Operation Guidelines for Adding Purslane Extract in Application Fields

I. Overview of Purslane Extract: Characteristics and Application Advantages

1.1 Core Components and Physicochemical Properties

Purslane Extract (Portulaca oleracea Extract) is a natural plant extract obtained from the whole plant of *Portulaca oleracea* through water extraction, alcohol extraction, or water-alcohol mixed extraction processes, which complies with the national standards of the corresponding field. Its core efficacy stems from the synergistic effect of various natural active ingredients. The unique component composition endows it with physicochemical properties suitable for multiple fields, making it an excellent natural raw material in the cosmetics, food and beverage, pharmaceutical and health product, and feed additive industries.

1.1.1 Core Active Ingredients and Content Standards (Conventional Commercial Specifications)

The efficacy of purslane extract is directly determined by the content of core active ingredients, and different extraction processes affect the proportion of these components. The core parameters of conventional commercial specifications are as follows (unit: mass fraction), and all detection methods comply with the standards of the corresponding field:

- **Total Flavonoids**: ≥ 1.5% (detected by High Performance Liquid Chromatography (HPLC) at a detection wavelength of 254 nm). Its core efficacy is antioxidant and anti-inflammatory, serving as a key efficacy ingredient in cosmetics and health products. When the content meets the standard, the IC50 (half-maximal inhibitory concentration) for scavenging DPPH radicals is ≤ 0.8 mg/mL.
- **Polysaccharides**: ≥ 5% (detected by the phenol-sulfuric acid method). Its core efficacy is moisturizing and immune regulation, suitable for moisturizing systems in cosmetics, immune-enhancing formulas in health products, and growth-promoting formulas in feeds. It can significantly increase the water content of the skin stratum corneum by ≥ 15% and the phagocytosis rate of macrophages in livestock and poultry by ≥ 20%.
- **Polyphenols**: ≥ 2% (detected by the Folin-Ciocalteu colorimetric method). It plays an auxiliary role in antioxidant and bacteriostatic activities, improving the stability of the final product. The inhibition zone diameter against *Staphylococcus aureus* and *Escherichia coli* is ≥ 12 mm.
- **Other Components**: Contains a small amount of purslane saponins, amino acids, and vitamins (vitamin C, vitamin E), with a total content ≤ 1%. These components can enhance the synergistic effect of efficacy and improve the functionality of the final product.

- **Impurity Control**: Heavy metals (lead ≤ 10 mg/kg, arsenic ≤ 2 mg/kg, mercury ≤ 0.1 mg/kg) and microorganisms (total plate count ≤ 100 CFU/g, mold and yeast ≤ 10 CFU/g) are strictly compliant with the standards of the corresponding fields, such as GB/T 30645-2014 "Plant Extracts for Cosmetics" and GB 1886.211-2016 "Food Additive - Purslane Extract".

1.1.2 Physical Properties

- **Appearance**: The water extract is a light yellow to brownish-yellow powder with strong hygroscopicity; the alcohol extract is a dark brown powder with weak hygroscopicity; the liquid extract (concentration 10%-50%) is a light yellow to brownish-yellow clear liquid without obvious precipitation. Different forms are suitable for different application scenarios.
- **Solubility**: The powdered extract is easily soluble in water (solubility ≥ 80 g/L at 25℃) and partially soluble in ethanol (solubility of alcohol extract in 75% ethanol ≥ 60 g/L), and insoluble in oils. The liquid extract can be directly dissolved in aqueous systems and has good compatibility with alcohol systems, achieving uniform dispersion without the need for additional solubilizers.
- **Form Adaptability**: The powdered extract has moderate fluidity with a bulk density of 0.55-0.65 g/cm³, enabling full dry mixing with solid raw materials. The liquid extract has good fluidity and can be directly incorporated into aqueous ingredients without complex pre-treatment, making it suitable for the production of various dosage forms.

1.1.3 Chemical Stability

The stability of purslane extract is greatly affected by temperature and pH, so the processing parameters must be strictly controlled. Its core stable characteristics are as follows:

- **pH Stability**: Stable in the pH range of 4.0-8.0. Beyond this range, the content of total flavonoids will decrease by 5%-15% within 72 hours. The optimal stable pH range is 5.5-7.0, which is compatible with the pH of human skin, most food, and pharmaceutical systems.
- **High-Temperature Resistance**: The heat resistance is moderate. When heated below 80℃ for 30 minutes, the loss of active ingredients is ≤ 3%; when heated above 100℃ for 10 minutes, the loss of active ingredients is ≥ 10%. The processing temperature must be adjusted according to the application field to avoid the degradation of active ingredients.
- **Compatibility**: It is well compatible with common moisturizers (glycerin, hyaluronic acid), emulsifiers (Tween-80, Span-60), and preservatives (phenoxyethanol, parabens) in cosmetics. It has no significant antagonistic effect with sweeteners, acidulants, and preservatives in foods. It can be mixed normally with excipients (starch, lactose) in pharmaceutical and health products, and has no antagonistic effect with antibiotics and minerals in feeds.

1.1.4 Hygroscopicity

The hygroscopicity of powdered purslane extract varies: the critical relative humidity of the water extract is about 65%, with strong hygroscopicity at room temperature, which is prone to caking; the critical relative humidity of the alcohol extract is about 70%, with weak hygroscopicity; the liquid extract has no obvious hygroscopicity. During storage, the environmental humidity must be controlled according to the form to avoid the loss of active ingredients or caking caused by moisture absorption.

1.2 Physiological Functions and Application Value

As a natural plant extract, purslane extract has multiple functions such as antioxidant, anti-inflammatory, moisturizing, bacteriostatic, and immune regulation. It is highly safe with no obvious toxic side effects and has extremely high application value in multiple fields. Its core physiological functions are as follows:

1.2.1 Antioxidant Function

The synergistic effect of total flavonoids and polyphenols can effectively scavenge free radicals in the body, inhibit oxidative stress reactions, and delay the oxidation and deterioration of substances. In cosmetics, it can delay skin aging and improve dull skin tone; in foods, it can extend the shelf life and reduce oxidative browning; in health products, it can assist in protecting body cells and reducing oxidative damage; in feeds, it can enhance the antioxidant capacity of livestock, poultry, and aquatic animals, and improve meat quality.

1.2.2 Anti-Inflammatory and Soothing Function

It can inhibit the expression of inflammatory factors such as TNF-α and IL-6, and has significant anti-inflammatory and anti-swelling effects. In cosmetics, it can soothe skin sensitivity, relieve redness and stinging, and is suitable for sensitive skin products; in pharmaceutical and health products, it can assist in improving inflammatory reactions and relieving mild swelling and pain; in feeds, it can reduce intestinal inflammation in livestock and poultry and lower the incidence of diarrhea.

1.2.3 Moisturizing and Repairing Function

Polysaccharides can absorb and lock water, increase the water content of the skin stratum corneum, and repair the skin barrier. It is mainly used in the cosmetics field, suitable for moisturizing products such as toners, lotions, creams, serums, masks, and cleansers. When the addition amount meets the standard, the water content of the skin stratum corneum can be increased by more than 15%, improving skin dryness and roughness.

1.2.4 Bacteriostatic Function

It has a significant inhibitory effect on harmful microorganisms such as *Staphylococcus aureus* and *Escherichia coli*, with an inhibition zone diameter of ≥ 12 mm. In foods,

it can inhibit the reproduction of harmful microorganisms and extend the shelf life; in cosmetics, it can reduce harmful bacteria on the skin surface and lower the risk of acne; in feeds, it can replace part of antibiotics, inhibit harmful bacteria in the intestines, and promote the growth of beneficial bacteria.

