstick, Blush)

- **Production Process**: In lipstick, heat and melt beeswax, paraffin and lanolin (70-75℃), cool to below 60℃ and add ginger extract (4%-9%), stir evenly, add pigment (adjustable as needed to enhance color), pour into mold for shaping; in blush, mix talcum powder, corn starch and mica powder evenly, add ginger extract (2%-6%), essence and a small amount of adhesive, mix and press into shape;
- **Precautions**: Addition amount in makeup should be controlled at 2%-9% to avoid too strong ginger aroma affecting makeup experience; temperature should be controlled during production to avoid gingerol degradation and volatile oil loss caused by high temperature; lipstick should ensure uniform system without particles or layering.

2.3.2 Hand Cream

- **Production Process**: Use vaseline, lanolin and glycerin as basic oil phase, heat and melt at 60-65℃, add ginger extract (5%-11%) and emulsifier, emulsify at high speed (1500rpm) for 15 minutes and cool, add preservative, essence and antioxidant, stir evenly;
- **Precautions**: Addition amount can be appropriately increased to enhance moisturizing, anti-inflammatory soothing and hand skin repair effects; avoid excessive oil to prevent stickiness; can be matched with ceramide and hyaluronic acid to improve moisturizing and repair capacity of hand cream, especially suitable for dry seasons in autumn and winter.

III. Application in Food Field: Production Process and Precautions

Ginger extract can exert flavoring, fresh-keeping, anti-oxidation and functional effects in food, suitable for liquid, solid and semi-solid food. The key is to control processing temperature and pH value, ensure food safety and efficacy stability, strictly follow food additive usage specifications, while retaining its natural ginger aroma and flavor.

3.1 Application in Beverages (Ginger Tea, Functional Drinks, Fruit-flavored Drinks, Alcoholic Beverages)

3.1.1 Production Process

Ginger Tea Beverage

1. Pretreatment: Heat purified water to 80-85℃, add white granulated sugar (5%-8%) and honey (2%-3%), stir to dissolve, cool to below 60℃;
2. Addition of ginger extract: Add ginger extract (1.5%-5%), stir for 15-20 minutes (rotating speed 500rpm) to ensure complete dissolution without precipitation;
3. Mixing and sterilization: Add preservative (potassium sorbate, 0.05%-0.1%) and essence, adopt UHT sterilization (135℃, 3-5 seconds) to reduce active component degradation;
4. Filling: Cool to below 25℃, sterile filling into PET bottles or aluminum cans, sealed packaging and light-proof storage.

Functional Drinks (Digestion-promoting, Anti-inflammatory Drinks)

1. Pre-dissolution: Mix ginger extract (2.5%-6%) with 5 times purified water, stir at 55-60℃ for 20 minutes to ensure no particles and complete dissolution;
2. Compounding: Add probiotics (such as *Bifidobacterium lactis*), prebiotics (fructooligosaccharides, 3%-5%), B vitamins (0.1%-0.2%), stir evenly, adjust pH to 5.0-6.0;

3. Sterilization and packaging: Adopt ultra-high pressure sterilization (600MPa, 5 minutes) to retain probiotics and ginger active components, sterile filling into oral liquid bottles or PET bottles, sealed packaging.

Alcoholic Beverages (Ginger Wine, Cocktails)

1. Basic system preparation: Liquor, fruit wine or cocktail base wine (alcohol content 10%-25%), add white granulated sugar (2%-5%), stir to dissolve, cool to below 25℃;
2. Addition of ginger extract: Add ginger extract (1%-4%), stir for 15 minutes, add essence and pigment (small amount optional to improve color), stir evenly;
3. Filtration and filling: Filter with 0.45μm filter membrane to remove impurities, sterile filling into glass bottles, sealed packaging and light-proof storage.

3.1.2 Precautions

1. Temperature control: For acidic beverages (pH < 5.0), ginger extract should be added after cooling to below 60℃ after sterilization to avoid gingerol degradation and volatile oil loss caused by high temperature and acidic environment; UHT sterilization time should be controlled ≤5 seconds to reduce active component loss;
2. Taste optimization: Ginger extract has pungent taste, which can be adjusted with sweeteners (erythritol, steviol glycosides), honey and high fructose syrup to avoid too strong pungency; when addition amount exceeds 5%, fruit powder (5%-8%) should be matched to neutralize pungency and improve palatability;
3. Stability control: In fruit juice beverages with pulp, ginger extract may adsorb pulp particles, homogenization (25MPa) is required to ensure suspension and avoid precipitation; storage temperature of liquid beverages ≤25℃, avoid direct sunlight to prevent browning and aroma weakening;
4. Compliance: Food-grade ginger extract must comply with GB 2760 standard, addition amount strictly follows regulations (≤6% in beverages), label should be marked "Contains ginger ingredients, daily intake not exceeding 15g";
5. Alcohol compatibility: Ginger extract has good compatibility with alcohol in alcoholic beverages, but addition amount should be controlled ≤4% to avoid aggravated pungency; meanwhile, ensure complete dissolution of extract to avoid precipitation.

