Artemisia argyi Extract: Safety Assessment · Application Fields · Recommended Dosage

I. Safety Assessment (Full Version)

Artemisia argyi Levl. et Van. extract contains core active ingredients including volatile oils (cineole, camphor, borneol, etc.), flavonoids (quercetin, kaempferol, etc.), polysaccharides, and polyphenols. It has been widely used in multiple fields, and its safety has been verified by numerous domestic and international trials and long-term applications, with an overall low risk. The following systematic assessment is conducted based on authoritative data across four core dimensions: toxicology, irritation, allergenicity, and risk substance control, to clarify the safety boundary.

(I) Toxicology Assessment

Toxicology tests are the core support for evaluating the safety of Artemisia argyi extract, covering three categories: acute toxicity, subchronic toxicity, and genotoxicity. All test data comply with relevant national and international standards (e.g., *Cosmetic Safety Technical Specifications (2015 Edition)*, *Procedures and Methods for Toxicological Evaluation of Food Safety*). Specific details are as follows:

1. **Acute Toxicity**: Oral acute toxicity tests show that the median lethal dose (LD_{50}) of oral Artemisia argyi water extract (prepared from both fresh and dried Artemisia argyi) in mice is 40g/kg and 133g/kg, respectively, which is far higher than the usual dosage. During the test period, no abnormal reactions or deaths were observed in the mice, indicating that Artemisia argyi extract has extremely low oral acute toxicity and belongs to the category of practically non-toxic substances. In the dermal acute toxicity test, rabbits were topically administered 50% Artemisia argyi extract for 24 consecutive hours without skin redness or erosion, with an LD_{50} > 5000mg/kg, showing no dermal toxicity risk.
2. **Subchronic Toxicity**: Mice were orally administered Artemisia argyi extract for 28 consecutive days at daily doses of 100mg/kg, 500mg/kg, and 1000mg/kg (covering 10-100 times the daily use dosage). After the test, the body weight, blood routine, and liver and kidney function indicators of the mice were all within the normal range. Pathological sections of major organs (heart, liver, spleen, lung, kidney) showed no abnormal lesions. Serum metabolomics analysis did not reveal metabolic disorders; instead, it showed a slight positive trend in regulating lipid metabolism, proving that long-term rational oral intake and topical application have no chronic accumulation toxicity.

3. **Genotoxicity**: The results of the AMES test (Salmonella reverse mutation test), mouse bone marrow micronucleus test, and sperm abnormality test were all negative, indicating that Artemisia argyi extract has no mutagenic or teratogenic effects and will not cause damage to genetic material, further verifying its long-term safety.

(II) Irritation and Allergenicity Assessment

The topical safety of Artemisia argyi extract is prominent, with extremely low incidence rates of irritation and allergenicity, making it suitable for most populations. Specific data and conclusions are as follows:

1. **Skin Irritation**: In rabbit skin irritation tests, applying 20% Artemisia argyi extract (the upper limit of the usual topical concentration) for 7 consecutive days resulted in a skin irritation reaction score < 0.5, which is classified as a non-irritating substance. In a human patch test involving 300 subjects, applying 10%-20% Artemisia argyi extract and observing at 24h, 48h, and 72h only 2 cases showed mild erythema (incidence rate 0.67%), which subsided without treatment and no obvious irritation reaction occurred. It is suitable for topical application on the whole body skin, including the face and limbs.
2. **Mucosal Irritation**: Eye irritation tests showed that dropping 5% Artemisia argyi extract (a commonly used concentration for mucosal contact) into rabbit eyes caused no corneal opacity or conjunctival congestion, with an irritation score < 1, which is classified as a non-mucosal irritating substance. In oral mucosal irritation tests, volunteers rinsed with 0.05%-0.2% Artemisia argyi extract solution (a commonly used concentration for rinsing) for 7 consecutive days without oral mucosal redness or pain, proving its safe use in the oral care field.
3. **Skin Allergenicity**: A human skin allergy test involving 200 subjects, using the closed patch method with 10 days of induction and 14 days of challenge, showed an allergenicity incidence rate of 0.5%, which is much lower than the average allergenicity rate of natural plant extracts (2%-3%). Clinical data show that the allergenicity incidence rate in allergic individuals after topical application is < 1%, and allergic reactions are mostly mild erythema and itching, which can be relieved 1-2 days after stopping the use, with no serious allergic risk. Allergic individuals can use it after a small trial.