1.2.5 Immune Regulation and Growth-Promoting Function

Polysaccharides can regulate the body's immune function, increasing the phagocytosis rate of macrophages by ≥ 20% and enhancing the body's resistance. In health products, it can assist in regulating the human immune system; in feeds, it can increase the daily weight gain of livestock, poultry, and aquatic animals (≥ 8% for livestock and poultry, ≥ 10% for fish), enhance stress resistance, and improve meat quality.

1.3 Main Application Fields

Relying on the characteristics of "natural safety, multi-functional efficacy, and multi-system compatibility", purslane extract has achieved full coverage of four core fields. Different fields are suitable for different forms and specifications of extracts, with specific application scenarios as follows:

1.3.1 Cosmetics Field

It is the most widely used in the cosmetics field, with core compatibility with aqueous systems, covering products such as toners, lotions, creams, serums, masks, and cleansers. For moisturizing products, water extract (high in polysaccharides) is preferred; for antioxidant and anti-inflammatory products, alcohol extract (high in total flavonoids and polyphenols) is preferred; liquid extract is suitable for toners and serums, while powdered extract is suitable for lotions, creams, and mask powders.

1.3.2 Food and Beverage Field

It is suitable for various food and beverages, with core functions of antioxidant, bacteriostatic, and nutritional enhancement, covering functional beverages, pastries, meat products, fruit and vegetable products, etc. Food-grade extract is preferred. For functional beverages and fruit and vegetable products, liquid extract (good solubility without affecting appearance) is preferred; for pastries and meat products, powdered extract (easy to mix and long shelf life) is preferred.

1.3.3 Pharmaceutical and Health Product Field

It mainly plays the roles of anti-inflammatory and anti-swelling, immune regulation, and auxiliary lipid-lowering. Common dosage forms include tablets, capsules, granules, and oral liquids. Pharmaceutical-grade extract (total flavonoids ≥ 2.0%, polysaccharides ≥ 8.0%) is selected. Tablets and capsules prefer powdered extract (high purity, easy for tabletting and filling), while oral liquids prefer liquid extract (good solubility).

1.3.4 Feed Additive Field

It is mainly applied in livestock and poultry feeds (pigs, chickens, ducks) and aquatic feeds (fish, shrimps), playing the roles of bacteriostatic growth promotion, enhancing body resistance, and improving meat quality. Feed-grade extract is selected, with powdered extract preferred (easy to mix and not easy to absorb moisture and cake), which can withstand the high temperature of feed granulation and is suitable for various feed systems.

II. Application in the Cosmetics Field: Production Process and Notes

Purslane extract is the most widely used in the cosmetics field, with core functions of moisturizing, soothing, antioxidant, and bacteriostatic. It is compatible with various aqueous-based cosmetics systems. The processing temperature, pH value, and stirring parameters must be strictly controlled to avoid the loss of active ingredients and ensure the stability and safety of the product. The details are classified by product type as follows:

☼ Application in Toners/Sherums (Compatible with Liquid Extract)

Production Process

1. **Pre-treatment (Optional)**: If the concentration of the liquid extract is too high (e.g., 50% concentration), it can be diluted with deionized water to 10%-20% concentration (the dilution ratio is adjusted according to the final product formula), stirred at room temperature for 3-5 minutes at a speed of 100 r/min to ensure uniform dispersion without precipitation.
2. **Formulation**: Add the diluted liquid extract (or the original concentration liquid extract) to the aqueous system of the toner/sherum according to the formula ratio, pour it slowly while stirring at a speed of 100-150 r/min for 5-10 minutes to ensure complete integration.
3. **pH Adjustment**: Detect the pH value of the system and adjust it to 5.5-7.0 (the optimal compatible range) to ensure the stability of the extract and avoid precipitation or degradation of active ingredients.
4. **Post-treatment**: Add preservatives, fragrances, and other ingredients, continue stirring for 3-5 minutes, and check the clarity and stability of the system. After qualification, carry out sterile filling.

Notes

- **Addition Amount Control**: The addition amount of the liquid extract in the toner is 0.5%-2.0% (mass fraction, the same below), and 2.0%-5.0% in the serum. For antioxidant serums, it is recommended to add 3.0%-5.0%, with a DPPH radical scavenging rate of over 80%. Excessive addition may cause the system to become

turbid and produce astringent taste.

- **Temperature Control**: The temperature of the aqueous system must be reduced to below 60℃, with the optimal temperature of 45-55℃. High temperature will cause the decomposition of active ingredients such as total flavonoids and polyphenols, with a loss rate exceeding 10%.
- **Clarity Control**: If turbidity occurs after addition, the addition amount of the extract can be appropriately reduced, or the pH value can be adjusted to 5.5-7.0. If necessary, a small amount of Tween-80 can be added for solubilization.
- **Sensitivity Compatibility**: For sensitive skin toners and serums, the addition amount of the extract is recommended to be controlled below 0.5% (liquid) to avoid skin irritation. A skin irritation test should be conducted before addition.

☼ Application in Lotions/Creams (Compatible with Powdered Extract)

Production Process

1. **Pre-treatment**: Take the required amount of powdered extract, add a small amount of deionized water (mass ratio of extract: deionized water = 1:5), stir evenly at a speed of 200 r/min for 5-10 minutes to prepare a uniform suspension, avoiding caking and uneven dispersion when added directly.
2. **Aqueous Phase Preparation**: Pour the suspension into the aqueous phase system of the cosmetics, adjust the temperature of the aqueous phase to 45-55℃, and stir for 10-15 minutes at a speed of 150-200 r/min to ensure the complete integration of the extract with the aqueous phase system without visible particles.
3. **Emulsification**: Slowly pour the aqueous phase into the oil phase system (the temperature of the oil phase is the same as that of the aqueous phase, 50-55℃), and perform high-speed emulsification for 10-15 minutes at a speed of 300-500 r/min to form a uniform emulsified system.
4. **Post-treatment**: After emulsification, cool the system to below 45℃, add preservatives, fragrances, emulsifiers, and other ingredients, continue stirring for 5 minutes, and check the pH value and stability. After qualification, fill the product.

Notes

- **Addition Amount Control**: The addition amount of the powdered extract in the lotion/cream is 0.3%-1.0%. For moisturizing and anti-inflammatory products, it is recommended to add 0.8%-1.0% to effectively inhibit skin inflammatory reactions. Insufficient addition cannot exert the efficacy, while excessive addition may lead to unstable systems and a granular feeling.
- **Stirring Control**: The stirring speed during pre-treatment must not be too low to avoid uneven suspension. During the emulsification of the aqueous phase and oil

phase, the speed must be sufficient to ensure uniform emulsification without layering.

- **Compatibility Control**: Avoid mixing the powdered extract directly with oils and surfactants. It should be dissolved in the aqueous phase first before being integrated with the oil phase. When mixing with moisturizers such as hyaluronic acid and glycerin, the stirring time can be appropriately extended to improve compatibility.
- **Storage Control**: The finished lotion/cream must be stored in a sealed and light-proof environment, avoiding high temperature and humidity to prevent the loss of active ingredients of the extract and affect the product efficacy.

☼ Application in Masks (Lotion for Mask Liquids, Powder for Mask Powders)

Production Process (Mask Liquids)

1. **Formulation**: Add the liquid extract to the aqueous phase system of the mask liquid according to the formula ratio (1.0%-3.0%), and add moisturizers such as glycerin and hyaluronic acid, stir evenly at a speed of 150 r/min for 8-10 minutes.
2. **pH Adjustment**: Adjust the pH value of the system to 5.5-7.0 to ensure the stability of the extract and its compatibility with the skin.
3. **Sterilization**: Perform sterile treatment on the prepared mask liquid (filtration through a 0.22 μm filter) to avoid microbial contamination.
4. **Filling**: Fill the sterile mask liquid into the mask sheet and seal the package to ensure no leakage.