3.2 Application in Condiments (Soy Sauce, Vinegar, Sauces, Hot Pot Base)

3.2.1 Production Process

Soy Sauce, Vinegar

1. Pretreatment: Sterilize basic liquid of soy sauce (or vinegar) (85℃, 15 minutes), cool to below 50℃;

2. Addition of ginger extract: Add ginger extract (0.8%-2.5%), stir for 10-15 minutes to ensure uniform dispersion without precipitation;
3. Mixing and filling: Add salt and monosodium glutamate (appropriate amount), stir evenly, adjust pH to 4.5-6.5, sterile filling into glass bottles, sealed packaging and light-proof storage.

Sauces, Hot Pot Base

1. Basic system preparation: Heat edible oil to 120-130℃, add spices such as chili, Chinese prickly ash and star anise, fry until fragrant and cool to below 80℃;
2. Addition of ginger extract: Add auxiliary materials such as ginger extract (2%-6%), bean paste, fermented black beans and white granulated sugar, stir for 20-25 minutes to ensure uniform mixing;
3. Sterilization and filling: Heat to 90℃, keep warm for 10 minutes for sterilization, cool to below 40℃, fill into glass bottles or plastic cans, sealed packaging.

3.2.2 Precautions

1. Temperature control: In condiment processing, ginger extract should be added after cooling to below 80℃ to avoid gingerol degradation and volatile oil loss caused by high temperature, affecting flavoring effect; sterilization temperature of hot pot base and sauces ≤90℃, shorten high-temperature residence time;
2. Taste control: Adjust addition amount according to pungency demand of condiments; addition amount in soy sauce and vinegar should not be too high (0.8%-2.5%) to avoid covering original flavor; addition amount can be appropriately increased in hot pot base and sauces (2%-6%) to enhance ginger aroma and pungent flavor;
3. Stability control: Moisture content of sauces and hot pot base should be controlled (≤15%) to avoid product deterioration caused by moisture absorption of ginger extract; storage environment humidity ≤65%, temperature ≤25℃, avoid direct sunlight;
4. Compliance: Strictly comply with GB 2760 standard, addition amount of ginger extract ≤2.5% in soy sauce and vinegar, ≤6% in hot pot base and sauces, label should mark addition amount;
5. Flavor synergy: Can be matched with garlic extract and Chinese prickly ash extract to synergize with ginger extract, improve condiment flavor level and enhance deodorization and aroma enhancement effects.

3.3 Application in Baked Goods (Bread, Cake, Biscuits, Pastries)

3.3.1 Production Process

Bread

1. Raw material mixing: Mix high-gluten flour, yeast and salt evenly, add water and butter, stir at low speed for 5 minutes in a dough mixer to form gluten;
2. Addition of ginger extract: Add ginger extract (1%-3.5%, based on flour mass), stir at high speed for 10-15 minutes to ensure uniform dispersion; can be matched with maltodextrin (1%-2%) to improve dispersibility and prevent moisture absorption and caking;
3. Fermentation: Primary fermentation (temperature 38℃, humidity 85%, 60 minutes), divide dough, proof for 15 minutes, secondary fermentation (38℃, humidity 85%, 40 minutes);
4. Baking: Oven temperature 175-185℃ (top heat 185℃, bottom heat 175℃), bake for 25-30 minutes, cool to room temperature and seal packaging, light-proof storage.

Cake

1. Batter preparation: Whisk eggs and white granulated sugar at high speed until volume expands 3-4 times, add low-gluten flour and baking powder, fold evenly to avoid gluten formation;
2. Addition of ginger extract: Add ginger extract (2%-4.5%, based on flour mass) and milk, fold until no particles and uniform fineness;
3. Baking: Brush oil on mold, pour in batter, oven temperature 165-175℃, bake for 30-35 minutes, demould after cooling;
4. Decoration (optional): Spread cream containing ginger extract (addition amount 3%-5%) on cake surface, sprinkle a small amount of ginger powder to improve flavor and appearance.

Biscuits

1. Dough mixing: Mix low-gluten flour, white granulated sugar and milk powder evenly, add melted butter and egg liquid, stir at low speed for 10 minutes to form uniform dough;
2. Addition of ginger extract: Add ginger extract (1%-3%), stir for 5-10 minutes, let dough stand for 30 minutes (relax gluten);
3. Forming and baking: Roll into 1-2mm thin slices, die-cutting forming, oven temperature 165-175℃, bake for 10-12 minutes, cool and seal packaging, light-proof storage.

3.3.2 Precautions

1. Temperature control: Baking temperature ≤185℃, over-temperature will cause carbonization of ginger extract, gingerol degradation and burnt smell; bottom heat can be reduced by 5-10℃ in late bread baking to prevent over-browning at the bottom;
2. Dough adjustment: Ginger extract has certain hygroscopicity, for every 1% ginger extract added, water addition should be increased by 0.2%-0.4% to avoid too dry or too sticky dough; biscuit dough hardness should be controlled to avoid forming difficulties;
3. Flavor control: Pungent taste of ginger extract will be weakened after baking, a small amount of honey (2%-3%), vanilla extract (0.1%) or chocolate powder can be matched to further neutralize pungency and improve flavor;
4. Storage: Baked goods should adopt moisture-proof and light-proof packaging (aluminum-plastic composite bag), storage environment humidity ≤60% to avoid product softening and deterioration caused by moisture absorption of ginger extract, and prevent gingerol oxidation and aroma weakening;
5. Color retention: Light yellow color of ginger extract will deepen slightly during baking, addition amount can be adjusted according to product needs to avoid too deep color affecting product appearance.

