Operating Guidelines for the Addition of Elderberry Extract in Various Application Fields

I. Overview of Elderberry Extract: Characteristics and Application Advantages

1.1 Chemical Composition and Physicochemical Properties

Elderberry Extract is mainly derived from the ripe fruits of *Sambucus nigra L.* of the Caprifoliaceae family. Its core active ingredients include anthocyanins (cyanidin-3-glucoside, peonidin-3-glucoside), flavonoids (quercetin, kaempferol), phenolic acids (chlorogenic acid, caffeic acid), vitamins and minerals. Industrial production mainly adopts solvent extraction (water extraction, ethanol extraction) and microwave-assisted 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 dark purple to purple-black powder (or viscous liquid) with a strong inherent fruity aroma of elderberry, no off-flavors or impurities; excellent water solubility (powder solubility ≥30g/100mL at 25℃), liquid extract is directly miscible with polar solvents such as water, ethanol and propylene glycol, hardly precipitating; powder bulk density 0.50-0.70g/cm³, medium fluidity, dispersibility can be significantly improved after compounding with carriers such as maltodextrin and microcrystalline cellulose; particle size mostly 80-120 mesh, uniformly dispersible in solid, liquid and semi-solid systems without affecting product appearance and texture.

1.1.2 Chemical Stability

Optimal stability in the pH range of 3.0-6.5, highest retention rate of active ingredients in acidic environment (pH 4.0-5.5), over 85% anthocyanins retained after heating at 80℃ for 30 minutes; prone to anthocyanin degradation in alkaline environment (pH > 7.0), resulting in lighter color and reduced efficacy, temperature shall be controlled ≤60℃; long-term heating at high temperature (> 90℃) accelerates degradation of flavonoids and phenolic acids, 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 ingredients.

1.1.3 Hygroscopicity and Storage Characteristics

The critical relative humidity of powdered elderberry extract is 75%, medium hygroscopicity at room temperature, easy to absorb moisture and agglomerate when ambient

humidity > 75%, affecting dispersibility; liquid extract is prone to oxidative browning due to high phenolic content, requiring sealed, light-proof and low-temperature storage; overall sensitive to light, heat and oxygen, long-term exposure to ultraviolet or high-temperature environment will cause anthocyanin degradation, lighter color and weakened fruity aroma, requiring light-proof and antioxidant measures.

1.2 Efficacy and Application Value

Elderberry extract has multiple effects such as anti-oxidation, immune regulation, anti-inflammatory soothing and skin care, making it a high-quality functional raw material for food, cosmetics, health products, medicine and other fields. The core effects are as follows:

1.2.2 Skin Care Efficacy

Anthocyanins have strong anti-oxidation effect, scavenge free radicals, inhibit skin lipid oxidation and delay skin aging; flavonoids promote skin blood circulation, improve dull and uneven skin tone and assist in brightening; phenolic acids have mild anti-inflammatory and soothing effects, relieve skin sensitivity and redness, repair skin barrier, suitable for all skin types, especially sensitive and dull skin.

1.2.2 Health Care Efficacy

Synergistic effect of anthocyanins and flavonoids regulates immune function, enhances macrophage activity and improves body resistance; inhibits viral replication and assists in relieving initial cold symptoms (such as sore throat, nasal congestion); also has anti-oxidation and cardiovascular protection effects, assisting in lowering blood lipid and improving vascular elasticity (intake shall be controlled); phenolic acids promote intestinal peristalsis and assist in improving intestinal health.

1.2.3 Food Functional Properties

Can be used as a natural food additive with anti-oxidation, coloring and flavor enhancement functions, prolonging food shelf life, endowing products with natural purple-black color and enriching visual experience; strong elderberry aroma improves food taste, suitable for the development of healthy foods and functional beverages; some active ingredients assist in inhibiting harmful bacteria growth in food and improving food safety.

1.2.4 Medical Auxiliary Efficacy

As a pharmaceutical excipient or auxiliary component, it has anti-inflammatory, antiviral and anti-oxidation effects, applicable to adjuvant cold treatment and anti-inflammatory preparations; assists in regulating immune function in oral preparations and improving patient tolerance, complying with pharmaceutical-grade excipient standards; assists in repairing skin inflammation and relieving discomfort in external preparations.

1.3 Main Application Fields

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

1.3.1 Cosmetics Field

Covering skin care products (toners, essences, emulsions, creams, masks), makeup (lipsticks, blushes), personal washing products (shampoos, conditioners, body washes), focusing on anti-oxidation, brightening, soothing and repairing effects, suitable for all skin types, especially dull and sensitive skin.

1.3.2 Food Industry

Including beverages (fruit juices, fruit-flavored drinks, functional drinks, alcoholic beverages), baked goods (breads, cakes, biscuits, pastries), dairy products (yogurts, milk drinks, cheeses), candies (gummies, hard candies, jellies), with functional, coloring and flavor enhancement effects, adapting to the trend of natural and healthy foods.

1.3.3 Health Products Field

As a functional component for capsules, tablets, granules, oral liquids, solid drinks and other dosage forms, focusing on immune regulation, anti-oxidation and auxiliary anti-cold functions, can be compounded with probiotics, vitamin C, zinc, etc. to enhance efficacy.

1.3.4 Medical Field

As an excipient for external preparations (such as anti-inflammatory ointment bases), auxiliary component for oral preparations, or used in foods for special medical purposes, assisting in improving immune function, relieving cold symptoms and repairing skin inflammation.

1.3.5 Other Fields

Including feed additives (improving livestock and poultry immune function and meat color), daily necessities (toothpastes, mouthwashes, assisting in oral cleaning and soothing oral mucosa), pet foods (improving pet immunity and hair quality).

II. Cosmetics Application: Production Process and Precautions

The core functions of elderberry extract in cosmetics are anti-oxidation, brightening, soothing and repairing, suitable for various dosage forms. The key is to control addition temperature and pH value, avoid oxidative degradation of active ingredients, ensure product safety, efficacy and stability, while retaining natural color and fruity aroma.

2.1 Skin Care Products (Toners, Essences, Emulsions, Creams, Masks)

2.1.1 Production Process

Toner / Essence

☻Pre-treatment: Put purified water, glycerin (4%-7%), propylene glycol (2%-4%) into the mixing tank, stir at 55-65℃ for 10-15 minutes, dissolve evenly, cool to below 40℃;

☻Add elderberry extract: Add elderberry extract (addition amount 3%-8%), stir for 20-25 minutes (speed 400-500rpm) to ensure uniform dispersion without particles or precipitation;

☻Mixing and filtration: Add preservative (phenoxyethanol, 0.3%-0.5%), essence (0.1%-0.2%), adjust pH to 4.5-5.5, filter with 0.22μm membrane to remove impurities and micro-particles;

☻Filling: Fill into glass or plastic bottles in aseptic environment, seal and store in dark.

Emulsion / Cream

☻ Water phase preparation: Purified water, elderberry extract (4%-12%), hyaluronic acid (0.1%-0.3%), glycerin, stir and dissolve at 60-65℃, keep warm for standby (temperature maintained at about 60℃);

☻ Oil phase preparation: Squalane, stearic acid, emulsifier (Tween-80, 2%-3%), lanolin (1%-2%), heat and melt at 65-70℃, stir evenly, keep warm for standby;

☻ Emulsification: Slowly pour oil phase into water phase, stir at high speed (1500-2000rpm) for 15-20 minutes, emulsification temperature maintained at 60-65℃ to ensure uniform emulsification without layering;

☻ Cooling and mixing: Cool to below 40℃, add preservatives, essence, antioxidant (vitamin E, 0.1%-0.2%), stir for 10-15 minutes, adjust pH to 4.5-6.0, continue cooling to room temperature;

☻ Filling: Aseptically fill into hoses or glass bottles, seal and store in dark.

Mask (Sheet / Wash-off)

1. Sheet mask: Purified water, elderberry extract (6%-18%), glycerin, xanthan gum (0.2%-0.4%), stir and dissolve at 45-55℃, add preservatives, essence, vitamin C (0.5%-1%), adjust pH to 4.5-5.5, filter and pour into mask cloth, vacuum seal;
2. Wash-off mask: Elderberry extract (10%-22%), 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, fill into hoses or jars.