Production Process (Mask Powders)

1. **Pre-mixing**: Take the powdered extract (addition amount 0.5%-1.0%), mix it evenly with the mask powder base (kaolin, talc, vitamin C powder) at a mass ratio of 1:10 to avoid caking when added directly.
2. **Total Mixing**: Add the pre-mix to a three-dimensional mixer and mix it evenly with other mask powder raw materials at a speed of 300 r/min for 15-20 minutes to ensure that the coefficient of variation of the mixing uniformity is ≤ 5%.
3. **Packaging**: Use sterile aluminum foil bags for quantitative packaging to avoid moisture absorption and contamination.

Notes

- **Efficacy Compatibility**: The mask liquid for soothing and repairing is recommended to add 2.0%-3.0% (liquid extract) to relieve skin redness and stinging; the mask powder for whitening and antioxidant is recommended to add 0.8%-1.0% (powdered extract).
- **Sterility Control**: During the production of mask liquids and powders, the tools and containers must be sterilized. The mask liquid must be filled immediately after

filtration to avoid microbial contamination and affect the shelf life of the product.

- **Moisture Resistance of Mask Powders**: The powdered extract in the mask powder is prone to moisture absorption. Desiccants should be added during packaging, and it should be stored in a dry and ventilated place. Use it as soon as possible after opening.
- **Compatibility**: The compatibility of the extract with preservatives and fragrances in the mask liquid should be tested in advance to avoid the occurrence of peculiar smell and precipitation.

☼ Application in Cleansers (Compatible with Powdered Extract)

Production Process

1. **Pre-treatment**: Add the powdered extract (addition amount 0.1%-0.3%) to a small amount of deionized water to prepare a suspension (extract: water = 1:5), stir evenly at a speed of 200 r/min for 5 minutes.
2. **Aqueous Phase Preparation**: Pour the suspension into the aqueous phase system of the cleanser, add surfactants (e.g., amino acid surfactants) and moisturizers, and stir evenly at a speed of 150 r/min for 10 minutes.
3. **Emulsification**: Add oil phase ingredients and perform high-speed emulsification for 5-8 minutes at a speed of 300 r/min to form a uniform paste system.
4. **Post-treatment**: Adjust the pH value of the system to 5.5-6.5 (compatible with skin pH), and check the viscosity and stability. After qualification, fill the product.

Notes

- **Addition Amount Control**: The addition amount must be strictly controlled at 0.1%-0.3%. Excessive addition may cause the cleanser to produce astringent taste and caking, and may also irritate the skin.
- **Component Isolation**: Avoid mixing the powdered extract directly with surfactants. It should be dissolved in the aqueous phase first before addition to prevent surfactants from destroying the active ingredients of the extract.
- **Gentleness Control**: In amino acid cleansers, the addition amount of the extract is recommended to be controlled at 0.1%-0.2% to ensure the product is mild and non-irritating, suitable for sensitive skin.
- **Stability Test**: The finished product must be left to stand for 24 hours. After confirming no layering and no precipitation, it can be delivered from the factory.

III. Application in the Food and Beverage Field: Production Process and Notes

In the food and beverage field, purslane extract plays a core role in antioxidant, bacteriostatic, and nutritional enhancement. It must follow the principle of "food safety standards + no impact on product taste and appearance". It is compatible with the aqueous or oil phase systems of foods (targeted pre-treatment is required). The details are classified by food type as follows:

☼ Application in Functional Beverages (Compatible with Liquid Extract)

Production Process

1. **Dilution**: Dilute the food-grade liquid purslane extract (concentration 30%-50%) with drinking water to 5%-10% concentration (the dilution ratio is adjusted according to the addition amount), stir evenly at a speed of 100 r/min for 3-5 minutes to ensure no turbidity and precipitation.
2. **Formulation**: Pour the diluted extract into the aqueous ingredients of the beverage (e.g., purified water, fruit juice, sweetener solution), pour it slowly while stirring at a speed of 150 r/min for 5-8 minutes, add other ingredients such as acidulants and vitamins, and make up the total volume with purified water.
3. **pH Adjustment**: Adjust the pH value of the system to 4.0-7.0 to ensure the stability of the extract and avoid the degradation of active ingredients.
4. **Sterilization and Filling**: Use UHT sterilization (135℃, 3-5 seconds) or pasteurization (65℃, 30 minutes), cool to below 25℃, and perform sterile filling (PET bottles/aluminum cans) to avoid secondary contamination.
5. **Quality Inspection**: Test the content of active ingredients and microbial indicators to ensure compliance with food safety standards.

Notes

- **Addition Amount Control**: The addition amount of the liquid extract is 0.5%-2.0% (mass fraction, the same below). When the addition amount is 1.0%, the antioxidant effect is the best, which can extend the shelf life of the beverage by 3-5 days. Excessive addition will produce an obvious astringent taste and affect the taste.
- **Sterilization Control**: The sterilization temperature must not be too high (≤ 100℃) and the time must not be too long to avoid the loss of active ingredients (over 10%). For UHT sterilization, rapid cooling is required to reduce the high-temperature residence time.
- **Taste Optimization**: The extract itself has a slight astringent taste, which can be masked by adding sweeteners (e.g., stevioside) and fragrances. The addition amount of the sweetener is only 0.03%-0.05%.

- **Clarity Control**: If turbidity occurs after addition, the concentration of the extract can be appropriately reduced, or secondary filtration (0.22 μm filter) can be performed to ensure the beverage is clear and transparent.

☼ Application in Pastries (Compatible with Powdered Extract)

Production Process

1. **Pre-mixing**: Take the powdered extract and mix it evenly with pastry excipients (flour, starch, powdered sugar) at a mass ratio of 1:10 to avoid caking and uneven distribution when added directly.
2. **Raw Material Mixing**: Add the pre-mixed mixture to the pastry ingredients (e.g., egg liquid, butter, water) according to the formula requirements, and stir evenly with a mixer at a speed of 200 r/min for 8-10 minutes to ensure the complete integration of the extract with all ingredients.
3. **Molding**: Follow the conventional pastry production process for kneading and molding (e.g., bread and cookie molding) to ensure uniform molding without obvious particles.
4. **Baking**: The baking temperature for bread is 180-200℃ (top fire 200℃, bottom fire 180℃) for 25-30 minutes; for cookies, the baking temperature is 170-190℃ for 10-12 minutes. High-temperature baking will cause a 3%-5% loss of active ingredients, which is within the normal range.
5. **Cooling and Packaging**: After baking, cool to room temperature, seal and package to avoid moisture absorption and oxidation.

Notes

- **Addition Amount Control**: The addition amount of the powdered extract is 0.1%-0.5%. When the addition amount is 0.3%, it can exert the antioxidant efficacy without affecting the taste of the pastry. Excessive addition may cause the pastry to have astringent taste and darken in color.
- **Pre-mixing Control**: The pre-mixing ratio must be accurate, and the mixing time must be sufficient to ensure the extract is evenly dispersed in the excipients, avoiding local high concentration and affecting the taste and appearance.
- **Temperature Control**: The baking temperature must not exceed 200℃, otherwise, it will lead to the loss of a large number of active ingredients of the extract and may produce a burnt taste.
- **Storage Control**: The finished pastry must be stored in a sealed and dry environment to avoid moisture absorption and softening, and at the same time reduce the loss of active ingredients of the extract, extending the shelf life by 2-3 days.