3.4 Application in Other Foods (Convenience Foods, Dairy Products, Confectionery)

3.4.1 Convenience Foods (Instant Noodles, Self-heating Foods, Frozen Foods)

- **Production Process**: In instant noodle seasoning packets, mix ginger extract (2%-5%) with seasonings such as salt, monosodium glutamate, chili powder and Chinese prickly ash powder evenly, sealed packaging; in self-heating foods, add ginger extract (1.5%-4%) to soup base, mix with other auxiliary materials and pack into sealed bags; in frozen foods (dumplings, glutinous rice balls), add ginger extract (1%-2.5%) to fillings, stir evenly before wrapping and quick-freezing;
- **Precautions**: In convenience foods, ginger extract should be fully mixed with other seasonings to ensure uniform flavor; moisture content of self-heating food soup base should be controlled to avoid moisture absorption; frozen foods should be stored below -18℃ to avoid degradation of ginger extract active components, while retaining its deodorization and aroma enhancement effects.

3.4.2 Dairy Products (Yogurt, Milk Drinks, Cheese)

- **Production Process**: In yogurt, after homogenization and pasteurization of raw milk, cool to 42℃, inoculate probiotics, add ginger extract (1%-4%), ferment for 4-6 hours, refrigerate for post-ripening; in milk drinks, mix milk with purified water, homogenize and cool to below 55℃, add ginger extract (2%-5%), white granulated

sugar and essence, stir evenly before sterilization and filling; in cheese, after sterilization and curdling of raw milk, add ginger extract (1.5%-3.5%), stir evenly, press forming and ripening;

- **Precautions**: pH of yogurt drops to 4.0-4.5 after fermentation, ginger extract has good stability in this range without additional adjustment; addition amount in milk drinks ≤5% to avoid affecting stability of milk system and preventing layering; sweeteners can be matched to neutralize pungency and improve palatability; dairy products should be refrigerated to avoid gingerol degradation and aroma loss caused by high temperature.

3.4.3 Confectionery (Soft Candy, Hard Candy)

- **Production Process**: In soft candy, add ginger extract (3%-6%) after dissolving gelatin and agar (60℃), stir evenly, add sweetener, essence and pigment (small amount optional), pour into mold for shaping, cool and package; in hard candy, boil sugar to 125-130℃, cool to below 100℃ and add ginger extract (2%-4.5%), stir to dissolve before shaping, cool and seal packaging;
- **Precautions**: Add ginger extract after cooling in late hard candy boiling to avoid high temperature degradation of gingerols; moisture content of soft candy should be controlled (15%-20%) to avoid adhesion caused by moisture absorption of ginger extract; citric acid can be matched to improve flavor level and neutralize sweetness and pungency.

IV. Application in Health Products Field: Production Process and Precautions

Ginger extract in health products mainly focuses on warming the middle energizer to dispel cold, promoting digestion, anti-inflammation, analgesia and enhancing immunity. Common dosage forms include capsules, tablets, granules, oral liquids and solid drinks, which need to balance efficacy stability and taking convenience, strictly comply with health product raw material technical requirements to ensure active component content meets standards.

4.1 Application in Capsules

4.1.1 Production Process

1. Raw material preparation: Select health product-grade ginger extract (purity ≥90%, gingerol content ≥10%), mix with microcrystalline cellulose (filler, ratio 8:2) and magnesium stearate (lubricant, 0.5%) according to formula;
2. Mixing process: Premix by equal increment method, put into V-type mixer, rotating speed 200rpm, mix for 15-20 minutes (coefficient of variation CV of mixing

uniformity ≤3%);

3. Capsule filling: Use automatic capsule filling machine in clean workshop (humidity ≤55%, temperature 20-25℃), fill size 0# or 1# capsules (200-500mg ginger extract per capsule), filling accuracy ±2%;
4. Quality inspection: Sampling test capsule appearance, weight difference (±7.5%), disintegration time limit (complete disintegration within 30 minutes) and gingerol content, package after qualification.

4.1.2 Precautions

1. Raw material purity: Health product-grade ginger extract must comply with *Technical Requirements for Health Food Raw Materials*, heavy metals (Pb≤0.1mg/kg, As≤0.05mg/kg) and microorganisms (total bacterial count ≤100CFU/g) must strictly meet standards; gingerol content ≥10% to ensure effects of warming middle energizer to dispel cold and promoting digestion;
2. Humidity control: Ginger extract has strong hygroscopicity, caking easily occurs when workshop humidity > 55% leading to mold jamming of filling machine, dehumidification equipment should be turned on, raw materials stored sealed to avoid moisture absorption;
3. Fluidity optimization: If angle of repose of ginger extract > 40°, 1%-2% silicon dioxide can be added to improve fluidity, ensure uniform filling and improve filling accuracy;
4. Packaging and storage: Adopt aluminum-plastic blister packaging with desiccant inside, store in cool, dry and light-proof place (temperature ≤25℃, humidity ≤55%), shelf life 24 months; label should mark suitable individuals (people with deficiency-cold of spleen and stomach, indigestion, low immunity), unsuitable individuals (pregnant women, infants, people with hyperactivity of fire due to yin deficiency, allergic constitution) and daily intake.

