Operation Guidelines for Adding Wormwood Extract in Various Application Fields

Foreword

This guideline specifies the **addition principles, dosage ranges, operation procedures, quality control key points, safety and contraindications** of **Artemisia argyi (Folium Artemisiae Argyi) extract** (including volatile oil, flavonoids, polysaccharides, total phenols and other active components; common forms: essential oil, extract, dry powder, aqueous solution, microemulsion/inclusion complex) in **six mainstream fields**: food, feed, daily chemicals, external medicine, plant protection, and environmental antibacterial.

It is applicable to industrial production, laboratory pilot scale-up, and large-scale application scenarios, providing a standardized operational basis for **compliant, efficient and safe use**.

This guideline is formulated based on the current **Chinese Pharmacopoeia (Folium Artemisiae Argyi)**, GB food/feed additive regulations, daily chemical raw material standards, and Ministry of Agriculture and Rural Affairs plant protection/feed regulations, combined with the pharmacological activities of wormwood extract (antibacterial, anti-inflammatory, antioxidant, mosquito-repellent, growth-promoting, antiviral). **It does not involve prescriptions for oral medicinal preparations.**

I General Basic Specifications (Mandatory Pre-requirements for All Fields)

1.1 Raw Material Definition and Classification

- **Botanical origin**: Dried leaves of *Artemisia argyi* H.Lév. & Vaniot (Asteraceae).

Preferred genuine producing areas: Qiai (Hubei), Henan, Anhui, Shandong.

- **Extract types**
    1. Volatile oil (essential oil): Mainly 1,8-cineole, borneol, camphor, terpenes;
    2. Aqueous extract/extract: Polysaccharides, flavonoid glycosides, organic acids;
    3. Ethanolic extract (ethanol/propylene glycol): Flavonoids, phenolic acids, terpenoids;
    4. Dry powder (spray-dried/freeze-dried): Standardized total flavonoids/total phenols.
- **Quality admission indicators (mandatory testing)**

- Heavy metals: Pb ≤ 2 mg/kg, As ≤ 2 mg/kg, Hg ≤ 0.1 mg/kg, Cd ≤ 0.3 mg/kg
- Microorganisms (food/daily chemicals/feed): Total plate count, mold & yeast, coliforms, *Salmonella*
- Active ingredient labeling: Total flavonoids, total phenols, volatile oil (90%–110% of labeled value)
- Solvent residues: Ethanol ≤ 5000 mg/kg; other organic solvents comply with corresponding national standards

1.2 General Addition Principles

1. **Dissolve first, add later**: Essential oil/lipid-soluble components must be emulsified, diluted or adsorbed by carrier first; **no direct high-concentration addition**.
2. **Low temperature & light protection**: Volatile oils are prohibited from high-temperature long-time cooking; **prefer post-stage addition**.
3. **Compatibility contraindications**: Avoid direct contact with strong oxidizers, strong acids/bases, or high-concentration metal ions.
4. **Gradient testing**: 0.01%–0.5% gradient small-scale test must be completed before industrialization to confirm stability, odor, color and efficacy.
5. **Record & traceability**: Full traceability of batch, source, content, dosage, temperature, time, pH, test results.

II Food Application Guidelines (Edible & Compliant: Flavoring, Antiseptic, Antioxidant, Functional Ingredient)

2.1 Scope

Pickled products, rice & flour products, meat products, condiments, edible flavors, functional foods (**only as natural flavor/antioxidant auxiliary ingredient; no therapeutic claims**).

2.2 Permitted Forms & Dosages (Safe Industrial Range)

Extract Form	Typical Dosage (in finished product)	Applicable Food Categories
Wormwood volatile oil (emulsified/inclusion)	0.005%–0.05% (50–500 mg/kg)	Meat products, marinated foods, flavor oil, pastries
Wormwood aqueous extract	0.1%–1.0%	Beverages, pastries, fillings, soups
Wormwood dry powder (total flavonoids ≥2%)	0.2%–2.0%	Dried noodles, biscuits, meal replacement, functional foods

*Note: No overuse. Essential oils are for **flavoring, aroma enhancement, auxiliary antibacterial** only, not as main preservative system.*

2.3 Operation Procedure

1. **Pretreatment**
   - Essential oil: Pre-dissolve with edible ethanol/propylene glycol/emulsifier (monoglyceride, sucrose ester) to 5%–10% mother liquor;
   - Extract/dry powder: Dissolve in purified water at ≤60 °C under stirring, filter to remove impurities.
2. **Addition process**
   - Poor thermal stability (essential oil): Add at cooling stage (≤60 °C), stir 10–30 min;
   - Aqueous extract: May be added during batching or mid-cooking; total heating ≤30 min.
3. **QC Key Points**
   - Odor control: Avoid excessive camphor/cineole causing off-flavor;
   - Color: Prone to browning; control pH 4.0–7.0, light-proof packaging;
   - Antibacterial verification: Shelf-life test against *E. coli*, *S. aureus*, molds.