☼ Application in Meat Products (Compatible with Powdered Extract)

Production Process

1. **Pre-treatment**: Add the powdered extract to a small amount of normal saline (mass ratio of extract: normal saline = 1:8) and stir to prepare a suspension at a speed of 200 r/min for 5-7 minutes to facilitate dispersion in the meat products.
2. **Weighing**: According to the meat product formula, accurately weigh the suspension (error ≤ ± 0.2%) and adjust the addition amount according to the type of meat product.
3. **Addition and Stirring**: Spray the suspension evenly on the surface of the meat product raw materials (e.g., pork, beef, chicken) or add it to the minced meat, stir evenly at a speed of 150 r/min for 10 minutes to ensure the extract is evenly covered on the raw materials.
4. **Marinating**: Place the raw materials in a marinating tank and marinate at room temperature for 2-4 hours to allow the extract to fully penetrate and exert its bacteriostatic and preservation effects.
5. **Subsequent Treatment**: Follow the conventional meat product production process for steaming and sterilization (steaming temperature 90-100℃, time 20-30 minutes), cool, and package.
6. **Quality Inspection**: Test the bacteriostatic effect of the meat product (inhibition rate against *Staphylococcus aureus* ≥ 60%) and taste to avoid excessive astringent taste.

Notes

- **Addition Amount Control**: The addition amount of the powdered extract is 0.3%-1.0%. When the addition amount is 0.8%, the inhibition rate against *Staphylococcus aureus* and *Escherichia coli* can reach over 70%, extending the shelf life of the meat product by 2-3 days.
- **Suspension Preparation**: The concentration of the normal saline must be controlled at 0.9% to avoid affecting the taste of the meat product due to high concentration. The suspension must be prepared on the spot and used immediately to avoid precipitation after prolonged storage.
- **Marinating Control**: The marinating time must not be too short (less than 2 hours), otherwise, the extract cannot fully penetrate and affect the bacteriostatic effect. The marinating temperature must not be too high to avoid the spoilage of the raw materials.
- **Taste Optimization**: If the meat product has an obvious astringent taste, the addition amount of the extract can be appropriately reduced, or a small amount of cooking wine and rock sugar can be added during marinating to mask the astringent taste.

☼ Application in Fruit and Vegetable Products (Compatible with Liquid Extract)

Production Process

1. **Raw Material Processing**: Wash, peel, core, and cut fresh fruits and vegetables (e.g., fruit and vegetable dices, strips) or make them into fruit and vegetable puree to ensure the raw materials are free of impurities and rot.
2. **Addition and Stirring**: According to the fruit and vegetable product formula, accurately weigh the food-grade liquid extract (error ≤ ± 0.2%) and pour it into the fruit and vegetable processing liquid (e.g., fruit and vegetable puree, marinating liquid), stir evenly at a speed of 100 r/min for 5 minutes.
3. **Processing**: Place the fruit and vegetable raw materials in the processing liquid, and perform marinating, juicing, and filling according to the conventional process to ensure the extract is fully in contact with the raw materials.
4. **Sterilization**: Use pasteurization (80-85℃, 15 minutes) to avoid the destruction of active ingredients of the extract by high temperature and kill harmful microorganisms at the same time.
5. **Cooling and Packaging**: After sterilization, cool rapidly to room temperature, seal and package, and store in a low-temperature environment.

Notes

- **Addition Amount Control**: The addition amount of the liquid extract is 0.5%-1.5%. When the addition amount is 1.0%, it can effectively inhibit the oxidative browning of fruits and vegetables, maintain their color, and extend the shelf life by 2-3 days.
- **pH Control**: Most fruit and vegetable products are acidic (pH 3.0-5.0). The pH value of the system must be ensured to be ≥ 4.0. If the pH is < 4.0, a small amount of sodium bicarbonate can be added appropriately to avoid the degradation of active ingredients of the extract.
- **Color Control**: The extract itself is light yellow to brownish-yellow. The addition amount must not be too high to avoid affecting the original color of the fruit and vegetable products (e.g., light-colored fruit and vegetable puree).
- **Storage Control**: The finished fruit and vegetable products must be stored in a refrigerated environment (0-4℃) to reduce the loss of active ingredients of the extract and inhibit microbial reproduction.

IV. Application in the Pharmaceutical and Health Product Field: Production Process and Notes

In the pharmaceutical and health product field, purslane extract plays a core role in anti-inflammatory, immune regulation, and auxiliary lipid-lowering. It must follow the principle of "pharmaceutical standards + accurate exertion of efficacy", strictly control the addition amount, purity, and sterility to ensure the medicinal safety and effectiveness of the product. The details are classified by dosage form as follows:

☼ Application in Tablets (Compatible with Powdered Extract)

Production Process

1. **Raw Material Preparation**: Select pharmaceutical-grade purslane extract (total flavonoids ≥ 2.0%, polysaccharides ≥ 8.0%), pass through a 100-mesh sieve to remove caking and impurities; mix it evenly with pharmaceutical excipients (starch: lactose = 1:1) at a mass ratio of 1:5.
2. **Pre-mixing**: Use the equal incremental method for pre-mixing (the extract is first mixed with a small amount of filler), put it into a V-type mixer, stir at a speed of 200 r/min for 10-15 minutes to ensure uniform mixing without caking, and the coefficient of variation of the mixing uniformity is ≤ 3%.
3. **Granulation**: Add an appropriate amount of binder (e.g., hydroxypropyl methylcellulose solution) to the mixture, stir to make a soft material, then granulate with a granulator. The particle size is controlled at 0.5-1.0 mm, and dry at 50-60℃ until the particle moisture content is ≤ 5%.
4. **Granulation and Tabletting**: Pass the dried particles through a 20-mesh sieve for granulation, add 1% magnesium stearate (lubricant) and mix for 10 minutes, then press into tablets with a rotary tablet press (pressure 10-15 MPa). The tablet weight is 0.3-0.5 g per tablet, ensuring the tablet has moderate hardness without fragments or loose tablets.
5. **Coating (Optional)**: If coating is required, coat the pressed tablets with a coating material (hydroxypropyl methylcellulose), and dry to a moisture content of ≤ 3% after coating.
6. **Quality Inspection**: Test the disintegration time (≤ 30 minutes), content of active ingredients, and microbial indicators of the tablets. Only after meeting the standards of the *Pharmacopoeia of the People's Republic of China* can the product be packaged.

Notes

- **Purity Control**: The purity of the pharmaceutical-grade extract must meet the pharmacopoeia standards, with the content of total flavonoids and polysaccharides reaching the standard. The heavy metal and microbial contamination must be strictly controlled (lead ≤ 5 mg/kg, arsenic ≤ 1 mg/kg for heavy metals). A test report

must be requested when purchasing.

- **Dosage Control**: Each tablet contains 0.1-0.3 g of powdered extract (calculated based on total flavonoids ≥ 2.0%, the content of total flavonoids per tablet is ≥ 2 mg). The weighing error is ≤ ± 0.005 g to ensure the efficacy ingredients per tablet meet the standard and avoid insufficient or excessive dosage.
- **Sterility Control**: During the production process, all tools, excipients, and equipment must be sterilized. The tablet press workshop must meet the D-level clean standard, and the operators must wear sterile clothing, gloves, and masks.
- **Stability Control**: The tablet must have a moisture content of ≤ 3%, and be stored in a cool and dry place to avoid the extension of disintegration time and the loss of active ingredients caused by moisture absorption.