4.2 Application in Tablets

4.2.1 Production Process

1. Raw material pretreatment: Sieve ginger extract (purity ≥90%) through 100-mesh sieve to remove caking, mix evenly with lactose (diluent, ratio 7:3) and hypromellose (binder, 2%);
2. Granulation: Add 50%-60% ethanol solution to make soft material, granulate through 16-mesh sieve, dry at 50-60℃ for 2-3 hours (moisture controlled at 3%-5%) to avoid gingerol degradation caused by high temperature;

3. Sizing and tableting: Sieve dried granules through 20-mesh sieve for sizing, add 1% magnesium stearate and mix for 10 minutes, tablet with rotary tablet machine (pressure 8-10kN, tablet hardness 5-7kgf, friability ≤1%);
4. Coating (optional): Adopt gastric-soluble coating powder, coating temperature 40-45℃, weight gain 3%-5% to improve stability and mask pungent taste of ginger.

4.2.2 Precautions

1. Granulation control: Binder dosage must be precise, too little leads to loose granules, too much leads to delayed disintegration; drying temperature ≤60℃ to prevent degradation of ginger extract active components (gingerols);
2. Disintegration optimization: Add 5%-10% crospovidone (disintegrant) to ensure disintegration time limit ≤15 minutes, facilitate human absorption and improve efficacy utilization rate;
3. Dosage design: Recommended daily intake for adults 1-2g (calculated as ginger extract), single tablet dose 500mg-1g, marked "1-2 times a day, 1 tablet each time, take with meals";
4. Stability monitoring: Regularly test tablet hardness, disintegration time limit and gingerol content during storage to avoid performance decline caused by moisture absorption; avoid taking with spicy and greasy food to affect absorption.

4.3 Application in Granules (Solid Drink Type)

4.3.1 Production Process

1. Raw material mixing: Put ginger extract (addition amount 20%-40g/100g), erythritol (sweetener, 30%), fructooligosaccharides (synergistic prebiotics, 10%), B vitamins (1%-2%) and essence (0.1%) into three-dimensional mixer, rotating speed 300rpm, mix for 20-25 minutes to ensure uniformity;
2. Granulation (optional): Add 3% povidone solution for granulation (18-mesh sieve), dry at 60℃ until moisture ≤5%, size and package to improve solubility;
3. Quantitative packaging: Adopt automatic granule packaging machine, packaging specification 10g/bag or 15g/bag (2-6g ginger extract per bag), light-proof packaging with aluminum-plastic composite film.

4.3.2 Precautions

1. Solubility guarantee: High concentration (> 30%) ginger extract dissolves slowly, particle size should be controlled at 40-60 mesh, or consumers are advised to brew with 60-70℃ warm water and stir until complete dissolution;

2. Taste optimization: Match steviol glycosides (0.03%) and fruit powder (5%) to adjust taste, neutralize pungent taste of ginger, ensure refreshing after brewing without off-flavors, improve taking experience;
3. Mixing uniformity: Trace components (such as B vitamins) must be premixed with a small amount of ginger extract first to avoid uneven content and ensure efficacy components meet standards per bag;
4. Storage and moisture-proof: Granules should be used up within 1 month after opening, unopened products stored in humidity ≤60% and light-proof environment to avoid moisture absorption, caking and gingerol oxidation.

4.4 Application in Oral Liquids

4.4.1 Production Process

1. Pre-dissolution: Mix ginger extract (addition amount 5%-11g/100mL) with purified water at 1:5, stir at 55-60℃ for 20 minutes to dissolve, ensure no particles or precipitation;
2. Mixing: Add 0.2% citric acid (adjust pH 5.0-6.0), 0.1% potassium sorbate (preservative), sweetener (erythritol, 3%-5%), stir evenly, add antioxidant (vitamin E, 0.1%-0.2%);
3. Filtration and filling: Filter with 0.22μm filter membrane to remove impurities, sterile filling (10mL/bottle), pasteurization (65℃, 30 minutes) to reduce active component degradation;
4. Packaging: Label, box, store in cool, dry and light-proof place.

4.4.2 Precautions

1. pH control: pH of acidic oral liquid ≥5.0 to avoid gingerol degradation in ginger extract, reduce gastrointestinal irritation and improve taking tolerance;
2. Antiseptic and antioxidant: Oral liquids are easy to breed microorganisms, sufficient preservatives must be added; add antioxidants such as vitamin E and tea polyphenols to delay ginger extract oxidation, prevent efficacy decline and aroma weakening;
3. Filling and sealing: Seal immediately after filling to prevent microbial contamination and active component loss; storage temperature ≤25℃, avoid direct sunlight, shelf life 12 months;
4. Dosage control: Each oral liquid bottle contains 0.5-1.1g ginger extract, 1-2 bottles a day, take with meals to avoid gastrointestinal discomfort (such as heartburn,

stomach pain) caused by excessive intake.

V. Application in Medical Field: Production Process and Precautions

Ginger extract is mainly used as excipient for external preparations and auxiliary component of oral preparations in medical field, must comply with *Chinese Pharmacopoeia* 2025 Edition, focus on purity, biocompatibility and preparation stability, strictly control impurity content and sterility to ensure synergistic effect with pharmaceutical active components, give full play to its auxiliary effects of warming middle energizer to dispel cold, anti-inflammation, analgesia and antiemesis.