2.1.2 Precautions

☻ Temperature control: Elderberry extract shall be added below 40℃ to avoid anthocyanin degradation, color fading and aroma loss caused by high temperature; emulsification temperature shall not exceed 70℃ to prevent further oxidation of active ingredients;

☻ pH adaptation: Optimal pH range for skin care products is 4.5-6.0, which maximizes anthocyanin activity and avoids skin irritation; stability test shall be conducted in advance for alkaline (pH > 7.0) systems, and citric acid can be added to adjust pH if necessary;

☻ Addition amount control: 3%-12% for ordinary skin care products, 4%-8% for sensitive skin products to avoid skin stinging and redness; addition amount can be appropriately increased in masks (6%-18%), but soothing ingredients such as panthenol and dipotassium glycyrrhizinate shall be matched to reduce irritation;

☻ Preservation and anti-oxidation: Elderberry extract contains natural phenols and sugars, easy to breed microorganisms, sufficient preservatives shall be added; antioxidants (vitamin E, tea polyphenols, 0.1%-0.2%) must be added to delay anthocyanin oxidative browning and prevent product darkening and efficacy reduction;

☻ Skin type adaptation: Low-sensitization elderberry extract (desensitized) shall be selected for sensitive skin products, avoiding irritating ingredients such as alcohol and essence; addition amount can be appropriately increased for dull skin products, matched with brightening ingredients such as niacinamide and vitamin C for synergistic effect;

☻ Color control: Elderberry extract has natural purple-black color, excessive addition may lead to overly dark product color, adjust addition amount according to product needs or match with light-colored raw materials to neutralize color.

2.2 Personal Washing Products (Shampoos, Conditioners, Body Washes)

2.2.1 Production Process

Shampoo

1. Pre-treatment: Purified water, sodium laureth sulfate (AES, 14%-19%), cocamidopropyl betaine (CAB, 4%-7%), stir and dissolve at 55-60℃ to form basic system, cool to below 40℃;
2. Add elderberry extract: Add elderberry extract (4%-9%), stir for 20-25 minutes, add humectant (panthenol, 2%-3%), hair care ingredients (hydrolyzed keratin, 0.5%-1%);
3. Mixing: Adjust pH to 5.0-6.0, add preservatives, essence, thickener (hydroxyethyl cellulose, 0.3%-0.5%), stir evenly to ensure no particles or layering;
4. Filtration and filling: Filter with 100-mesh sieve to remove impurities, aseptically fill into plastic bottles, seal and package.

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, cool to below 40℃;
2. Add elderberry extract: Add elderberry extract (5%-10%), glycerin, hair care oil (1%-2%), stir for 15-20 minutes to ensure uniform dispersion;
3. Finalization: Adjust pH to 4.5-5.5, add preservatives and essence, stir until 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 (pearlescent agent, 2%-3%), keep warm for 25-30 minutes to form pearlescent system;
2. Add elderberry extract: Cool to below 38℃, add elderberry extract (3%-7%), stir for 15 minutes, add humectants and preservatives;
3. Finalization: Adjust pH to 5.0-6.0, stir until uniform and pearlescent, cool to room temperature and fill.

2.2.2 Precautions

☻ Surfactant compatibility: Good compatibility with anionic and non-ionic surfactants, avoid compounding with high-concentration cationic surfactants to prevent precipitation and layering;

☻ Foam control: Little effect on foam volume, if foam is insufficient, appropriately increase AES dosage (1%-2%) or add foam enhancer (such as cocamide DEA);

☻ Stability test: Layering and color fading may occur during long-term storage, add thickeners to improve stability and antioxidants to delay oxidation; storage temperature controlled at 5-35℃, avoid direct sunlight;

☻ Irritation control: Addition amount ≤9% in shampoos and body washes to avoid scalp and skin irritation; match with dipotassium glycyrrhizinate (0.1%-0.2%) and panthenol to enhance soothing effect and reduce allergy risk;

☻ Hair care optimization: Match with hydrolyzed keratin and hair care oil in conditioners for synergistic effect with elderberry extract, improve hair smoothness, repair damaged hair and reduce dryness and split ends.

2.3 Other Cosmetics (Makeup, Hand Creams)

2.3.1 Makeup (Lipsticks, Blushes)

- **Production process**: For lipsticks, heat and melt beeswax, paraffin and lanolin (70-75℃), cool to below 60℃, add elderberry extract (5%-10%), stir evenly, add pigments (adjustable as needed to enhance color), pour into molds for shaping; for blushes, mix talc, corn starch and mica powder evenly, add elderberry extract (3%-7%), essence and a small amount of adhesive, mix and compress;
- **Precautions**: Addition amount controlled at 3%-10% to avoid overly dark color affecting makeup tone; control temperature during production to avoid anthocyanin degradation caused by high temperature; ensure uniform system in lipsticks 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 elderberry extract (6%-12%) and emulsifier, emulsify at high speed (1500rpm) for 15 minutes, cool, add preservatives, essence and antioxidant, stir evenly;
- **Precautions**: Appropriately increase addition amount to enhance moisturizing, anti-oxidation and repairing effects; avoid excessive oil to prevent stickiness; match with ceramide and hyaluronic acid to improve moisturizing and repairing power.

III. Food Application: Production Process and Precautions

Elderberry extract exerts anti-oxidation, coloring, flavor enhancement and functional effects in foods, suitable for liquid, solid and semi-solid foods. The key is to control processing temperature and pH value, ensure food safety and efficacy stability, strictly follow food additive usage specifications, while retaining natural fruity aroma and color.

3.1 Beverages (Fruit Juices, Fruit-flavored Drinks, Functional Drinks, Alcoholic Beverages)

3.1.1 Production Process

Fruit Juice Drinks

1. Pre-treatment: Dilute concentrated fruit juice (30%-40%) to target concentration with purified water, add white sugar (4%-7%), citric acid (0.1%-0.2%), stir and dissolve, adjust pH to 4.0-5.0;
2. Add elderberry extract: Cool to below 55℃, add elderberry extract (0.8%-4%), stir for 15-20 minutes (speed 500rpm) to ensure complete dissolution without

precipitation;

3. Mixing and sterilization: Add preservative (potassium sorbate, 0.05%-0.1%), essence, adopt UHT sterilization (135℃, 3-5 seconds) to reduce active ingredient degradation;
4. Filling: Cool to below 25℃, aseptically fill into PET bottles or aluminum cans, seal and store in dark.

Functional Drinks (Immune Regulation, Anti-cold)

1. Pre-dissolution: Mix elderberry extract (3%-6%) with 5 times purified water, stir at 55-60℃ for 20 minutes to ensure no particles and complete dissolution;
2. Compounding: Add vitamin C (0.5%-1%), zinc (0.01%-0.02%), probiotics (such as *Bifidobacterium lactis*), prebiotics (fructooligosaccharides, 3%-5%), stir evenly, adjust pH to 4.5-5.5;
3. Sterilization and packaging: Adopt ultra-high pressure sterilization (600MPa, 5 minutes) to retain probiotics and elderberry active ingredients, aseptically fill into oral liquid bottles or PET bottles, seal and package.

Alcoholic Beverages (Fruit Wines, Cocktails)

1. Basic system preparation: Liquor, fruit wine or cocktail base (alcohol content 10%-20%), add white sugar (2%-5%), stir and dissolve, cool to below 25℃;
2. Add elderberry extract: Add elderberry extract (1%-3%), stir for 15 minutes, add essence and pigments (small amount optional to enhance color), stir evenly;
3. Filtration and filling: Filter with 0.45μm membrane to remove impurities, aseptically fill into glass bottles, seal and store in dark.

3.1.2 Precautions

☻ Temperature control: For acidic beverages (pH < 4.5), add elderberry extract after cooling to below 55℃ after sterilization to avoid anthocyanin degradation caused by high temperature and acidic environment; UHT sterilization time ≤5 seconds to reduce active ingredient loss;

☻ Taste optimization: Elderberry extract has slight astringency, match with sweeteners (erythritol, steviol glycosides), high fructose syrup to adjust taste and avoid masking juice flavor; when addition amount exceeds 4%, match with fruit powder (5%-8%) to neutralize astringency;

☻ Stability control: In fruit juice drinks with pulp, elderberry extract may adsorb pulp particles, ensure suspension by homogenization (25MPa) to avoid precipitation; liquid beverage storage temperature ≤25℃, avoid direct sunlight to prevent browning and color fading;

☻ Compliance: Food-grade elderberry extract must comply with GB 2760, addition amount strictly follows regulations (≤6% in beverages), label shall mark "Contains elderberry ingredients, daily intake not exceeding 20g";

1. Alcohol compatibility: Good compatibility with alcohol in alcoholic beverages, but addition amount ≤3% to avoid aggravated astringency; ensure complete dissolution of extract to avoid precipitation.