☼ Application in Capsules (Compatible with Powdered Extract)

Production Process

1. **Raw Material Preparation**: Select pharmaceutical-grade powdered extract, mix it evenly with pharmaceutical excipients (lactose) at a mass ratio of 1:2 to ensure the purity of the extract is up to standard without impurities.
2. **Mixing**: Put the mixture into a V-type mixer, stir at a speed of 150 r/min for 8-10 minutes to ensure uniform dispersion, and the coefficient of variation of the mixing uniformity is ≤ 3%.
3. **Weighing**: According to the capsule formula, accurately weigh the mixture (the error of the extract content per capsule is ≤ ± 0.005 g) to ensure the efficacy ingredients per capsule meet the standard, suitable for an adult dosage of 2-3 capsules per day.
4. **Filling**: Add the mixture into a capsule filling machine, adjust the filling amount, and fill it into hollow capsules (capsule specifications 0# or 1#) to ensure the filling is full without powder leakage or empty capsules.
5. **Polishing**: Polished the filled capsules to remove surface powder and ensure the capsules have a clean appearance.
6. **Quality Inspection**: Test the filling weight difference (≤ ± 7.5%), content of active ingredients, and microbial indicators of the capsules. Only after meeting the pharmacopoeia standards can the product be packaged.

Notes

- **Excipient Selection**: The excipients must be pharmaceutical-grade, and the lactose must meet the pharmacopoeia standards. The compatibility with the extract must

be tested in advance to avoid antagonistic effects and affect the exertion of efficacy.

- **Humidity Control**: The humidity of the filling workshop must be controlled ≤ 60% to avoid the caking of the extract caused by moisture absorption and affect the filling uniformity. The raw materials must be stored in a sealed container and used as soon as possible after opening.
- **Filling Accuracy**: The filling machine must be calibrated regularly to ensure the filling accuracy meets the standard and avoid excessive filling weight difference affecting the use effect.
- **Packaging and Storage**: Use aluminum-plastic blister packaging, store in a light-proof, sealed, and dry environment with a shelf life of 18-24 months. After opening, use it within 7 days.

☼ Application in Oral Liquids (Compatible with Liquid Extract)

Production Process

1. **Raw Material Preparation**: Select pharmaceutical-grade liquid extract (concentration 50%), ensure no heavy metal or microbial contamination, and meet the pharmacopoeia standards.
2. **Dilution**: Dilute the liquid extract with sterile water to 20% concentration, stir evenly at a speed of 100 r/min for 5-8 minutes to ensure no precipitation or turbidity.
3. **Formulation**: Add the diluted extract to a sterile mixing tank, add pharmaceutical sweeteners (e.g., stevioside) and preservatives (e.g., potassium sorbate), stir evenly at a speed of 150 r/min for 8-10 minutes, and adjust the pH value to 5.0-7.0.
4. **Filtration**: Filter the prepared oral liquid through a sterile filter (filtration precision 0.22 μm) to remove impurities and microorganisms and ensure sterility.
5. **Filling**: Fill the filtered oral liquid into ampoules or oral liquid bottles (10 mL per vial) with sterile filling equipment, and seal it. The error of the extract content per vial is ≤ ± 0.01 g.
6. **Sterilization**: Perform sterilization on the sealed oral liquid (121℃, 15 minutes) to ensure the microbial indicators meet the standard.
7. **Quality Inspection**: Test the clarity, disintegration time, and content of active ingredients of the oral liquid. Only after meeting the pharmacopoeia standards can the product be packaged.

Notes

- **Sterility Control**: The entire production process must be carried out in a sterile environment. The mixing tank, filter, and filling equipment must be sterilized in

advance (121℃, 30 minutes) and used after cooling.

- **Dilution Control**: The dilution ratio must be accurate to ensure the uniform concentration of the extract after dilution, avoiding local high concentration leading to turbidity and precipitation. The sterile water used for dilution must meet the standard of injection water.
- **pH Control**: The pH value must be strictly controlled at 5.0-7.0 to avoid the degradation of active ingredients of the extract beyond the range, affecting the efficacy.
- **Sterilization Control**: The sterilization temperature is 121℃, and the time is controlled within 15 minutes to avoid the loss of a large number of active ingredients caused by too long sterilization time. After sterilization, rapid cooling is required to avoid secondary contamination.

V. Application in the Feed Additive Field: Production Process and Notes

In the feed additive field, purslane extract plays a core role in bacteriostatic growth promotion, enhancing body resistance, and improving meat quality. It must follow the principle of "feed industry standards + compatibility with animal physiological characteristics" to ensure the extract is evenly dispersed in the feed without affecting the palatability of the feed. The details are classified by animal type as follows:

☼ Application in Livestock and Poultry Feeds (Compatible with Powdered Extract)

Production Process

1. **Raw Material Preparation**: Select feed-grade purslane extract (total flavonoids ≥ 1.0%, polysaccharides ≥ 5.0%), which complies with GB/T 19424-2022 "General Requirements for Plant Extracts as Feed Additives". The feed raw materials (corn, soybean meal, bran, etc.) must be dried (moisture content ≤ 12%) and crushed to a particle size of 0.8-1.2 mm.
2. **Pre-dilution**: Take the feed-grade powdered extract, mix it evenly with the feed carrier (corn powder) at a mass ratio of 1:20, stir at a speed of 100 r/min for 10-15 minutes to prepare a pre-mix, avoiding caking and uneven dispersion when added directly.
3. **Weighing**: According to the feed formula, accurately weigh the pre-mix (the error of the addition amount is ≤ ± 0.1%), and adjust the addition amount according to the growth stage of livestock and poultry (different addition amounts for piglets, growing and fattening pigs, and broilers).
4. **Mixing**: Add the pre-mix to a feed mixer and mix it evenly with other feed raw materials at a speed of 80-100 r/min for 20-30 minutes to ensure the extract is evenly distributed in the feed (the coefficient of variation of the mixing uniformity is ≤ 7%).

5. **Granulation (Optional)**: If granulated feed is required, add the mixed feed to a granulator, granulate at a temperature of 80-90℃, with a particle size of 2-4 mm (adjusted according to the type of livestock and poultry), and dry to a moisture content of ≤ 12%.
6. **Quality Inspection**: Test the uniformity, content of the extract, and microbial indicators of the feed to ensure compliance with the feed industry standards, with no caking or peculiar smell.

Notes

- **Addition Amount Control**: The addition amount of the extract in the piglet feed is 0.5%-1.0% (mass fraction, the same below), which can increase the daily weight gain of piglets by 8%-10% and reduce the diarrhea rate; the addition amount of the extract in the growing and fattening pig feed is 0.3%-0.5%, which can improve the pork quality; the addition amount of the extract in the broiler and laying hen feed is 0.2%-0.4%, which can increase the daily weight gain of broilers and the egg production rate of laying hens.
- **Mixing Uniformity**: The dilution ratio of the pre-mix must be reasonable, and the mixing time must be sufficient to ensure the extract is evenly distributed in the feed, avoiding local high or low concentration affecting the use effect.
- **Moisture Content Control**: The moisture content of the feed raw materials and finished feed must be controlled ≤ 12% to avoid the caking of the extract caused by moisture absorption and affect the shelf life of the feed.
- **Palatability Control**: The addition amount of the extract must not be too high (exceeding 1.0% will affect the palatability of the feed and lead to a decrease in livestock and poultry feed intake). If the palatability problem occurs, the proportion of the carrier can be appropriately increased.

☼ Application in Aquatic Feeds (Compatible with Powdered Extract)

Production Process

1. **Raw Material Preparation**: Select feed-grade powdered extract, mix it evenly with the feed carrier (fish meal) at a mass ratio of 1:15 to prepare a pre-mix. The aquatic feed raw materials (soybean meal, fish meal, minerals, etc.) must be dried and crushed to ensure no impurities.
2. **Weighing**: According to the aquatic feed formula, accurately weigh the pre-mix (the error of the addition amount is ≤ ± 0.1%), and adjust the addition amount according to the type of aquatic animals (different addition amounts for fish and shrimps).
3. **Mixing**: Add the pre-mix to a feed mixer and mix it evenly with other aquatic feed raw materials at a speed of 100-150 r/min for 30 minutes to ensure uniform

distribution.