5.1 Application in External Preparations (Analgesic Ointment, Skin Repair Preparations)

5.1.1 Production Process

1. Oil phase preparation: Mix vaseline, lanolin and liquid paraffin in proportion, heat and melt at 70-75℃, stir evenly and keep warm for standby;
2. Water phase preparation: Purified water, medical-grade ginger extract (5%-11%, purity ≥95%), glycerin, stir and dissolve at 65-70℃, add preservative (benzalkonium bromide, 0.02%-0.05%);
3. Emulsification: Slowly pour water phase into oil phase, stir at high speed (1500rpm) for 15-20 minutes, maintain emulsification temperature at 65-70℃ to form uniform ointment base;
4. Cooling and filling: Cool to below 40℃, add pharmaceutical active components (such as ibuprofen for analgesic ointment), stir evenly, fill into aluminum tubes, sealed packaging, put into storage after sterile treatment.

5.1.2 Precautions

1. Purity requirements: Medical-grade ginger extract must comply with excipient standards of *Chinese Pharmacopoeia* 2025 Edition, heavy metals and related substances (total impurities ≤0.5%) strictly controlled; gingerol content ≥15% to ensure anti-inflammatory, analgesic and skin repair effects;
2. Sterile treatment: External preparations must undergo sterile treatment (γ-ray sterilization, dose 25kGy), bacterial endotoxin ≤10EU/g to avoid skin infection, especially suitable for damaged skin and inflammatory parts;
3. Compatibility: Conduct compatibility test with pharmaceutical active components (store at 40℃, 75%RH for 1 month), confirm no interaction, no impact on efficacy, no production of toxic and harmful substances;

4. Irritation: External preparations must pass skin irritation test (no erythema, edema), preparations for sensitive parts (such as face, around mucous membranes) need to reduce ginger extract addition amount (4%-6%) to lower irritation;
5. Stability: External ointment should be stored light-proof and sealed, avoid high temperature and direct sunlight to prevent gingerol degradation in ginger extract, ensure stable efficacy, shelf life 18-24 months.

5.2 Application in Oral Preparations (Preparations for Warming Middle Energizer to Dispel Cold, Auxiliary Treatment of Colds)

5.2.1 Production Process

1. Raw material pretreatment: Sieve medical-grade ginger extract (purity ≥95%) through 100-mesh sieve to remove caking, mix with pharmaceutical active components, lactose (diluent) and disintegrant in proportion;
2. Granulation and drying: Add binder (hypromellose) to make soft material, dry at 50-60℃ after granulation, moisture controlled at 3%-5% to avoid gingerol degradation caused by high temperature;
3. Tableting and coating: Add lubricant (magnesium stearate, 0.5%) after sizing, tablet (pressure 7-9kN), adopt enteric coating (avoid gastric acid destroying active components), coating temperature 40-45℃;
4. Quality inspection: Test content uniformity (deviation ≤±5%), disintegration time limit (enteric-coated tablets disintegrate within 30 minutes in artificial intestinal juice), dissolution rate (≥80% dissolution in 45 minutes) and gingerol content, package only after qualification.

5.2.2 Precautions

1. pH adaptation: Oral preparations need to be released in intestinal tract, enteric coating must ensure no disintegration in gastric acid (pH < 3.0) and rapid disintegration in intestinal juice (pH > 7.0) to avoid ginger extract degradation in gastric acid and improve efficacy utilization rate;
2. Dosage control: Daily intake of ginger extract in oral medical preparations ≤2g to avoid gastrointestinal discomfort such as diarrhea, abdominal pain and heartburn caused by excessive intake;
3. Storage conditions: Store in cool and dry place (temperature 2-8℃, refrigerated) to avoid moisture absorption and oxidation, shelf life 24 months;
4. Contraindicated individuals: Pregnant women, lactating women, infants, people with hyperactivity of fire due to yin deficiency, intestinal ulcer patients, allergic constitution are prohibited, label must clearly mark contraindications, adverse reactions and usage dosage;

5. Efficacy synergy: When compounded with cold medicines and gastrointestinal conditioning medicines, compatibility ratio should be controlled, avoid taking with alkaline drugs to prevent gingerol degradation; can be compounded with licorice extract and jujube extract to neutralize pungent irritation of ginger and improve preparation tolerance;
6. Quality monitoring: Gingerol content must be monitored throughout production, sampling test per batch to ensure compliance with *Chinese Pharmacopoeia* standards; regularly test dissolution rate and content uniformity during storage to prevent efficacy decline caused by active component loss.

5.3 Application in Foods for Special Medical Purposes (Special for Gastrointestinal Discomfort, Postoperative Recovery)

5.3.1 Production Process

1. Raw material screening: Select high-purity medical-grade ginger extract (purity ≥98%, gingerol content ≥18%), remove impurities, sieve through 120-mesh sieve to ensure no caking or foreign matter;
2. Compounding preparation: Mix with maltodextrin (carrier, ratio 6:4), oligopeptides (intestinal repair component, 5%-8%), vitamin C (antioxidant, 0.3%-0.5%), premix by equal increment method, put into three-dimensional mixer and stir for 25-30 minutes, mixing uniformity CV ≤2%;
3. Granulation and drying: Add 4% hypromellose solution for granulation, dry at low temperature 55℃ until moisture ≤4%, size and sieve through 30-mesh sieve to remove coarse particles;
4. Sterile treatment: Sterilize granules with γ-ray (dose 20kGy) to ensure bacterial endotoxin ≤5EU/g, total bacterial count ≤10CFU/g, meeting sterility requirements of foods for special medical purposes;
5. Quantitative packaging: Adopt sterile aluminum foil bags for quantitative packaging (5g/bag or 10g/bag), 1-3g ginger extract per bag, seal and put into light-proof packaging box with desiccant inside, mark eating method and dosage.