3.2 Baked Goods (Breads, Cakes, Biscuits, Pastries)

3.2.1 Production Process

Bread

1. Raw material mixing: Dry mix high-gluten flour, yeast and salt evenly, add water and butter, stir at low speed for 5 minutes in dough mixer to form gluten;
2. Add elderberry extract: Add elderberry extract (1.5%-4%, based on flour mass), stir at high speed for 10-15 minutes to ensure uniform dispersion; can match with maltodextrin (1%-2%) to improve dispersibility and prevent moisture absorption and agglomeration;
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 185℃, bottom 175℃), bake for 25-30 minutes, cool to room temperature, seal and store in dark.

Cake

1. Batter preparation: Whisk eggs and white sugar at high speed until volume expands 3-4 times, add low-gluten flour and baking powder, fold evenly to avoid gluten formation;
2. Add elderberry extract: Add elderberry extract (2.5%-5%, based on flour mass) and milk, fold until no particles, uniform and delicate;
3. Baking: Brush oil on molds, pour in batter, oven temperature 165-175℃, bake for 30-35 minutes, cool and demold;
4. Decoration (optional): Spread cream containing elderberry extract (addition amount 4%-6%) on cake surface, sprinkle a small amount of elderberry powder to enhance flavor and appearance.

Biscuit

1. Dough mixing: Mix low-gluten flour, white sugar and milk powder evenly, add melted butter and egg liquid, stir at low speed for 10 minutes to form uniform dough;
2. Add elderberry extract: Add elderberry extract (1.5%-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-cut, oven temperature 165-175℃, bake for 10-12 minutes, cool, seal and store in dark.

3.2.2 Precautions

☻ Temperature control: Baking temperature ≤185℃, over-temperature causes elderberry extract carbonization, anthocyanin degradation and burnt odor; reduce bottom heat by 5-10℃ in late bread baking to prevent over-browning at bottom;

☻ Dough adjustment: Elderberry extract has certain hygroscopicity, increase water addition by 0.3%-0.5% for each 1% extract added to avoid overly dry or sticky dough; control biscuit dough hardness to avoid forming difficulties;

☻ Flavor control: Astringency of elderberry extract weakens after baking, match with a small amount of honey (2%-3%), vanilla extract (0.1%) or chocolate powder to further neutralize astringency and improve flavor;

☻ Storage: Use moisture-proof and light-proof packaging (aluminum-plastic composite bags) for baked goods, storage environment humidity ≤60% to avoid softening and deterioration caused by moisture absorption, and prevent anthocyanin oxidation and color fading;

☻ Color retention: Natural purple-black color of elderberry extract deepens slightly during baking, adjust addition amount according to product needs to avoid overly dark color affecting appearance.

3.3 Dairy Products (Yogurts, Milk Drinks, Cheeses)

3.3.1 Production Process

Yogurt

1. Pre-treatment: Mix raw milk and whey protein powder in proportion, add white sugar (5%-7%), homogenize at 50-60℃, 20-25MPa to ensure uniform system;
2. Sterilization and cooling: Pasteurization (65℃, 30 minutes), cool to 42℃, inoculate *Lactobacillus bulgaricus* and *Streptococcus thermophilus*;
3. Add elderberry extract: Add elderberry extract (1.5%-5%), stir for 5-10 minutes, ferment for 4-6 hours (elderberry extract promotes probiotic proliferation, viable count increases by 15%-25%);
4. Post-ripening: Cool to 2-6℃, refrigerate for post-ripening 12 hours to improve smoothness and flavor, store in dark.

Milk Drink

1. Basic system preparation: Mix milk (30%-40%) with purified water, add emulsifier (polyglycerol fatty acid ester, 0.2%-0.3%), homogenize (20MPa) to avoid layering;
2. Add elderberry extract: Cool to below 55℃, add elderberry extract (2.5%-6%), white sugar and essence, stir evenly, adjust pH to 4.5-5.5;

3. Sterilization and filling: UHT sterilization (135℃, 4 seconds), cool and aseptically fill to avoid microbial contamination, seal and store in dark.

Cheese

1. Pre-treatment: Sterilize raw milk (65℃, 30 minutes), cool to 38℃, add rennet, stand for curdling;
2. Add elderberry extract: Cut curd, drain whey, add elderberry extract (2%-4%), stir evenly, compress and shape;
3. Ripening: Ripen for 7-15 days at 10-15℃, humidity 80%-85%, seal and refrigerate after ripening.

3.3.2 Precautions

☻ pH adaptation: pH drops to 4.0-4.5 after yogurt fermentation, elderberry extract has good stability in this range without additional adjustment; for acidic milk drinks (pH < 3.8), add after sterilization to reduce anthocyanin degradation;

☻ Addition amount control: Exceeding 5% in yogurt may cause sour taste and flatulence, recommended 1.5%-4%; ≤6% in milk drinks to avoid affecting dairy system stability and layering;

☻ Microbial synergy: When compounded with probiotics, control elderberry extract to probiotics ratio at 10:1 to avoid excessive fermentation causing sourness;

☻ Storage: Yogurt stored at 2-6℃, shelf life 7-14 days; milk drink storage temperature ≤25℃, avoid direct sunlight to prevent browning and layering; cheese refrigerated to avoid moisture absorption and deterioration;

☻ Color and taste: Light purple after adding elderberry extract, adjust addition amount according to product needs; match with sweeteners to neutralize astringency and improve palatability.

3.4 Other Foods (Candies, Jellies)

3.4.1 Candies (Gummies, Hard Candies)

- **Production process**: For gummies, add elderberry extract (4%-7%) after dissolving gelatin and agar (60℃), stir evenly, add sweeteners, essence and pigments (small amount optional), pour into molds for shaping, cool and package; for hard candies, boil to 125-130℃, cool to below 100℃, add elderberry extract (2.5%-5%), stir and dissolve for shaping, cool and seal;
- **Precautions**: Add after cooling in late hard candy boiling to avoid high-temperature anthocyanin degradation; control moisture content of gummies (15%-20%) to avoid adhesion caused by moisture absorption; match with citric acid to enhance flavor layers and neutralize sweetness.

3.4.2 Jelly

- **Production process**: Heat and dissolve purified water and jelly powder (agar/ carrageenan, 1%-2%), add elderberry extract (3%-6%), white sugar and citric acid, stir evenly, adjust pH to 4.5-5.5, pour into molds, cool and shape, seal and package;
- **Precautions**: Adjust pH to 4.5-5.5 to improve jelly stability and avoid layering and water seepage; exceeding 6% may cause soft texture, appropriately increase jelly powder dosage; store jelly in dark to prevent color fading.

IV. Health Products Application: Production Process and Precautions

Elderberry extract focuses on immune regulation, anti-oxidation and auxiliary anti-cold effects in health products, common dosage forms include capsules, tablets, granules, oral liquids and solid drinks, need to balance efficacy stability and convenience, strictly follow health product raw material technical requirements to ensure active ingredient content meets standards.

4.1 Capsule Application

4.1.1 Production Process

☻ Raw material preparation: Select health product-grade elderberry extract (purity ≥90%, anthocyanin ≥15%), mix with microcrystalline cellulose (filler, ratio 8:2), magnesium stearate (lubricant, 0.5%) according to formula;

☻ Mixing process: Premix by equal increment method, put into V-type mixer, speed 200rpm, mix for 15-20 minutes (mix uniformity coefficient of variation CV ≤3%);

☻ Capsule filling: Use automatic capsule filling machine in clean workshop (humidity ≤55%, temperature 20-25℃), fill 0# or 1# capsules (200-500mg elderberry extract per capsule), filling accuracy ±2%;

☻ Quality inspection: Sampling test appearance, weight difference (±7.5%), disintegration time limit (complete disintegration within 30 minutes), anthocyanin content, package after qualification.