2.4 Safety & Compliance

- **Strictly prohibit therapeutic claims** (curing, anti-inflammatory, antiviral, etc.).
- Not recommended or only ultra-low dosage in infant/pregnant women foods.
- Comply with GB 2760 for natural flavors/food flavors.

III Feed & Breeding Guidelines (Livestock, Poultry, Aquaculture, Pets)

3.1 Functions

Growth promotion, antioxidant, intestinal health, partial antibiotic replacement, insect repellent, meat/egg quality improvement, immunity enhancement.

3.2 Dosage (Complete Feed Basis, Mature Industrial Range)

Target	Wormwood Extract (dry powder/extract)	Addition Method
Broiler/layer	0.1%–0.5%	Premix then stepwise dilution
Swine (piglet/finisher)	0.1%–0.6%	Mix with carrier then add to meal
Aquaculture (fish/shrimp)	0.05%–0.3%	Mix before pelleting or post-spray
Ruminant (cattle/sheep)	0.1%–0.4%	Mix into concentrate supplement

- Wormwood essential oil: 0.01%–0.05%, **carrier adsorption required** (wheat bran, corn starch, zeolite powder).

3.3 Operation Specifications

1. **Uniformity priority**: Two-stage dilution (mix with 10–20× carrier first, then bulk feed).
2. Pelleting temperature: Essential oils recommended for **post-spraying** to avoid loss at ≥75 °C.
3. Storage: Cool, dry, light-proof, sealed; shelf life ≤6 months.

3.4 Contraindications

- Do not directly mix with strong disinfectants or strong alkaline agents.
- Breeding/pregnant animals may use normal dosage; **no overdosage**.

Ⅳ Daily Chemicals & Personal Care Guidelines (Skin, Hair, Bath, Mosquito Repellent, Antibacterial Lotion)

4.1 Scope

Creams, emulsions, essences, body wash, shampoo, soap, mosquito repellent spray, feminine lotion (external), foot care.

4.2 Recommended Dosages (Finished Product Mass Fraction)

Product Type	Wormwood Extract Dosage	Remarks
Skin cream/emulsion	0.2%–2.0%	Aqueous/ethanolic extract, anti-inflammatory soothing
Essence/toner	0.5%–3.0%	Prefer small-molecule ethanolic/aqueous extract
Body wash/hand soap	0.1%–1.0%	Cleansing + auxiliary antibacterial
Mosquito repellent spray	Essential oil 0.1%–0.5%	Compound with mint, citronella
External lotion (intimate/foot)	0.5%–2.0%	Adjust pH 4.5–6.5

4.3 Operation Key Points

1. **Phase matching**
    - Water-soluble: Add to aqueous phase (40–60 °C);

- Essential oil/lipid-soluble: Add to oil phase or emulsify with Tween/polyglycerol ester first.

2. **Stability control**
   - Most stable at pH 5.0–7.5; strong acids/bases cause discoloration/deactivation;
   - Recommend antioxidants (vitamin E, rosemary extract);
   - Browning-prone systems: light-proof bottles, nitrogen filling, low-temp storage.
3. **Safety Red Lines**
   - High-concentration essential oil: **no direct contact with mucosa or broken skin**;
   - Volatile oil not recommended for infant products;
   - Mandatory skin irritation, allergy, repeat patch tests.

Ⅴ External Pharmaceutical Guidelines (Patches, Moxa Oil, Cream, Lotion, Disinfectant Gel; Non-Oral)

5.1 Scope

External antibacterial, anti-inflammatory, warming, antipruritic, moxibustion oil, TCM external preparations (managed as TCM raw materials/excipients).

5.2 Quality & Addition Requirements

- Raw materials must comply with **Chinese Pharmacopoeia: Folium Artemisiae Argyi**.
- Extract purity: External preparations recommend total flavonoids ≥3% or volatile oil ≥1.0%.
- Typical dosage: 0.5%–5.0% (base: vaseline, lanolin, carbomer, hydrogel, plaster base).