(III) Risk Substance Control

The potential risks of Artemisia argyi extract mainly come from impurity residues during raw material planting and production processing. At present, the industry has formed a sound risk control system, and relevant indicators comply with national and industry standards. Specific details are as follows:

1. **Pesticide Residues**: As a medicine-food homology plant, if pesticides are used during raw material planting, it may lead to excessive pesticide residues in the extract. Currently, mainstream production enterprises adopt the GAP (Good Agricultural Practices) planting model, prohibiting the use of highly toxic and highly residual pesticides. In the testing of finished extract, the residues of organophosphorus and pyrethroid pesticides are all < 0.01mg/kg, complying with the requirements of *Good Manufacturing Practice for Chinese Medicinal Materials* and *Cosmetic Safety Technical Specifications*, with no pesticide residue risk.
2. **Heavy Metal Residues**: Raw material planting soil and production equipment may introduce heavy metal impurities. National and industry standards require: lead <10mg/kg, arsenic < 2mg/kg, mercury < 1mg/kg, cadmium < 0.3mg/kg. Currently, the heavy metal residues of large-scale produced Artemisia argyi extract are all controlled within 50% of the standard limits, with more guaranteed safety. The heavy metal residues of some leading enterprises' products are even lower than 5mg/kg (lead) and 1mg/kg (arsenic).
3. **Microbial Contamination**: Improper hygiene control during production and processing may lead to microbial contamination of the extract, such as bacteria and mold. Different application scenarios have different microbial control standards: cosmetic-grade extract requires total bacterial count < 100CFU/g, total mold and yeast count < 10CFU/g, with no pathogenic bacteria; food-grade extract requires total bacterial count < 1000CFU/g, total mold and yeast count < 100CFU/g, with no pathogenic bacteria. Currently, mainstream enterprises adopt GMP standards for production, which can effectively control microbial contamination risk. The total bacterial count of some enterprises' products is even < 50CFU/g (cosmetic-grade) and < 500CFU/g (food-grade).
4. **Other Risks**: Excessive use of volatile oil components (e.g., camphor) in Artemisia argyi extract may have a slight impact on the nervous system of infants and young children, so the addition amount must be strictly controlled in infant products. Traditional records state that Artemisia argyi "has minor toxicity", mainly due to excessive oral intake. Currently, tests have confirmed that rational oral intake and topical application in normal doses have no toxicity. Excessive oral intake (daily > 50g extract) may cause mild discomfort such as dizziness and nausea, which can be relieved after stopping the use, with no serious adverse reactions. It is necessary to clearly prohibit excessive oral intake and high-concentration contact with infants and young children.

(IV) Safety Assessment Summary

Based on the comprehensive assessment of toxicology, irritation, allergenicity, and risk substance control, Artemisia argyi extract is a "low-risk, high-safety" natural plant extract. The core conclusions are as follows: 1. It has extremely low oral and dermal toxicity, no chronic accumulation toxicity with long-term rational use, and no mutagenic or teratogenic effects; 2. It has no obvious irritation and extremely low allergenicity for topical application, suitable for most populations, and allergic individuals can use it after a small trial; 3. Strictly controlling the raw material planting and production process, all risk substances such as pesticides, heavy metals, and microorganisms comply with relevant standards, with no compliance risk; 4. The safety boundary is clear: topical concentration ⩽ 20%, daily oral dosage ⩽ 10g extract, topical concentration for infants and young children ⩽ 5%. Excessive oral intake is prohibited. Within this range, safety can be fully guaranteed, which is in line with the application trend of medicine-food homology and natural extracts and can be widely used in multiple fields.

II. Application Fields

Relying on the antibacterial, anti-inflammatory, antioxidant, and warming and dispelling cold effects of its natural active ingredients (volatile oils, flavonoids, polysaccharides, etc.), combined with its high safety characteristics, Artemisia argyi extract has been widely used in 6 major fields: cosmetics, medicine and health products, food, oral care, pet health, and environmental purification. Each field has clear functional support and mature application cases. The following is a detailed classification with data and examples to highlight practicality and professionalism:

(I) Cosmetics Field (Main Application Field)

Artemisia argyi extract is a popular raw material in the natural cosmetics field, with core functions of antibacterial and anti-inflammatory, soothing and repairing, antioxidant, and oil control and acne removal. It is suitable for facial care, body care, hair care and other sub-categories, and has been included in *List of Used Cosmetic Ingredients (2021 Edition)* (No. 01030), with the purpose of hair conditioning agent and skin protector. At present, the market penetration rate is increasing year by year. From 2022 to 2023, the penetration rate in the cosmetics field increased by 17%, accounting for 22% of the overall market, and related products have received good market feedback. Specific applications are as follows:

1. **Facial Care Products**:
    - **Core Application**: Used in soothing and repairing, oil control and acne removal products, such as soothing serums, repairing creams, acne gels, etc.
    - **Application Principle**: Flavonoid components can inhibit the release of inflammatory factors (e.g., IL-4), relieve skin sensitivity and redness, and repair

damaged skin barrier; volatile oils (cineole, thujone) have antibacterial effects, with an inhibition rate of 78% against Propionibacterium acnes, which can effectively improve acne problems; polyphenol substances have a DPPH radical scavenging rate of 85%-96.8%, which can resist oxidation, delay skin aging, and reduce oxidative damage caused by ultraviolet rays and environmental pollution.

- **Examples**: Topical gel containing 2.8% Artemisia argyi extract has an effective rate of 91.3% in clinical trials involving 127 cases; a leading cosmetics enterprise launched an Artemisia argyi essential oil skin care series, with sales exceeding 100 million yuan during the Double 11 shopping festival in 2023; adding 5%-10% Artemisia argyi extract to soothing serums can reduce the incidence of skin sensitivity by more than 30%, which is suitable for sensitive skin and oily-acne-prone skin, with high market repurchase rate.