4.1.2 Precautions

- Raw material purity: Health product-grade elderberry extract must comply with *Health Food Raw Material Technical Requirements*, heavy metals (Pb≤0.1mg/kg, As≤0.05mg/kg) and microorganisms (total colony count ≤100CFU/g) strictly meet standards; anthocyanin ≥15% to ensure immune regulation and anti-oxidation effects;
- Humidity control: Strong hygroscopicity of elderberry extract, easy agglomeration causing filling machine jamming when workshop humidity > 55%, turn on dehumidification equipment, store raw materials sealed to avoid moisture absorption;
- Fluidity optimization: If angle of repose > 40°, add 1%-2% silicon dioxide to improve fluidity, ensure uniform filling and improve filling accuracy;
- Packaging and storage: Adopt aluminum-plastic blister packaging with desiccant, store in cool, dry and dark place (temperature ≤25℃, humidity ≤55%), shelf life 24 months; label suitable 人群 (low immunity, cold-prone people), unsuitable 人群 (pregnant women, infants, allergic constitution), daily intake.

4.2 Tablet Application

4.2.1 Production Process

- Raw material pre-treatment: Sieve elderberry extract (purity ≥90%) through 100-mesh sieve to remove agglomerates, mix evenly with lactose (diluent, ratio 7:3), hypromellose (binder, 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 3%-5%) to avoid high-temperature anthocyanin degradation;
- Sizing and tableting: Sieve dried granules through 20-mesh sieve, add 1% magnesium stearate and mix for 10 minutes, tablet with rotary tablet machine (pressure 8-10kN, hardness 5-7kgf, friability ≤1%);
- Coating (optional): Adopt gastric-soluble coating powder, coating temperature 40-45℃, weight gain 3%-5% to improve stability and mask elderberry astringency.

4.2.2 Precautions

- Granulation control: Accurate binder dosage, insufficient causes loose granules, excessive causes delayed disintegration; drying temperature ≤60℃ to prevent active ingredient (anthocyanin) degradation;
- Disintegration optimization: Add 5%-10% crospovidone (disintegrant) to ensure disintegration time limit ≤15 minutes, facilitate absorption and improve efficacy utilization;
- Dosage design: Adult recommended daily intake 1-2g (as elderberry extract), single tablet dose 500mg-1g, mark "1-2 times daily, 1 tablet each time, take with meals";

☻ Stability monitoring: Regularly test hardness, disintegration time limit and anthocyanin content during storage to avoid performance degradation caused by moisture absorption; avoid taking with spicy, greasy food to affect absorption.

4.3 Granule (Solid Drink) Application

4.3.1 Production Process

☻ Raw material mixing: Put elderberry extract (25%-45g/100g), erythritol (sweetener, 30%), fructooligosaccharides (synergistic prebiotics, 10%), vitamin C (1%-2%), essence (0.1%) into three-dimensional mixer, speed 300rpm, mix for 20-25 minutes to ensure uniformity;

☻ Granulation (optional): Add 3% povidone solution for granulation (18-mesh sieve), dry at 60℃ to moisture ≤5%, size and package to improve solubility;

☻ Quantitative packaging: Adopt automatic granule packaging machine, specification 10g/bag or 15g/bag (2.5-6.75g elderberry extract per bag), aluminum-plastic film light-proof packaging.

4.3.2 Precautions

☻ Solubility guarantee: Slow dissolution at high concentration (> 30%), control particle size 40-60 mesh or advise consumers to brew with 60-70℃ warm water, stir until complete dissolution;

☻ Taste optimization: Match with steviol glycosides (0.03%) and fruit powder (5%) to adjust taste, neutralize astringency, ensure refreshing taste after brewing;

☻ Mix uniformity: Trace ingredients (such as vitamin C, zinc) premix with a small amount of elderberry extract first to avoid uneven content and ensure efficacy per bag;

☻ Storage and moisture-proof: Use up within 1 month after opening, unopened products stored in humidity ≤60%, dark environment to avoid agglomeration and anthocyanin oxidation.

4.4 Oral Liquid Application

4.4.1 Production Process

☻ Pre-dissolution: Mix elderberry extract (6%-12g/100mL) with purified water at 1:5, stir at 55-60℃ for 20 minutes to dissolve, ensure no particles or precipitation;

☻ Mixing: Add 0.2% citric acid (adjust pH 4.5-5.5), 0.1% potassium sorbate (preservative), sweetener (erythritol, 3%-5%), stir evenly, add antioxidant (vitamin E, 0.1%-0.2%);

- Filtration and filling: Filter with 0.22μm membrane to remove impurities, aseptically fill (10mL/piece), pasteurize (65℃, 30 minutes) to reduce active ingredient degradation;
- Packaging: Label, box, store in cool, dry and dark place.

4.4.2 Precautions

- pH control: Acidic oral liquid pH≥4.5 to avoid anthocyanin degradation and reduce gastrointestinal irritation, improve tolerance;
- Preservation and anti-oxidation: Easy to breed microorganisms, add sufficient preservatives; add vitamin E, tea polyphenols to delay oxidative browning and prevent darkening and efficacy reduction;
- Filling and sealing: Seal immediately after filling to avoid microbial contamination and active ingredient loss; storage temperature ≤25℃, avoid direct sunlight, shelf life 12 months;
- Dosage control: 0.6-1.2g elderberry extract per piece, 1-2 pieces daily, take with meals to avoid gastrointestinal discomfort caused by excessive intake.

V. Medical Application: Production Process and Precautions

Elderberry extract is mainly used as external preparation excipient and oral preparation auxiliary component in medical field, must comply with *Chinese Pharmacopoeia* 2025 Edition, focus on purity, biocompatibility and preparation stability, strictly control impurity content and sterility, ensure synergistic effect with active pharmaceutical ingredients, give full play to auxiliary anti-inflammatory, anti-oxidation and immune regulation effects.

5.1 External Preparation Application (Anti-inflammatory Ointments, Skin Repair Preparations)

5.1.1 Production Process

- Oil phase preparation: Mix vaseline, lanolin and liquid paraffin in proportion, heat and melt at 70-75℃, stir evenly, keep warm for standby;
- Water phase preparation: Purified water, pharmaceutical-grade elderberry extract (6%-12%, purity ≥95%), glycerin, stir and dissolve at 65-70℃, add preservative (benzalkonium bromide, 0.02%-0.05%);
- Emulsification: Slowly pour water phase into oil phase, stir at high speed (1500rpm) for 15-20 minutes, emulsification temperature maintained at 65-70℃ to form uniform ointment base;

☻ Cooling and filling: Cool to below 40℃, add active pharmaceutical ingredients (such as hydrocortisone for anti-inflammatory ointments), stir evenly, fill into aluminum tubes, seal and package, sterilize and warehouse.

5.1.2 Precautions

☻ Purity requirement: Pharmaceutical-grade elderberry extract must comply with *Chinese Pharmacopoeia* 2025 Edition excipient standards, heavy metals and related substances (total impurities ≤0.5%) strictly controlled; anthocyanin ≥20% to ensure anti-inflammatory, anti-oxidation and skin repair effects;

☻ Sterilization: External preparations require sterilization (γ-ray sterilization, dose 25kGy), bacterial endotoxin ≤10EU/g to avoid skin infection, especially for damaged skin and inflammatory parts;

☻ Compatibility: Conduct compatibility test with active pharmaceutical ingredients (store at 40℃, 75%RH for 1 month), confirm no interaction, no effect on efficacy, no toxic and harmful substances;

☻ Irritation: Pass skin irritation test (no erythema, edema), reduce addition amount (4%-6%) for sensitive parts (such as face, around mucous membranes);

☻ Stability: Store external ointments sealed in dark, avoid high temperature and direct sunlight to prevent anthocyanin degradation, ensure stable efficacy, shelf life 18-24 months.

5.2 Oral Preparation Application (Immune Regulation Drugs, Adjuvant Cold Treatment Preparations)

5.2.1 Production Process

☻ Raw material pre-treatment: Sieve pharmaceutical-grade elderberry extract (purity ≥95%) through 100-mesh sieve to remove agglomerates, mix with active pharmaceutical ingredients, lactose (diluent), disintegrant in proportion;

☻ Granulation and drying: Add binder (hypromellose) to make soft material, granulate and dry at 50-60℃, moisture 3%-5% to avoid high-temperature anthocyanin degradation;

☻ Tableting and coating: Size and add lubricant (magnesium stearate, 0.5%), tablet (pressure 7-9kN), adopt enteric coating (avoid gastric acid destruction), coating temperature 40-45℃;

☻ Quality inspection: Test content uniformity (deviation ≤±5%), disintegration time limit (enteric-coated tablets disintegrate within 30 minutes in artificial intestinal fluid), dissolution (≥80% in 45 minutes), anthocyanin content, package after qualification.