5.3 Operation Procedure

1. Melt/dissolve base (≤60 °C);
2. Add wormwood extract in portions, homogenize until fully dispersed;
3. Cool to <40 °C for filling, light-proof sealing;
4. Mandatory tests: microbial limit, irritation, content uniformity, stability.

5.4 Contraindications

- **Strictly forbidden for oral use**.
- Caution in broken skin, acute eczema, allergic constitution.
- Pregnant women: caution with high-concentration essential oil on abdomen/lumbosacral area.

Ⅵ Plant Protection & Green Agricultural Control Guidelines (Antibacterial, Insect Repellent, Preservation, Soil Conditioning)

6.1 Application Scenarios

Fruit & vegetable preservation, foliar spray (disease/insect resistance), seed treatment, storage pest control, organic planting antibacterial agent.

6.2 Dilution & Usage Concentration (Field Common)

- Foliar spray: Dilute aqueous/ethanolic extract 500–1500×, interval 7–10 days;
- Postharvest preservation: Dip/spray 0.1%–0.5% dilution, air-dry before storage;
- Storage pest control: Essential oil adsorbed on carrier, placed in space or mixed with grain (low dose, non-direct contact only for food-grade grain);
- Seed soaking: Dilute 800–1200×, soak 2–4 h, air-dry before sowing.

6.3 Operation Specifications

- Avoid high-temperature strong light (early morning/evening);
- Essential oil **must be emulsified first** to avoid phytotoxicity/leaf burn;
- Interval 2–3 days with strong alkaline pesticides (organic copper, lime sulfur); **no tank mixing**.

Ⅶ Environmental Antibacterial & Public Health Guidelines (Air Purification, Fabric Antibacterial, Deodorization, Disinfection Auxiliary)

7.1 Scope

Indoor spray, pet environment deodorization, fabric finishing, air conditioner/filter antibacterial, public surface wiping.

7.2 Addition Concentration

- Spray solution: Extract 0.05%–0.3% + ethanol (20%–50%) for solubilization/synergy;

- Fabric finishing: Pad/spray 0.2%–1.0%, dry & cure.

7.3 Precautions

- Avoid excessive inhalation in enclosed spaces;
- Keep away from open flames (ethanol-containing formulas);
- May slightly discolor silk/wool; **preliminary sample test required**.

Ⅷ General Safety, Storage & Waste Disposal

8.1 Storage

- Temperature: 5–25 °C, light-proof, sealed, moisture-proof;
- Essential oils: Explosion-proof/cool cabinet, away from heat & static electricity;
- Shelf life: dry powder 12–24 months, extract 6–12 months, essential oil 6–18 months.

8.2 Personal Protective Equipment (PPE)

- High-concentration operation: gloves, goggles, mask;
- Avoid long-term inhalation of volatile oil; ventilate operation area.

8.3 Emergency Handling

- Skin contact: Rinse with water + neutral detergent;
- Eye contact: Flush with plenty of running water for 15 min, seek medical attention;
- Ingestion (non-food grade): **Do not induce vomiting**, seek medical attention immediately.

8.4 Waste

- Small amount: Dilute then discharge to wastewater system;
- Large residue/waste liquid: Dispose in compliance as general industrial solid waste/hazardous waste (depending on solvent & concentration).

IX. Quality Inspection & Acceptance (Mandatory Items)

1. Appearance: Uniform color, no odor, mold, layering or precipitation (liquid);
2. Content: Active ingredients (total flavonoids, total phenols, volatile oil) meet label;
3. Physicochemical: moisture, ash, pH, density, refractive index (essential oil);
4. Hygiene: heavy metals, microorganisms, solvent residues;
5. Stability: heat resistance (45 °C), cold resistance (−5 °C), light stability.

X Prohibited & Cautious Use (Mandatory)

1. **Oral medicinal preparations**: This guideline only covers external use, food, feed, plant protection; **does not include oral drug prescriptions/dosages**.
2. New formulations without safety assessment or ultra-high dosage: **prohibited for direct industrialization**.
3. Volatile oil: Strict restriction or prohibition in products for wormwood-allergic people, pregnant women, infants.
4. **Shall not replace** standard-compliant preservatives, veterinary drugs, or main pesticide systems.