4. **Granulation**: Granulate the mixed feed into particles (particle size 1-3 mm, adjusted according to the size of aquatic animals) at a temperature of 90-100℃, dry to a moisture content of ≤ 10%, and ensure the particles have good water stability (no dispersion after soaking for 30 minutes).
5. **Cooling and Packaging**: After granulation, cool to room temperature, seal and package to avoid moisture absorption and oxidation.
6. **Quality Inspection**: Test the water stability, content of the extract, and bacteriostatic effect of the feed to ensure compliance with the feed industry standards before use.

Notes

- **Addition Amount Control**: The addition amount of the extract in the fish feed (carp, grass carp) is 0.5%-1.0%, which can increase the survival rate of fish by 10%-15% and improve the meat quality; the addition amount of the extract in the shrimp feed is 0.8%-1.2%, which can enhance the stress resistance of shrimps and reduce the incidence of diseases.
- **Granulation Control**: The granulation temperature must not be too high (≤ 100℃) to avoid the loss of active ingredients. The particle size must be suitable for the size of aquatic animals to avoid the inability to eat.
- **Water Stability**: An appropriate binder can be added during granulation to improve the water stability of the particles, avoid the rapid dissolution and loss of the extract, and ensure that aquatic animals can fully ingest it.
- **Storage Control**: The aquatic feed must be stored in a dry and ventilated place (humidity ≤ 65%) with a shelf life of 3-6 months to avoid moisture absorption and deterioration affecting the use effect.

VI. Common Problems and Solutions in the Addition Process

Based on the practical experience of various application fields, four core common problems in the addition process are sorted out, along with specific solutions and measured data to help operators quickly avoid misunderstandings and solve problems, ensuring the smooth progress of the addition process and the quality of the final product.

6.1 Common Problem 1: Uneven Dispersion and Caking of the Extract

6.1.1 Problem Performance

After addition, the extract cannot be completely integrated with the system (cosmetics aqueous phase, food ingredients, feed raw materials), and caking and particles visible

to the naked eye appear, affecting the appearance and efficacy of the final product (e.g., turbidity of cosmetics, unqualified uniformity of feed).

6.1.2 Core Causes

- The powdered extract is not pre-treated (no pre-mixing or preparation of suspension) and added directly.
- The stirring speed is insufficient and the stirring time is too short to break up the caking.
- The extract is caked due to moisture absorption and not crushed or sieved in advance.
- The temperature of the system is too low (e.g., the temperature of the cosmetics aqueous phase < 40℃), resulting in a decrease in the solubility of the extract.

6.1.3 Solutions

- The powdered extract must be pre-treated in advance: in the cosmetics and food fields, it can be made into a suspension (extract: water = 1:5); in the feed and pharmaceutical fields, it can be pre-mixed with a carrier (ratio 1:10-1:20).
- Adjust the stirring parameters: increase the stirring speed to 150-200 r/min and extend the stirring time by 5-10 minutes to ensure the caking is completely broken up.
- For the extract caked due to moisture absorption, it must be crushed in advance with a grinder, passed through a 80-mesh sieve, and pre-treated after removing the caking.
- Adjust the temperature of the system: control the temperature of the cosmetics and food aqueous phase systems at 45-55℃ to improve the solubility of the extract and facilitate dispersion.

6.2 Common Problem 2: Excessive Loss of Active Ingredients

6.2.1 Problem Performance

After addition, the content of active ingredients such as total flavonoids and polysaccharides in the final product is detected, with a loss rate exceeding 10%, which cannot achieve the expected efficacy (e.g., insufficient antioxidant effect of cosmetics, poor bacteriostatic effect of feed).

6.2.2 Core Causes

- The temperature of the system is too high (e.g., the temperature during cosmetics addition > 60℃, the sterilization temperature of food > 100℃), leading to the decomposition of active ingredients.
- The pH value of the system is beyond the range of 4.0-8.0, and the active ingredients are unstable and degrade.

- The extract reacts with other components in the system (e.g., strong oxidants, surfactants), destroying the active ingredients.
- After addition, the system is left to stand for too long without timely subsequent treatment (e.g., filling, sterilization).

6.2.3 Solutions

- Strictly control the temperature: the temperature of the system during addition ≤ 60℃, the sterilization temperature of food and cosmetics ≤ 90℃, and the time ≤ 20 minutes; the sterilization temperature of pharmaceutical oral liquids is 121℃, and the time is controlled within 15 minutes.
- Adjust the pH value of the system: control the pH value of the system at 4.0-8.0 throughout the process, with the optimal range of 5.5-7.0 to avoid the degradation of active ingredients.
- Avoid antagonistic components: avoid mixing the extract directly with strong oxidants and high-concentration surfactants. They should be added separately with an interval of 5-10 minutes.
- Timely treatment: after the addition of the extract, carry out subsequent treatment (e.g., emulsification, filling, sterilization) within 30 minutes to reduce the loss of active ingredients.

6.3 Common Problem 3: Peculiar Smell and Turbidity of the Final Product

6.3.1 Problem Performance

After addition to cosmetics and food and beverages, a slight astringent or bitter taste appears, or the system becomes turbid and precipitates; after addition to feed, the palatability decreases, and the feed intake of livestock and poultry and aquatic animals decreases.

6.3.2 Core Causes

- The addition amount of the extract is too high, and its own astringent and bitter taste is prominent.
- The purity of the extract is insufficient, containing impurities, leading to peculiar smell and turbidity.
- The compatibility of the system is poor, and the extract reacts with other components to precipitate.
- The dilution ratio of the liquid extract is unreasonable, and the high concentration leads to turbidity.

6.3.3 Solutions

- Adjust the addition amount: reduce the addition amount of the extract, and control it at the middle and lower limit of the recommended range for each field (e.g., the

addition amount of the liquid extract in the toner of cosmetics is adjusted to 0.5%-1.0%).

- Select high-purity extract: replace the specification to ensure the purity of the extract meets the standard and remove impurities.
- Improve compatibility: a small amount of solubilizer (e.g., Tween-80) can be added to cosmetics, sweeteners and fragrances can be added to food to mask the astringent taste, and the proportion of the carrier can be increased in feed to improve palatability.
- Reasonable dilution: dilute the liquid extract to a concentration of 5%-20% to avoid turbidity and peculiar smell caused by high concentration.

6.4 Common Problem 4: Microbial Contamination

6.4.1 Problem Performance

After addition, the microbial indicators of the final product exceed the standard (e.g., the total plate count of cosmetics > 100 CFU/g, the total plate count of food > 1000 CFU/g, microbial detection in pharmaceutical products), leading to product spoilage and inability to use.

6.4.2 Core Causes

- The extract itself has a microbial contamination, and the third-party test report is not strictly verified when purchasing, which does not meet the microbial control standards of the corresponding field.
- The production environment is not up to standard, such as the insufficient cleanliness of the cosmetics and pharmaceutical workshops, the poor hygiene conditions of the feed and food processing workshops, and the contamination of raw materials and finished products by microorganisms in the air.
- The production tools and containers are not completely sterilized, with residual microorganisms, which multiply after contact with the extract and the system.
- The subsequent treatment is improper, such as the insufficient sterilization of food and pharmaceutical products, the failure to seal the cosmetics in time after filling, and the secondary contamination caused by the humid and high-temperature storage environment.
- The solvent used for diluting the liquid extract (e.g., drinking water, sterile water) has a microbial contamination, which is directly brought into the system.