5.2.2 Precautions

☻ pH adaptation: Oral preparations release in intestine, enteric coating ensures no disintegration in gastric acid (pH < 3.0), rapid disintegration in intestinal fluid (pH > 7.0) to avoid degradation in gastric acid and improve efficacy utilization;

☻ Dosage control: Daily intake ≤2g in oral medical preparations to avoid gastrointestinal discomfort such as diarrhea and abdominal pain;

☻ Storage conditions: Store in cool and dry place (2-8℃, refrigerated) to avoid moisture absorption and oxidation, shelf life 24 months;

☻ Contraindicated crowd: Pregnant women, lactating women, infants, allergic constitution and intestinal ulcer patients prohibited, clearly mark contraindications, adverse reactions and usage on label;

☻ Efficacy synergy: Control addition amount when compounded with cold and immune regulation drugs to avoid antagonism and ensure adjuvant treatment effect.

5.3 Food for Special Medical Purposes Application

- **Production process**: Mix elderberry extract (9%-13g/100g) with whey protein, medium-chain triglycerides, vitamins and minerals to make liquid or powder formula, UHT sterilization (135℃, 3-5 seconds) and aseptic filling; stir liquid dosage form evenly to avoid precipitation; control particle size of powder dosage form for easy brewing;
- **Precautions**: Comply with special medical purpose food standards, for specific 人群 such as intestinal diseases and low immunity, addition amount 9%-11% to avoid intestinal irritation; powder easy to brew without precipitation, mild taste after brewing; liquid formula pH 5.0-6.5 for easy absorption, avoid excessive acidity irritating gastrointestinal tract; clearly mark applicable 人群, usage and daily intake on label.

VI. Other Fields Application: Production Process and Precautions

6.1 Feed Field Application

6.1.1 Production Process

☻ Mixing: Mix feed-grade elderberry extract (purity ≥85%) with feed base (corn flour, soybean meal, 80%), vitamins and minerals, stir in twin-shaft mixer at 300rpm for 20 minutes to ensure uniform dispersion (CV ≤5%);

☻ Granulation: Make mixed materials into pellet feed (particle size 3-5mm) through granulator (temperature 80-90℃, ring die compression ratio 1:8), cool to room temperature and package to avoid high-temperature active ingredient degradation.

6.1.2 Precautions

☻ Addition amount control: 1%-2% in broiler feed (improve survival rate, skin health and immunity), 2%-3% in sow feed (improve lactation and piglet immunity), 0.5%-1% in aquatic feed (promote growth, regulate intestine and reduce diseases);

☻ Heat resistance: Granulation temperature ≤90℃, over-temperature causes anthocyanin and flavonoid degradation, losing immune regulation and anti-inflammatory effects;

☻ Storage: Store feed in dry and ventilated place (humidity ≤65%) to avoid agglomeration and deterioration; package in cardboard barrels with plastic liners, sealed and dark;

☻ Compatibility: Good compatibility with vitamins, minerals and probiotics, synergistically improve immunity, avoid compounding with strong oxidants.

6.2 Daily Necessities Application (Toothpastes, Mouthwashes)

6.2.1 Production Process

Toothpaste

1. Basic system preparation: Mix calcium carbonate (abrasive), glycerin, sodium carboxymethyl cellulose (thickener), purified water at 60℃ to form uniform paste;
2. Add elderberry extract: Cool to below 45℃, add elderberry extract (2%-5%), fluoride and essence, stir for 20 minutes to ensure uniformity without particles or precipitation;
3. Degassing and filling: Vacuum degassing (remove bubbles), fill into toothpaste tubes, seal and package to avoid oxidation.

Mouthwash

1. Pre-dissolution: Mix elderberry extract (1%-3%) with purified water and ethanol (10%-15%), stir at 60℃ for 15 minutes to dissolve evenly, avoid precipitation;
2. Mixing: Add menthol (0.1%-0.2%), preservative (chlorhexidine, 0.05%), adjust pH to 5.5-6.5, stir evenly to neutralize slight astringency;
3. Filtration and filling: Filter with 0.22μm membrane to remove impurities, aseptically fill into glass bottles, seal and store in dark.

6.2.2 Precautions

☻ Compatibility: Good compatibility with abrasives, fluorides and thickeners in toothpastes, avoid compounding with strong oxidants to prevent active ingredient oxidation and precipitation;

☻ Irritation: Ethanol content ≤15% in mouthwashes to avoid oral mucosa irritation; addition amount ≤3% to prevent bitter and astringent taste, match with small amount of sweeteners for neutralization;

☻ Stability: Store in cool and dry place, avoid direct sunlight to prevent oxidation and darkening (from dark purple to brown); use up as soon as possible after opening to avoid moisture absorption and contamination;

☻ Color control: Natural purple-black color, excessive addition in toothpastes may cause overly dark paste, adjust addition amount according to product needs (2%-3% appropriate).

VII. General Precautions During Production of Elderberry Extract

7.1 Raw Material Selection and Quality Control

- Purity classification: Food-grade ≥85%, cosmetic-grade ≥90%, health product-grade ≥90% (anthocyanin ≥15%), pharmaceutical-grade ≥95% (anthocyanin ≥20%), feed-grade ≥85%, select as needed to avoid "low-grade high-use" and ensure compliance and efficacy;
- Source compliance: Prioritize FSSC 22000, BRCGS certified suppliers, raw materials require COA (Certificate of Analysis), clarify heavy metals, microorganisms, anthocyanin content and other core indicators to ensure stable quality;
- Impurity control: Food and cosmetic-grade heavy metals Pb≤0.5mg/kg, As≤1.0mg/kg; pharmaceutical and health product-grade Pb≤0.1mg/kg, As≤0.05mg/kg; feed-grade Pb≤1.0mg/kg, As≤2.0mg/kg; avoid unqualified products caused by excessive impurities;
- Activity indicator: Clarify anthocyanin content for different grades, pharmaceutical-grade ≥20%, health product-grade ≥15%, cosmetic-grade ≥12% to ensure efficacy.

7.2 Process Parameter Control

- Temperature control: Over-temperature causes active ingredient (anthocyanins, flavonoids) degradation and darkening, real-time temperature control (error ±2℃);
- Cosmetic processing: Addition temperature ≤45℃, emulsification temperature ≤75℃ to avoid high-temperature anthocyanin destruction;
- Food processing: Baking ≤185℃, sterilization ≤135℃ (UHT), acidic beverage addition ≤60℃, shorten high-temperature residence time (≤5 minutes);
- Medical processing: Granulation ≤60℃, sterilization ≤135℃ to ensure active ingredient retention rate ≥85%;

- Industrial processing: Feed granulation ≤90℃ to avoid degradation;
- pH control: Stable pH range 5.0-7.5, shorten processing time ≤30 minutes for acidity (pH < 4.0), avoid long-term storage for alkalinity (pH > 8.0) to prevent anthocyanin degradation;
- Mix uniformity: Mix 15-30 minutes in three-dimensional/V-type mixer, CV ≤5% for food, cosmetic and feed-grade, CV ≤3% for pharmaceutical and health product-grade to avoid quality differences.

7.3 Storage and Packaging Requirements

- Storage conditions: Temperature 20-25℃, pharmaceutical and health product-grade refrigerated (2-8℃); humidity ≤60% (solid), ≤55% (health products, cosmetics); dark storage, ultraviolet accelerates oxidative browning causing darkening and efficacy reduction;
- Packaging materials: Aluminum-plastic composite film for food/health products/cosmetics (oxygen permeability ≤5mL/(m²·24h)) to prevent oxidation; cardboard barrels with plastic liners for industrial and feed-grade; sealed glass bottles or food-grade plastic barrels for liquid extracts;
- Shelf life management: Solid unopened 24 months, 3-6 months after opening; liquid unopened 12 months, 1 month after opening (refrigerated); expired products prohibited, dispose according to hazardous waste regulations.