5.3.2 Precautions

1. Raw material standards: Ginger extract used in foods for special medical purposes must comply with *General Standard for Foods for Special Medical Purpose Formula* (GB 29922), purity ≥98%, gingerol content ≥18%, no allergens, no residual solvents, heavy metals (Pb≤0.05mg/kg, As≤0.02mg/kg) strictly meet standards;
2. Sterile control: Whole production process in Class 100 clean workshop, raw and auxiliary materials sterilized in advance, packaging materials sterile treated to avoid microbial contamination, ensure products adapt to special needs of people with gastrointestinal discomfort and postoperative weakness;

3. Formula adaptation: Compounding ratio should be adjusted according to applicable individuals (such as postoperative recovery period, gastrointestinal ulcer recovery period), oligopeptide dosage controlled at 5%-8% to synergize with ginger extract to repair intestinal mucosa and reduce ginger pungent irritation; vitamin C can enhance antioxidant effect and delay gingerol oxidation;
4. Dosage and eating method: Recommended daily intake 5-10g (calculated as finished product), take 1-2 times, brew with 40-50℃ warm water to avoid high temperature destroying active components; postoperative individuals should take under doctor's guidance to avoid excessive intake;
5. Storage requirements: Adopt moisture-proof, light-proof and sterile packaging, store in 2-8℃ refrigerated environment to avoid moisture absorption, oxidation and microbial breeding, shelf life 18 months; use up within 48 hours after opening, seal and refrigerate remaining part;
6. Contraindications and warnings: Not applicable to people allergic to ginger extract and oligopeptides; diabetic patients should pay attention to maltodextrin dosage and take under doctor's guidance; label must clearly mark applicable individuals，contraindications, eating restrictions and medical guidance suggestions.

VI. Applications in Other Fields: Production Process and Precautions

The application of ginger extract in feed additives, daily necessities, pet food and other fields focuses on meeting scenario-specific requirements, controlling addition dosage and stability, balancing efficacy and safety, complying with industry standards of corresponding fields, and giving full play to its effects in promoting digestion, anti-inflammation and enhancing immunity.

6.1 Application in Feed Additives (Livestock, Poultry and Aquatic Feed)

6.1.1 Production Process

1. Raw Material Pretreatment: Select feed-grade ginger extract (purity ≥80%, gingerol content ≥8%), mix with corn starch (carrier, ratio 7:3), and sift through 80-mesh to remove agglomerates and impurities.
2. Compound Mixing: Add probiotics (*Bacillus subtilis*, 0.5%–1%) and amino acids (lysine, 1%–2%), put into a twin-screw mixer at 250 rpm for 20 minutes to ensure mixing uniformity CV ≤5%.
3. Granulation and Molding: Add a small amount of purified water, granulate (12-mesh sieve), dry at 60°C until moisture ≤10%, cool and size-reduce to avoid moisture absorption and caking.

4. Packaging and Storage: Package in woven bags (25 kg/bag) lined with moisture-proof film, seal, label as feed additive, and store in warehouse.

6.1.2 Precautions

1. Dosage Control: 0.3%–1% in livestock and poultry feed, 0.5%–1.5% in aquatic feed. Excessive dosage may reduce feed intake and cause diarrhea.
2. Compatibility: Good compatibility with other additives (antibiotics, vitamins, minerals). Avoid strong alkaline components to prevent gingerol degradation.
3. Moisture-Proof Storage: Hygroscopic; store at humidity ≤60%, temperature ≤25°C, away from direct sunlight to prevent caking and oxidation. Shelf life: 12 months.
4. Efficacy Adaptation: Improves gastrointestinal function and immunity in livestock; enhances stress resistance and meat quality in aquatic animals, reducing mortality.
5. Compliance: Comply with the *Catalogue of Feed Additives*. Label shall indicate ingredients, dosage, applicable animals and shelf life. Prohibited for forbidden animal species.

6.2 Application in Daily Necessities (Toothpaste, Mouthwash)

6.2.1 Production Process

Toothpaste

1. Base System Preparation: Put calcium carbonate (abrasive, 40%–50%), sorbitol (humectant, 20%–25%), sodium carboxymethyl cellulose (thickener, 1%–2%) and purified water into a mixing tank, stir at 50–55°C for 15 minutes to form a uniform paste.
2. Addition of Ginger Extract: Add ginger extract (1%–3%), fluoride (0.1%–0.15%) and flavor (0.5%–1%), stir at low speed for 20 minutes to ensure uniform dispersion without particles.
3. Degassing and Filling: Degas the paste (vacuum degree -0.08 MPa) to avoid bubbles, fill into toothpaste tubes, seal and store away from light.