6.4.3 Solutions

- Strictly control the quality of raw materials: when purchasing the extract, a third-party test report must be requested, and the microbial indicators (total plate count of cosmetics ≤ 100 CFU/g, food ≤ 1000 CFU/g, pharmaceuticals ≤ 10 CFU/g) must be verified. Unqualified raw materials are strictly prohibited from entering the warehouse. If necessary, the stored extract can be sterilized twice (powder can be sterilized by drying at 60℃ for 30 minutes, and liquid can be sterilized by filtration

through a 0.22 μm filter).

- Standardize the production environment: the cosmetics and pharmaceutical workshops must meet the corresponding clean standards (cosmetics workshops ≥ 100,000 levels, pharmaceutical workshops ≥ D-level), and be ventilated and disinfected regularly; the feed and food processing workshops should be cleaned daily, and the ground and equipment should be sterilized regularly (using ultraviolet or chlorine-containing disinfectants) to control the workshop temperature (≤ 25℃) and humidity (≤ 65%).
- Thoroughly sterilize production tools: the stirrers, mixing tanks, filters, filling equipment, etc., used in production must be thoroughly sterilized before use (121℃ high-pressure steam sterilization for 30 minutes in the cosmetics and pharmaceutical fields, 85℃ hot water sterilization for 20 minutes in the food and feed fields), and used after cooling to avoid residual microorganisms.
- Strengthen subsequent treatment and storage: food and pharmaceutical products are strictly sterilized according to the corresponding standards (pasteurization at 65℃ for 30 minutes for food, 121℃ for 15 minutes for pharmaceutical oral liquids) to ensure thorough sterilization; all products must be sealed immediately after filling, with sterile packaging for cosmetics and pharmaceuticals, and sealed and moisture-proof packaging for feed and food; the storage environment should be kept cool, dry, and ventilated to avoid high temperature and humidity, and cosmetics and pharmaceuticals should be stored in a light-proof place to reduce the conditions for microbial growth.
- Strictly control the quality of dilution solvent: the solvent used for diluting the liquid extract must meet the standards of the corresponding field (deionized water for cosmetics, drinking water for food, sterile injection water for pharmaceuticals). The microbial indicators must be tested before use,

VI. Common Problems and Solutions in the Addition Process

- **Strictly control the quality of dilution solvent**: The solvent used for diluting the liquid extract must meet the standards of the corresponding field (deionized water for cosmetics, drinking water for food, sterile injection water for pharmaceuticals). The microbial indicators must be tested before use, and unqualified solvents are strictly prohibited to avoid bringing microbial contamination into the system.

6.5 Notes on Problem Handling

- For all problems, a root-cause analysis must be conducted immediately after occurrence to determine the specific cause and take targeted solutions.
- The production process should be adjusted according to the actual situation to ensure that the final product meets the quality standards.

- The solutions should be recorded and summarized to form a knowledge base for future reference.

VII. Storage and Transportation Requirements

The storage and transportation of purslane extract directly affect the stability and quality of its active ingredients. It is necessary to control the environmental conditions according to the form of the extract (powder, liquid) to avoid moisture absorption, oxidation, and microbial contamination, ensuring that the raw material meets the efficacy requirements before use and is suitable for the addition needs of various fields.

7.1 Storage Requirements

7.1.1 Storage of Powdered Extract

- **Environmental Conditions**: Store in a cool, dry, well-ventilated, and light-proof warehouse with a temperature controlled at 10-25℃ and a relative humidity ≤ 65% (≤ 60% for water extract, ≤ 65% for alcohol extract). Avoid high temperature, humidity, and direct sunlight to prevent moisture absorption, caking, and oxidation of active ingredients.
- **Packaging Requirements**: Use double-layer sealed packaging (inner aluminum foil bag, outer cardboard drum). The packaging must be intact and tightly sealed to prevent air, moisture, and dust from entering. Each drum should be labeled with the raw material name, specification, production date, shelf life, manufacturer, etc., for traceability.
- **Stacking Requirements**: The stacking height should not exceed 3 layers to avoid packaging damage caused by extrusion. Store separately from oxidants, humid raw materials, and toxic substances at a distance of ≥ 1 meter to prevent cross-contamination. Strictly prohibit stacking on the ground (must be placed on pallets) to avoid contact with ground moisture.
- **Shelf Life**: For unopened powdered extract stored under the specified conditions, the shelf life of water extract is 12 months, and that of alcohol extract is 18 months. After opening, it must be sealed tightly and used as soon as possible (15 days for water extract, 30 days for alcohol extract). Check daily during use; if caking, discoloration, or peculiar smell is found, stop using immediately.

7.1.2 Storage of Liquid Extract

- **Environmental Conditions**: Store in a cool and light-proof warehouse with a temperature controlled at 5-20℃. Avoid high temperature, direct sunlight, and low-

temperature freezing (freezing of liquid extract will destroy active ingredients, and precipitation may occur after thawing, making it unusable). The relative humidity should be ≤ 70%. No strict humidity control is required, but the warehouse must be kept dry to avoid packaging corrosion caused by moisture.

- **Packaging Requirements**: Use sealed corrosion-resistant containers (e.g., food-grade PET barrels, pharmaceutical-grade glass bottles). The containers must be cleaned and sterilized before use, and sealed tightly to prevent leakage, volatilization, and microbial contamination. The label should include the same information as the powdered extract, and a warning "Do not freeze" should be marked on the liquid extract.
- **Stacking Requirements**: Stack vertically to avoid 倾倒 (tilting) and collision that may cause container damage and leakage. Store separately from strong oxidants and acidic substances to prevent chemical reactions. The stacking height should not exceed 2 layers to avoid container extrusion.
- **Shelf Life**: For unopened liquid extract stored under the specified conditions, the shelf life is 12 months. After opening, it must be sealed and stored in a refrigerator (0-4℃), and used within 7 days. If turbidity, precipitation, or peculiar smell is found, stop using immediately.

7.2 Transportation Requirements

7.2.1 General Requirements

- **Transportation Tools**: Use clean, dry, sealed, odorless, and non-contaminated transportation vehicles (e.g., refrigerated trucks, box trucks). Avoid using damp, odorous, or corrosive vehicles to prevent raw material contamination.
- **Protection Measures**: Avoid severe jolting, collision, and extrusion during transportation to prevent packaging damage and leakage. The powdered extract must be well protected against moisture (e.g., covered with waterproof cloth), and the liquid extract must be firmly fixed to avoid tilting. The entire process must be carried out in the dark to prevent the oxidation of active ingredients caused by direct sunlight.
- **Temperature Control**: The transportation temperature of powdered extract should be controlled at 5-30℃ to avoid high temperature (> 30℃) and low temperature (< 5℃). The transportation temperature of liquid extract should be controlled at 5-25℃. In winter, take anti-freezing measures (e.g., heating the carriage), and in summer, take cooling measures (e.g., refrigerated transportation). Freezing and direct sunlight are strictly prohibited.
- **Loading and Unloading Requirements**: Handle with care during loading and unloading; strictly prohibit throwing, hitting, or squeezing the packaging. When handling powdered extract, avoid dust and wear masks and gloves to protect the operators. When handling liquid extract, prevent container damage and leakage. If leakage occurs, clean it immediately to avoid contaminating other goods.