7.4 Regulatory Compliance and Safety

- Domestic regulations: Food-grade complies with GB 2760, GB 18187-2000; cosmetic-grade complies with *Safety and Technical Specifications for Cosmetics* (2022 Edition); health product-grade complies with *Health Food Raw Material Technical Requirements*; pharmaceutical-grade complies with *Chinese Pharmacopoeia* 2025 Edition; feed-grade complies with feed additive standards;
- International regulations: US FDA GRAS certification, EU EC No. 1223/2009; verify target country regulations in advance for export products to ensure compliance;
- Safe intake: Adult daily ≤2g (as elderberry extract), excessive may cause diarrhea and abdominal pain; prohibited for infants, pregnant women, lactating women, intestinal ulcer patients and allergic constitution;
- Label specification: Food and cosmetics mark "Elderberry Extract" and addition amount; health products mark suitable/unsuitable crowd daily intake, anthocyanin content; medical products mark contraindications, adverse reactions, usage; feed products mark addition amount and applicable livestock/aquatic species.

VIII. Differentiated Strategies of Elderberry Extract in Different Application Fields

8.1 Differentiated Strategies in the Cosmetics Field

Core Logic: Taking "efficacy segmentation + skin type adaptation" as the core, combined with the characteristics of active ingredients such as anthocyanins and flavonoids in elderberry extract, design differentiated addition schemes, raw material selection and efficacy enhancement combinations for different skin care needs, skin types and product formulations, balancing mildness and efficacy to create the core competitiveness of products.

8.1.1 Differentiation in Raw Material Selection

- Products for Sensitive Skin: Select low-sensitizing elderberry extract (desensitized), with a purity ≥95%, and prioritize small-molecule anthocyanins (molecular weight ≤5000Da) to enhance skin penetration and reduce stinging; paired with alcohol-free and fragrance-free formulas, suitable for sensitive skin, redness-prone skin and post-treatment repair scenarios.
- Brightening and Antioxidant Products: Select elderberry extract with high anthocyanin and flavonoid content (anthocyanins ≥18%), combined with brightening ingredients such as vitamin C and niacinamide to inhibit tyrosinase activity, while relieving irritation caused by brightening ingredients, suitable for oily and dull skin products to improve uneven skin tone.
- Soothing and Repairing Products: Select elderberry extract with high phenolic acid content (phenolic acids ≥8%), combined with panthenol and dipotassium glycyrrhizinate to enhance anti-inflammatory and soothing effects, suitable for sensitive skin and post-sun repair scenarios, reducing skin redness and stinging.
- Special for Hair and Body Care Products: Select surfactant-tolerant elderberry extract (specially modified) to avoid precipitation caused by reaction with anionic surfactants, and improve water solubility, suitable for formulations such as shampoos and body washes to ensure long-term storage stability.

8.1.2 Differentiation in Addition Schemes

- Formulation Adaptation: For liquid products such as toners and essence waters, select liquid elderberry extract (concentration 50%-80%), which can be directly dissolved without additional pretreatment, with an addition amount of 2%-5%; for semi-solid products such as lotions and creams, select powdered extract, paired with maltodextrin to improve dispersibility, with an addition amount of 3%-10%; for mask products, select high-activity extract, with an addition amount of 6%-18%, combined with panthenol and centella asiatica extract to enhance soothing effect.
- Efficacy Enhancement: For post-sun repair products, anthocyanin derivatives can be compounded with elderberry extract (to enhance anti-inflammatory and soothing

effects) at an addition amount of 3%-5%; for anti-aging products, compound with peptides and 玻色因 (pro-xylane), with elderberry extract as an auxiliary repair ingredient at an addition amount of 4%-6% to reduce the irritation of anti-aging ingredients.

- Mildness Optimization: For sensitive skin products, adopt "low-temperature addition + low-speed stirring" process, with an addition temperature ≤40℃ and a stirring speed of 300rpm to avoid damaging active ingredients and reduce skin irritation; 0.1%-0.2% dipotassium glycyrrhizinate can be added to neutralize the slight irritation of elderberry extract.

8.1.3 Differentiation in Market Positioning

1. High-end Products: Select organically certified elderberry extract (complying with USDA organic certification), emphasize "natural and additive-free", compound with high-end repair ingredients (such as squalane and ergothioneine), with an addition amount of 8%-12%, focusing on "mild repair + high-end experience", suitable for high-end skin care scenarios;
2. Mid-range Products: Select conventional cosmetic-grade extract (purity ≥90%), focus on a single efficacy (such as brightening and soothing), with an addition amount of 5%-8%, highlighting cost performance, suitable for public skin care needs;
3. Affordable Products: Select cost-effective cosmetic-grade extract (purity ≥90%), with an addition amount of 2%-5%, paired with basic moisturizing ingredients to meet daily care needs, focusing on high cost performance.

8.2 Differentiated Strategies in the Food Field

Core Logic: Taking "compliance + taste adaptation + function enhancement" as the core, combined with the characteristics of food formulations (liquid, solid, semi-solid) and consumer demand (children, the elderly, healthy people), differentially select the purity, addition amount and compounding scheme of elderberry extract, balancing safety, taste and functionality, and complying with the specifications for the use of food additives.

8.2.1 Differentiation in Raw Material Selection

- Children's Food (Jelly, Gummy Candies): Select food-grade elderberry extract (purity ≥85%), remove sour and astringent components (deacidified), with anthocyanins ≥15%, avoid adding irritating components to ensure mild taste, suitable for children's taste needs; at the same time, control heavy metal content (Pb≤0.3mg/kg) to meet children's food safety standards.
- Functional Food (Immunomodulatory, Antioxidant Drinks): Select high-activity food-grade extract (purity ≥90%, anthocyanins ≥20%), prioritize water-extracted

extract (retaining more water-soluble active ingredients), suitable for compounding with probiotics and prebiotics to enhance immunomodulatory and antioxidant effects.

- Bakery and Dairy Products: Select elderberry extract with good temperature resistance (microencapsulated), which can withstand baking temperatures of 180-190°C to avoid degradation of active ingredients; at the same time, improve hygroscopicity to prevent bakery products from softening and dairy products from stratifying.
- Fruit Juices and Beverages: Select liquid elderberry extract (concentration 60%-70%) with good water solubility, easy to mix with fruit juice and reduce precipitation; at the same time, select low-sour and low-astringent extract to avoid affecting the taste of fruit juice.

8.2.2 Differentiation in Addition Schemes

- Taste Adaptation: Add 0.8%-4% to liquid beverages (fruit juice, milk beverages), paired with sweeteners (erythritol, steviol glycosides) to neutralize slight sour and astringent tastes; add 1.5%-4% to bakery products, use the baking process to reduce sour and astringent tastes, and can be paired with honey and vanilla extract to further optimize taste; add 3%-6% to candies and jellies, after deacidification, paired with fruit flavors to improve palatability.
- Function Enhancement: For immunomodulatory foods, compound elderberry extract with probiotics and vitamin C (ratio 8:1:1) at an addition amount of 2%-5% to synergistically enhance the body's resistance; for antioxidant foods, compound with vitamin C and tea polyphenols, with elderberry extract added at 3%-4% to synergistically improve antioxidant effect;
- Formulation Adaptation: For liquid foods (beverages, milk beverages), directly add liquid elderberry extract, stir evenly and then sterilize; for solid foods (bread, biscuits), dry-mix powdered extract with raw materials and adjust water addition (increase 0.3%-0.5% water per 1% extract); for semi-solid foods (yogurt, jelly), pre-dissolve powdered extract before adding to avoid precipitation.

8.2.3 Differentiation in Consumer Groups

- Children's Group: Focus on "mild and non-irritating, sweet taste", with an addition amount ≤3%, mainly in the form of jelly, gummy candies and children's milk beverages, with labels indicating "for children only, daily intake not exceeding 10g";
- Elderly Group: Focus on "immunomodulation and easy absorption", with an addition amount of 2%-4%, mainly in the form of granules, oral liquids and yogurt, compounded with dietary fiber to adapt to the elderly's intestinal function and improve absorption efficiency;
- Healthy Group: Focus on "natural functionality", with an addition amount of 3%-5%, diverse formulations (beverages, bakery, health products), emphasizing "additive-free and natural health", suitable for daily health care needs.

8.3 Differentiated Strategies in the Health Product Field

Core Logic: Taking "precise efficacy + convenient formulation + compliance" as the core, differentially select the purity, formulation and compounding scheme of elderberry extract for different health care needs (immunomodulation, antioxidant) and user groups (adults, the elderly), ensuring stable efficacy and convenient administration, and strictly following relevant health product regulations.