Mouthwash

1. Pretreatment: Put purified water, ethanol (5%–10%) and glycerin (2%–3%) into a mixing tank, stir to dissolve, and cool below 35°C.
2. Addition of Ginger Extract: Add ginger extract (0.5%–2%), chlorhexidine (preservative, 0.05%–0.1%) and flavor (0.3%–0.5%), stir for 15 minutes, adjust pH to 6.0–7.0.
3. Filtration and Filling: Filter through 0.45 μm membrane to remove impurities, fill aseptically into mouthwash bottles, seal and store away from light.

6.2.2 Precautions

1. Irritation Control: ≤3% in toothpaste, ≤2% in mouthwash to avoid irritating oral mucosa. For sensitive oral individuals, control at 0.5%–1%. Licorice extract can be used to neutralize pungency.
2. Stability: Control moisture content of toothpaste at 20%–25% to avoid paste softening and layering. Antioxidants shall be added to mouthwash to prevent gingerol oxidation and aroma loss.
3. Compatibility: Good compatibility with abrasives and fluoride in toothpaste, ethanol and preservatives in mouthwash, without precipitation or odor.
4. Efficacy: The antibacterial and anti-inflammatory effects assist oral cleaning and relieve gingival swelling and inflammation.
5. Safety: Do not swallow toothpaste; spit out mouthwash after use. Label applicable individuals, usage and precautions.

6.3 Application in Pet Food (Pet Staple Food, Pet Health Products)

6.3.1 Production Process

Pet Staple Food (Dog and Cat Dry Food)

1. Raw Material Mixing: Mix corn flour, meat meal, soybean meal, vitamins and minerals evenly, add ginger extract (0.2%–0.8%), stir for 15 minutes.
2. Extrusion Molding: Put into extruder at 120–130°C, cool to room temperature to avoid gingerol degradation.
3. Drying and Packaging: Dry at 60°C until moisture ≤12%, package quantitatively (1 kg/bag, 5 kg/bag), seal and store away from light.

Pet Health Products (Pet Gastrointestinal Conditioning Granules)

1. Raw Material Compounding: Mix ginger extract (1%–3%) with probiotics (*Saccharomyces boulardii*, 1%), maltodextrin and glucose by geometric dilution.
2. Granulation and Drying: Granulate with a small amount of purified water, dry at 55°C until moisture ≤8%, size-reduce and sift through 40-mesh.
3. Packaging: Package in aluminum foil bags (1 g/bag, 5 g/bag), seal and put into light-proof boxes, label applicable pet species and dosage.

6.3.2 Precautions

1. Dosage Control: 0.2%–0.8% in staple food, 1%–3% in health products. Adjust according to body weight to avoid gastrointestinal discomfort.
2. Palatability Optimization: Neutralize pungency with pet-specific flavors (chicken, beef).
3. Storage: Moisture-proof and light-proof packaging; humidity ≤60%, temperature ≤25°C; shelf life 12–18 months.

4. Species Adaptation: Suitable for dogs and cats. Reduce dosage for puppies and kittens (0.2%–0.5%) under veterinary guidance.
5. Compliance: Comply with the *Measures for the Administration of Pet Feed*.

VII. General Precautions and Quality Control

7.1 Raw Material Quality Control

1. Raw Material Screening: Select food-grade, cosmetic-grade, health-food-grade or pharmaceutical-grade ginger extract with clear purity and gingerol content.
2. Supplier Audit: Qualified suppliers, COA required, batch inspection before storage.
3. Raw Material Storage: Powder in dry, low-temperature, light-proof environment (≤25°C, humidity ≤60%); liquid stored at 2–8°C.

7.2 Production Process Control

1. Temperature Control: ≤60°C in most fields; ≤45°C in cosmetics and pharmaceuticals.
2. pH Control: Stable at pH 4.0–7.0.
3. Mixing Uniformity: Ensure uniform dispersion or complete dissolution.
4. Aseptic Control: Clean rooms for pharmaceuticals, cosmetics and FSMP.

7.3 Storage and Transportation Requirements

1. Storage Environment: Cool, dry, ventilated, away from heat and strong oxidants.
2. Packaging: Sealed, moisture-proof, light-proof; with desiccant for powder.
3. Transportation: Avoid shock, high temperature and rain; cold chain for refrigerated products.

7.4 Safety and Compliance Requirements

1. Compliance: Comply with GB 2760, *Cosmetics Safety Technical Specification*, *Chinese Pharmacopoeia*, etc.
2. Contraindications and Warnings: Clearly label contraindicated individuals， usage, dosage and adverse reactions.
3. Allergy Warning: Warn for possible allergy; suggest skin test for sensitive individuals.
4. Quality Traceability: Establish batch traceability and retain inspection records.

VIII. Differentiation Strategies of Ginger Extract in Various Application Fields

8.1 Differentiation Strategy in Cosmetics

Core logic: Focus on **efficacy segmentation + skin type adaptation**, combining active components such as gingerols and curcumin.

8.1.1 Raw Material Selection Differentiation

- Sensitive skin: Low-irritation, desensitized and de-spiced extract, purity ≥95%, small molecule gingerols ≤4000 Da.
- Oil control & anti-inflammation: High gingerol (≥12%), compound with salicylic acid and witch hazel extract.
- Warming & soothing: High curcumin (≥8%), compound with panthenol and ceramides.
- Hair & body care: Surfactant-resistant extract to avoid precipitation.