7.2.2 Special Requirements for Different Fields

- **Cosmetics and Pharmaceutical-Grade Extracts**: The transportation vehicle must be sterile, dust-proof, and moisture-proof, and comply with the hygiene standards of the corresponding fields during transportation. Avoid mixing with food and feed-grade extracts to prevent cross-contamination. The transportation documents must be complete, and warning labels such as "Pharmaceutical/Cosmetic Raw Material", "Fragile", "Light-Proof", and "Moisture-Proof" should be marked.
- **Food and Feed-Grade Extracts**: The transportation vehicle must comply with the food and feed transportation hygiene standards, and avoid mixing with toxic substances and odorous goods. The feed-grade powdered extract must be treated to prevent dust pollution to avoid contaminating the environment and other goods. The packaging should be inspected regularly during transportation, and damaged packaging should be handled immediately.

VIII. Quality Inspection and Acceptance Standards

To ensure that the purslane extract meets the quality standards and is suitable for the addition requirements of various fields, a strict quality inspection and acceptance process must be established. The core indicators should be checked throughout the entire process from raw material warehousing to production and finished product delivery. Unqualified products are strictly prohibited from warehousing and use, and the specific standards are clearly classified according to the application fields.

8.1 Raw Material Warehousing Inspection (Core Link)

8.1.1 General Inspection Indicators (Applicable to All Fields)

Inspection Indicator	Qualification Standard	Remarks
Appearance	Powder: Light yellow to brownish-yellow (water extract), dark brown (alcohol extract), no caking or impurities; Liquid: Light yellow to brownish-yellow clear liquid, no precipitation or turbidity	If discoloration, caking, or precipitation is found, the product is directly judged as unqualified
Total Flavonoids Content	Cosmetic/Food/Feed Grade ≥ 1.5%, Pharmaceutical Grade ≥ 2.0%	Core efficacy indicator; unqualified products are strictly prohibited from warehousing
Polysaccharides Content	Cosmetic/Food/Feed Grade ≥ 5.0%, Pharmaceutical Grade ≥ 8.0%	Meets the requirements of moisturizing and immune regulation
Polyphenols Content	All Grades ≥ 2.0%	Auxiliary antioxidant and bacteriostatic effect,

		improving stability
Heavy Metals	Lead ≤ 10 mg/kg (cosmetic/food/feed), ≤ 5 mg/kg (pharmaceutical); Arsenic ≤ 2 mg/kg (cosmetic/food/feed), ≤ 1 mg/kg (pharmaceutical); Mercury ≤ 0.1 mg/kg (all grades)	Strictly comply with the national standards of the corresponding fields
Microorganisms	Cosmetics: Total plate count ≤ 100 CFU/g, mold and yeast ≤ 10 CFU/g; Food: Total plate count ≤ 1000 CFU/g, mold and yeast ≤ 100 CFU/g; Pharmaceuticals: Total plate count ≤ 10 CFU/g, no mold or yeast; Feed: Total plate count ≤ 10000 CFU/g	The requirements for pharmaceutical and cosmetic grades are the strictest

8.1.2 Special Inspection Indicators (Divided by Field)

- **Cosmetic Grade**: Add solubility test (water solubility ≥ 80 g/L at 25°C) and pH value test (5.5-7.0) to ensure compatibility with the aqueous phase system of cosmetics.
- **Food Grade**: Add taste test (no obvious peculiar smell or astringent taste) and clarity test (no turbidity after dilution of liquid extract) to ensure no impact on food taste and appearance.
- **Pharmaceutical Grade**: Add disintegration time test (tablets ≤ 30 minutes), filling weight difference test (capsules ≤ ± 7.5%), and sterility test (no microbial detection) to meet the standards of the *Pharmacopoeia of the People's Republic of China*.
- **Feed Grade**: Add bulk density test (0.55-0.65 g/cm³) and mixing uniformity test (coefficient of variation ≤ 7%) to ensure compatibility with the feed production process.

8.2 Production Process Inspection

During the production and addition process of various fields, key indicators must be tested regularly to ensure that the addition process is compliant, the active ingredients are not lost, and the quality of the final product is stable. The specific inspection points are as follows:

- **Pre-treatment Stage**: Test the uniformity and concentration of the extract suspension/dilution to ensure no caking and the concentration meets the standard (liquid extract diluted to 5%-20%).
- **Addition and Mixing Stage**: Test the pH value (4.0-8.0) and temperature (≤ 60°C) of the system. After uniform mixing, test the dispersion uniformity of the extract

to avoid local high concentration.

- **Post-treatment Stage**: Test the clarity and stability of cosmetics, taste and color of food, sterility and content of active ingredients of pharmaceuticals, and mixing uniformity of feed.
- **Inspection Frequency**: Test at least once per batch. For batch production, test the pH value and temperature every 2 hours to ensure parameter stability.

8.3 Finished Product Delivery Inspection

Before the delivery of the finished product, a full inspection must be conducted according to the standards of the corresponding field, focusing on the content of active ingredients, microbial indicators, and appearance quality. Only after passing the inspection can the product be delivered. The specific requirements are as follows:

- **Loss Rate of Active Ingredients**: The loss rate of total flavonoids and polysaccharides in the final product must be ≤ 10%. If it exceeds 10%, the root cause must be traced and the production process must be adjusted again.
- **Microbial Indicators**: Strictly comply with the microbial standards of finished products in various fields (e.g., total plate count of cosmetics ≤ 100 CFU/g, food ≤ 1000 CFU/g). Products with unqualified microbial indicators are strictly prohibited from delivery.
- **Appearance and Stability**: Cosmetics must be free of turbidity, precipitation, and peculiar smell, and no layering after standing for 24 hours. Food must be free of discoloration, peculiar smell, and turbidity, with normal taste. Pharmaceutical products must meet the pharmacopoeia standards, with no damage or liquid leakage. Feed must be free of caking and peculiar smell, with uniform mixing.
- **Inspection Records**: All inspection data must be recorded in detail, including inspection indicators, test results, inspection time, and inspectors, and archived for traceability.

IX. Supplementary Provisions

9.1 Scope of Application

This guideline applies to the entire process of addition, storage, transportation, and quality inspection of purslane extract (water extraction, alcohol extraction, water-alcohol mixed extraction process) in four core fields: cosmetics, food and beverage, pharmaceutical and health products, and feed additives. It covers two forms of extracts: powder and liquid, and can be used as a reference for production operators, quality inspectors, and purchasers.

9.2 Responsibility Statement

1. Purchasers must strictly verify the qualifications of the extract suppliers to ensure that the raw materials meet the standards of the corresponding fields. They must request and retain test reports and be responsible for the quality of the raw materials.
2. Production operators must strictly follow the process and parameters specified in this guideline for addition operations, standardize the pre-treatment, mixing, sterilization, and other links, and keep operation records to be responsible for the production process.
3. Quality inspectors must strictly implement the inspection standards, control the inspection links of raw material warehousing, production process, and finished product delivery throughout the entire process, ensure the authenticity and accuracy of the inspection data, and be responsible for the inspection results.
4. Storage and transportation personnel must strictly comply with the storage and transportation requirements, control the environmental conditions, take protection measures, prevent raw material damage, contamination, and deterioration, and be responsible for the quality of raw material storage and transportation.

9.3 Guideline Update

This guideline will be regularly revised and improved based on the update of national standards, optimization of production processes, and accumulation of practical experience to ensure the professionalism, practicality, and compliance of the content. If the national standards of various fields change, the relevant parameters and standards shall be adjusted according to the latest national standards.

9.4 Exception Handling

In the process of production, storage, transportation, and inspection, if any abnormal situation occurs (e.g., raw material deterioration, excessive loss of active ingredients, microbial contamination, packaging damage), the relevant operations must be stopped immediately, the root cause of the abnormality must be traced, and corresponding solutions must be taken. The operations can only be resumed after the problem is solved. For major abnormal situations, they must be reported to the relevant person in charge in a timely manner and archived for traceability.