8.3.1 Differentiation in Raw Material Selection

- Immunomodulatory Health Products: Select health product-grade elderberry extract (purity ≥90%, anthocyanins ≥20%), prioritize water-extracted extract with good water solubility and easy absorption by the human body, which can enhance macrophage activity and improve the body's resistance; compound with immunomodulatory ingredients such as vitamin C and zinc to synergistically enhance efficacy.
- Antioxidant Health Products: Select high-activity extract (purity ≥95%, anthocyanins ≥25%), compound with tea polyphenols and vitamin E to synergistically scavenge free radicals and delay aging, suitable for beauty-conscious people and middle-aged and elderly people.
- Convenient-to-Take Health Products: Select microencapsulated elderberry extract to mask sour and astringent tastes and improve taking experience; at the same time, enhance stability and extend shelf life, suitable for formulations such as capsules and tablets.

8.3.2 Differentiation in Formulations and Dosages

- Formulation Adaptation: For convenient adult administration, select capsules and tablets (single dose 500mg-1g), 1-2 times a day, taken with meals; for the elderly and people with swallowing difficulties, select granules and oral liquids (single dose 10-15mL), which can be taken with warm water or directly, easy to absorb; for long-term users, select sustained-release tablets to extend the release time of active ingredients and improve the sustainability of efficacy.
- Dosage Control: For immunomodulation, the daily intake is 1-2g (calculated as elderberry extract) to avoid gastrointestinal discomfort caused by excessive intake; for antioxidant, the daily intake is 1-1.5g, paired with antioxidant ingredients to enhance efficacy; for special groups (the elderly, people with weak constitution), the daily intake is 1g, and the dosage is adjusted gradually.

8.3.3 Differentiation in Compliance and Positioning

- High-end Health Products: Select organically certified, high-purity extract (purity ≥95%), compound with high-end functional ingredients (such as probiotics and peptides), emphasize "natural and efficient", and clearly label anthocyanin content and daily intake on the label;
- Mid-range Health Products: Select conventional health product-grade extract (purity ≥90%), focus on a single efficacy (immunomodulation), highlight cost

performance, suitable for public consumption;

- Affordable Health Products: Select cost-effective extract (purity ≥90%), with moderate dosage, focusing on "daily health care" to meet basic immunomodulatory and antioxidant needs.

8.4 Differentiated Strategies in the Pharmaceutical Field

Core Logic: Taking "purity compliance + biocompatibility + efficacy synergy" as the core, differentially select pharmaceutical-grade elderberry extract for different pharmaceutical formulations (external use, oral administration) and treatment needs (skin inflammation, immunomodulation, auxiliary treatment of colds), strictly control impurity content and sterility, ensure synergistic effect with active pharmaceutical ingredients, and comply with the standards of the Chinese Pharmacopoeia (2025 Edition).

8.4.1 Differentiation in Raw Material Selection

- External Preparations (Anti-inflammatory Ointments, Skin Repair Preparations): Select pharmaceutical-grade elderberry extract (purity ≥95%, anthocyanins ≥20%), impurity-free and sterile, with strong anti-inflammatory, antioxidant and skin healing-promoting effects; prioritize fat-soluble extract, which is easy to fuse with ointment base to enhance skin penetration and promote wound healing.
- Oral Preparations (Immunomodulatory Drugs, Auxiliary Cold Treatment Preparations): Select pharmaceutical-grade extract (purity ≥95%, anthocyanins ≥20%), enteric-coated to avoid damage to active ingredients by gastric acid and ensure release in the intestinal tract; at the same time, control irritation to avoid intestinal discomfort caused by excessive intake.
- Special Medical Purpose Foods: Select high-purity extract (purity ≥95%), suitable for specific groups such as those with intestinal diseases and low immunity, with an addition amount of 9%-11%, avoiding intestinal irritation, and easy to absorb, providing dual effects of nutrition supplement and immunomodulation.

8.4.2 Differentiation in Formulations and Processes

- External Preparations: Adopt "sterile emulsification + γ-ray sterilization" process to ensure sterility of the preparation (endotoxin ≤10EU/g); compound elderberry extract with active pharmaceutical ingredients (such as hydrocortisone) at a ratio of 5:1 to synergistically enhance anti-inflammatory and repair effects; select petrolatum and lanolin as the base for ointment formulations to improve moisturizing and repair effects.
- Oral Preparations: Adopt enteric coating process to ensure no disintegration in gastric acid (pH < 3.0) and rapid disintegration in intestinal fluid (pH > 7.0); granulation temperature ≤60℃ to avoid degradation of active ingredients; dosage control ≤2g per day, taken in 2-3 divided doses to reduce intestinal irritation.

- Special Medical Purpose Foods: Made into liquid or powder formulations, the pH of liquid formulations is controlled at 5.0-6.5 for easy absorption; powder formulations are easy to dissolve without precipitation, adapting to the digestive and absorption capacity of people with specific diseases.

8.4.3 Differentiation in Safety

- External Preparations: Pass skin irritation test to ensure no erythema or edema; for preparations used on sensitive areas, the addition amount of elderberry extract is controlled at 4%-6% to reduce irritation;
- Oral Preparations: Clearly label contraindicated groups (pregnant women, infants and young children, patients with intestinal ulcers, people with allergic constitution) and adverse reactions (mild diarrhea, abdominal pain), and remind users to take as directed by a doctor;
- Special Medical Purpose Foods: For people with specific diseases, clinical verification is required to ensure safety and effectiveness, and the label indicates the applicable groups and eating methods.

8.5 Differentiated Strategies in Other Fields

8.5.1 Feed Field

Core Logic: Taking "cost control + efficacy adaptation" as the core, differentially select feed-grade elderberry extract for different poultry, livestock and aquatic varieties, control the addition amount, balance efficacy and cost, and improve breeding efficiency. Raw Material Selection: Select feed-grade extract (purity ≥85%) with high cost performance and good temperature resistance (can withstand granulation temperature of 90℃); Addition Scheme: Add 1%-2% to broiler feed to improve survival rate and skin health; add 2%-3% to sow feed to improve lactation performance; add 0.5%-1% to aquatic feed to promote growth and regulate intestines; Compounding Scheme: Compound with vitamins and minerals to enhance the immunity of poultry, livestock and aquatic products and reduce diseases.

8.5.2 Daily Necessities Field

Core Logic: Taking "mildness + function adaptation" as the core, differentially select extracts for different daily necessities formulations (toothpaste, mouthwash), control irritation and improve user experience. Raw Material Selection: Select daily necessities-grade extract (purity ≥90%), mild and non-irritating, with good compatibility with toothpaste and mouthwash ingredients; Addition Scheme: Add 2%-5% to toothpaste, compound with fluoride and menthol to assist cleaning and soothe oral mucosa; add 1%-3% to mouthwash, control ethanol content ≤15% to avoid irritating oral mucosa, and pair with menthol to improve taste; Stability Optimization: Select oxidation-resistant extract to avoid color deepening caused by direct sunlight and extend shelf life.

IX. Common Problems and Solutions

9.1 Common Problems in the Production Process

9.1.1 Uneven Dispersion and Precipitation of Elderberry Extract

Cause of Problem: Powdered extract absorbs moisture and agglomerates, not pre-dissolved when added, poor compatibility with the system, and uneven mixing;

Solutions: 1. Sieve the powdered extract through a 100-mesh sieve before use to remove agglomerates; 2. In liquid products, pre-dissolve the extract with 5 times the amount of purified water (stir at 60℃ for 20 minutes) before adding to the system; 3. In solid products, pre-mix with carriers (maltodextrin, microcrystalline cellulose) at a ratio of 1:2 before mixing with other raw materials; 4. Adjust the stirring speed (400-1500rpm) and extend the mixing time (15-30 minutes) to ensure uniform dispersion; 5. Avoid compatibility with cationic surfactants to prevent precipitation.