8.1.2 Addition Scheme Differentiation

- Liquid products: 1%–4% liquid extract;
- Semi-solids: 2%–8% powder extract;
- Masks: 5%–15% high-activity extract.
- Low-temperature addition (≤38°C) and low-speed stirring for sensitive skin.

8.1.3 Market Positioning Differentiation

1. High-end: Organic certified extract, 6%–10% addition.
2. Mid-end: Regular cosmetic grade, 4%–7% addition.
3. Budget: Cost-effective grade, 1%–4% addition.

8.2 Differentiation Strategy in Food

Core logic: **Compliance + taste adaptation + function enhancement**.

8.2.1 Raw Material Selection Differentiation

- Children’s food: De-spiced, low heavy metals.

- Functional food: High activity, water-extracted.
- Baking & dairy: Microencapsulated, heat-resistant.
- Beverages: Liquid, water-soluble, low pungency.

8.2.2 Addition Scheme Differentiation

- Beverages: 0.5%–3%;
- Baking: 1%–3%;
- Candies & jellies: 2%–5%.
- Compound with jujube, longan, probiotics, etc.

8.2.3 Consumer Group Differentiation

- Children: Mild, ≤2%;
- Elderly: Warming and gastrointestinal care;
- General adults: Natural functional food.

8.3 Differentiation Strategy in Health Products

Core logic: **Precise efficacy + convenient dosage form + compliance**.

8.3.1 Raw Material Selection Differentiation

- Warming: Health-food-grade, gingerol ≥12%;
- Gastrointestinal care: High purity ≥95%, gingerol ≥15%;
- Convenience: Microencapsulated to mask pungency.

8.3.2 Dosage Form and Dosage Differentiation

- Capsules/tablets: 400–800 mg;
- Granules/oral liquids for the elderly;
- Daily intake: 0.6–1.6 g.

8.3.3 Compliance and Positioning Differentiation

High-end, mid-end and budget positioning based on purity and formula.

8.4 Differentiation Strategy in Pharmaceutical Field

Core logic: **Qualified purity + biocompatibility + synergistic effect**.

8.4.1 Raw Material Selection Differentiation

- Topical: Pharmaceutical grade, purity ≥95%, gingerol ≥15%, lipophilic;
- Oral: Enteric-coated to avoid gastric acid destruction;
- FSMP: High purity, mild, easy to absorb.

8.4.2 Dosage Form and Process Differentiation

- Topical: Aseptic emulsification and sterilization;
- Oral: Enteric coating, granulation temperature ≤58°C;
- FSMP: Liquid or powder, pH 5.5–7.0.

8.4.3 Safety Differentiation

- Topical: Skin irritation test;
- Oral: Clear contraindications;
- FSMP: Clinically validated.

8.5 Differentiation Strategies in Other Fields

8.5.1 Feed

Cost-effective feed-grade extract; targeted dosage for livestock, poultry and aquaculture.

8.5.2 Daily Necessities

Mild, compatible with surfactants; stable in toothpaste, mouthwash and hand sanitizer.

IX. Common Problems and Solutions

9.1 Common Problems in Production

9.1.1 Uneven Dispersion and Precipitation

Causes: Caking, poor compatibility, insufficient mixing.

Solutions: Sieve, pre-dissolve, premix with carrier, optimize stirring.

9.1.2 Active Ingredient Degradation

Causes: High temperature, inappropriate pH, oxidation, light.

Solutions: Control temperature and pH, avoid light, add antioxidants, use microencapsulation.

9.1.3 Poor Taste/Odor (Pungency, Browning)

Solutions: Use de-spiced extract, control dosage, add antioxidants and sweeteners.

9.1.4 Poor Stability (Layer, Cake, Deterioration)

Solutions: Improve compatibility, use thickeners and preservatives, proper packaging and storage.

9.2 Common Regulatory and Safety Problems

9.2.1 Non-Compliance

Solutions: Comply with standards, standardize labels, verify purity and COA.

9.2.2 Safety Problems (Allergy, Irritation)

Solutions: Conduct irritation tests, control dosage, label contraindications.

X. Appendix

10.1 Summary of Ginger Extract Standards

Application	Purity	Key Indexes	Standards
Cosmetics	≥90%	Pb≤0.5, As≤1.0, gingerol≥8%	Cosmetics Safety Technical Specification (2022)
Food	≥85%	Pb≤0.5, As≤1.0, gingerol≥5%	GB 2760-2014, GB 18187-2000
Health Food	≥90%	Pb≤0.1, As≤0.05, gingerol≥10%	Health Food Raw Material Requirements
Pharmaceutical	≥95%	Pb≤0.1, As≤0.05, gingerol≥15%	Chinese Pharmacopoeia 2025
Feed	≥85%	Pb≤1.0, As≤2.0, gingerol≥4%	Feed Additive Standards

10.2 Recommended Compound Ingredients

- Cosmetics: HA, ceramides, panthenol, salicylic acid, etc.
- Food: Jujube, longan, probiotics, yam, etc.
- Health Products: Probiotics, yam, etc.
- Pharmaceutical: Ibuprofen, lactose, whey protein, etc.

10.3 Storage, Transportation and Shelf Life

- Solid: 24 months unopened;
- Liquid: 12 months unopened, 1 month after opening.

10.4 Terminology

1. Gingerols
2. Desensitized and de-spiced ginger extract
3. Microencapsulated extract
4. Coefficient of variation (CV)
5. UHT sterilization