9.1.2 Degradation of Active Ingredients and Decline in Efficacy

Cause of Problem: Excessively high processing temperature, pH value deviating from the stable range, exposure to ultraviolet light or high temperature environment, and contact with strong oxidants;

Solutions: 1. Strictly control the processing temperature (cosmetics addition ≤45℃, baking ≤190℃, sterilization ≤135℃) to avoid overheating; 2. Adjust the system pH to 5.0-7.5, shorten the processing time to ≤30 minutes for acidic (pH < 4.0), and avoid long-term storage for alkaline (pH > 8.0); 3. Operate in the dark during production and use light-proof packaging for products; 4. Avoid contact with strong oxidants, add 0.1%-0.2% vitamin E and 0.1%-0.3% tea polyphenols to delay oxidation; 5. Select microencapsulated extract to protect active ingredients from damage.

9.1.3 Poor Product Taste/Odor (Sour and Astringent Taste, Browning)

Cause of Problem: Sour and astringent components of elderberry extract not removed, oxidative browning, and excessive addition amount;

Solutions: 1. Select deacidified extract for food and cosmetics to reduce sour and astringent taste; 2. Add sweeteners (erythritol, steviol glycosides), fruit powder and flavors to neutralize sour and astringent taste; 3. Control the addition amount, ≤4% for food and ≤10% for cosmetics, to avoid aggravated sour and astringent taste caused by excess; 4. Add antioxidants (vitamin E, tea polyphenols) to delay oxidative browning and prevent color deepening and odor deterioration; 5. Use ultra-high pressure sterilization for liquid products to avoid browning caused by high temperature.

9.1.4 Poor Product Stability (Stratification, Agglomeration, Deterioration)

Cause of Problem: Poor system compatibility, insufficient thickener dosage, excessive humidity/temperature in the storage environment, and insufficient preservative addition;

Solutions:

- Select extract with good compatibility with the system, and select surfactant-tolerant extract for hair and body care products;
- Add thickeners (xanthan gum, hydroxyethyl cellulose) to liquid products to improve stability and avoid stratification;
- Use moisture-proof packaging (aluminum-plastic composite film) for solid products, and store in an environment with humidity ≤60% and temperature 20-25℃; 4. Add preservatives according to specifications (potassium sorbate for food, phenoxyethanol for cosmetics) to avoid microbial growth leading to deterioration; 5. Store liquid extract in a sealed container, refrigerate after opening, and use up within 1 month.

9.2 Common Problems in Regulations and Safety

9.2.1 Non-compliance Problems (Labeling, Addition Amount, Raw Material Purity)

Cause of Problem: Failure to follow the regulatory requirements of each field, non-standard labeling, excessive addition amount, and substandard raw material purity;

Solutions:

- Strictly follow the corresponding field regulations (GB 2760 for food, Technical Specifications for Cosmetic Safety for cosmetics, Chinese Pharmacopoeia for medicine), and control the addition amount (≤4% for food, ≤18% for cosmetics, ≤2g/day for medicine);
- Standardize labeling: For food and cosmetics, label "elderberry extract" and its addition amount; for health products, label suitable/unsuitable groups, daily intake and anthocyanin content; for pharmaceutical products, label contraindications and adverse reactions; 3. Select raw materials that meet the purity requirements of the corresponding level (≥85% for food grade, ≥95% for pharmaceutical grade), and request COA to ensure that heavy metals and microorganisms meet the standards.

9.2.2 Safety Problems (Allergy, Irritation, Excessive Reaction)

Cause of Problem: Insufficient extract purity, excessive addition amount, failure to conduct irritation tests, and improper adaptation to user groups;

Solutions:

- Conduct skin irritation and allergy tests before using cosmetics and pharmaceutical products, and select desensitized elderberry extract for sensitive skin products;
- Control the addition amount to avoid excess (≤2g per day for adults) to prevent diarrhea and abdominal pain;
- Clearly define contraindicated groups (infants and young children, pregnant women, lactating women, patients with intestinal ulcers, people with allergic constitution), and label warning words on the label;
- Avoid compounding cosmetics with irritating ingredients such as alcohol and fragrance to reduce the risk of allergy.

X. Appendix

10.1 Summary of Relevant Standards for Elderberry Extract

Application Field	Purity Requirement	Core Index Requirements	Relevant Standards
Cosmetics	≥90%	Pb≤0.5mg/kg, As≤1.0mg/kg; Anthocyanins≥12%	Technical Specifications for Cosmetic Safety (2022 Edition)
Food	≥85%	Pb≤0.5mg/kg, As≤1.0mg/kg; Total Colony Count≤1000CFU/g; Anthocyanins≥10%	GB 2760-2014, GB 18187-2000
Health Products	≥90%	Pb≤0.1mg/kg, As≤0.05mg/kg; Anthocyanins≥15%	Technical Requirements for Health Food Raw Materials
Medicine	≥95%	Pb≤0.1mg/kg, As≤0.05mg/kg; Anthocyanins≥20%; Total Impurities≤0.5%	Chinese Pharmacopoeia (2025 Edition)
Feed	≥85%	Pb≤1.0mg/kg, As≤2.0mg/kg; Moisture≤8%; Anthocyanins≥8%	Relevant Standards for Feed Additives

10.2 Recommended Common Compounding Ingredients

10.2.1 Compounding Ingredients in the Cosmetics Field

Moisturizing and Repairing: Elderberry Extract + Hyaluronic Acid + Ceramide; Soothing and Anti-inflammatory: Elderberry Extract + Panthenol + Dipotassium Glycyrrhizinate; Brightening and Antioxidant: Elderberry Extract + Vitamin C + Niacinamide; Post-sun Repair: Elderberry Extract + Anthocyanin Derivatives + Centella Asiatica Extract.

10.2.2 Compounding Ingredients in the Food Field

Immunomodulation: Elderberry Extract + Probiotics + Vitamin C; Antioxidant: Elderberry Extract + Vitamin C + Tea Polyphenols; Taste Optimization: Elderberry Extract + Erythritol + Fruit Powder; Stability Improvement: Elderberry Extract + Glyceryl Monostearate + Xanthan Gum.

10.2.3 Compounding Ingredients in the Health Product Field

Immunomodulation: Elderberry Extract + Probiotics + Vitamin C + Zinc; Antioxidant: Elderberry Extract + Tea Polyphenols + Vitamin E; Convenient Taking: Elderberry Extract + Microcrystalline Cellulose + Magnesium Stearate.

10.2.4 Compounding Ingredients in the Pharmaceutical Field

External Repair: Elderberry Extract + Hydrocortisone + Petrolatum; Oral Immunomodulation: Elderberry Extract + Lactose + Crospovidone; Special Medical Purpose: Elderberry Extract + Whey Protein + Medium-chain Triglycerides.

10.3 Storage and Transportation Notes

1. Storage: Store solid extract in a cool and dry place (temperature 20-25℃, humidity ≤60%), away from light and sealed; store pharmaceutical-grade and health product-grade extract in a refrigerator (2-8℃); store liquid extract in a sealed and light-proof container, refrigerate, and use up within 1 month after opening.
2. Transportation: Use sealed packaging (aluminum-plastic composite film, cardboard drum) to avoid extrusion and damage; avoid light, moisture and high temperature during transportation (transportation temperature ≤35℃); use cold chain transportation for pharmaceutical-grade and health product-grade extract to ensure the stability of active ingredients.
3. Shelf Life: Unopened solid extract: 24 months; opened: 3-6 months; Unopened liquid extract: 12 months; opened (refrigerated): 1 month; Expired products are forbidden to use and must be disposed of in accordance with hazardous waste regulations.

10.4 Term Explanation

1. Anthocyanins: The core active ingredient of elderberry extract, with antioxidant, immunomodulatory, anti-inflammatory and other effects, with a molecular weight range of 2000-8000Da, which is the key component determining the color and efficacy of the extract.
2. Desensitized Elderberry Extract: Special treatment to remove sensitizing impurities, reduce the sensitization rate, suitable for sensitive skin and children's products.
3. Microencapsulated Extract: Elderberry extract wrapped by microencapsulation technology to protect active ingredients (anthocyanins) from oxidation and degradation, while masking sour and astringent tastes, and improving stability and taking/using experience.
4. Coefficient of Variation (CV) of Mixing Uniformity: An indicator to measure the uniformity of raw material mixing. The smaller the value, the more uniform the mixing. ≤3% for pharmaceutical-grade and health product-grade, ≤5% for food-grade, cosmetic-grade and feed-grade.
5. UHT Sterilization: Ultra-high Temperature Instant Sterilization, temperature 135-150℃, time 3-5 seconds, which can quickly sterilize, reduce the degradation of active ingredients of elderberry extract, and retain its efficacy and natural flavor.