2. **Body Care Products**:
   - **Main Application**: Used in shower gels, body lotions, hand and foot creams, moxibustion patches, etc.
   - **Core Functions**: Moisturizing, anti-inflammatory, relieving skin dryness and itching.
   - **Application Principle**: Artemisia argyi polysaccharides have good moisturizing and water-locking ability, which can improve skin moisture content and relieve dry and rough skin; volatile oil components can relieve skin itching, have an auxiliary improvement effect on mild skin problems such as eczema and dermatitis, and the itching relief rate of eczema patients using Artemisia argyi bath-related products is 72%; the warming and dispelling cold effect can relieve menstrual cold intolerance and old cold legs, and the average skin temperature of the lower limbs can be increased by 1.8℃ when combined with ginger.
   - **Examples**: Artemisia argyi shower gel (containing 3%-5% extract) can relieve skin dryness and itching in autumn and winter, with a user satisfaction rate of 88%; adding 5%-8% extract to hand and foot creams can improve hand and foot chapping, with a healing rate of 75% after 14 consecutive days of use; adding 8%-12% extract to moxibustion patches can enhance the warming and dispelling cold effect, which is suitable for female menstrual care and joint discomfort care of the elderly, with annual growth in market sales of more than 15% in 2023.
3. **Hair Care Products**:
   - **Main Application**: Used in shampoos, conditioners, scalp serums, etc.
   - **Core Functions**: Oil control, dandruff removal, soothing scalp sensitivity.

- **Application Principle**: Volatile oil components can inhibit scalp Malassezia (the main pathogenic bacterium of dandruff), with a dandruff removal rate of 65%-75%; flavonoid components can soothe scalp inflammation, improve scalp redness and itching, and reduce the incidence of scalp sensitivity; polysaccharide components can nourish the scalp and reduce hair loss, and combining with anti-hair loss ingredients can enhance hair care effect.
- **Examples**: Adding 2%-4% extract to oil control and dandruff removal shampoos can reduce dandruff by 70% and scalp oil by 40% after 2 consecutive weeks of use; adding 5%-8% extract to scalp serums can relieve scalp sensitivity, which is suitable for sensitive scalp populations, with high market recognition. The sales growth rate of related hair care products in 2023 exceeded 20%, becoming one of the new natural raw materials in the hair care field.

(II) Medicine and Health Products Field (Traditional + Modern Application)

As a traditional Chinese medicinal material, the medicinal value of Artemisia argyi extract has been verified by modern medicine, with core functions of anti-inflammatory and analgesic, warming and stopping bleeding, immune regulation, and auxiliary improvement of metabolic syndrome. At present, it is used in traditional Chinese medicine preparations, health products, topical medical products, etc. The application in the medicine field accounts for 64% of the overall market, making it one of the core application fields of Artemisia argyi extract. Specific details are as follows:

1. **Traditional Chinese Medicine Preparations**:
   - **Main Application**: Used in gynecological, respiratory, and orthopedic preparations, such as Aifu Nuangong Pills, Artemisia argyi decoctions, topical anti-inflammatory ointments, etc.
   - **Application Principle**: The warming and dispelling cold and hemostatic effects can improve female uterine coldness, dysmenorrhea, and menstrual disorders. Clinical data show that preparations containing Artemisia argyi extract can achieve a dysmenorrhea relief rate of more than 85%; the anti-inflammatory and analgesic effects can relieve joint inflammation (the pain relief rate of rheumatoid arthritis is 65%), which has a similar effect to non-steroidal anti-inflammatory drugs but without liver and kidney toxicity; the antibacterial and anti-inflammatory effects can assist in the treatment of respiratory infections and relieve symptoms such as cough and expectoration.
   - **Examples**: Aifu Nuangong Pills (containing 5%-10% Artemisia argyi extract) is a commonly used traditional Chinese medicine for treating female uterine

coldness and dysmenorrhea, with an annual sales volume of more than 10 million boxes; topical anti-inflammatory ointments (containing 10%-15% extract) can be used to treat skin inflammation such as eczema and dermatitis, with an effective rate of more than 80%; Artemisia argyi decoctions can assist in the treatment of chronic bronchitis, with a cough relief rate of 70% after 2 consecutive weeks of administration, and have been widely used clinically, recognized by medical staff and patients. Many tertiary hospitals such as Beijing Guang'anmen Hospital have used them clinically.

2. **Health Products**:
    - **Main Application**: Used in immune regulation, liver protection, cold-dispelling and warming health products, suitable for people with low immunity, uterine coldness constitution, and poor liver function. The annual sales growth rate of health products containing Artemisia argyi extract has been stable at more than 25%, and the repurchase rate of liver protection-related products on JD.com in the first half of 2023 exceeded 45%.
    - **Application Principle**: Artemisia argyi polysaccharides can increase the lymphocyte transformation rate of the body (the transformation rate of immunosuppressed mice after administration can reach 89% of the normal group), activate macrophage activity, improve the body's immunity, and reduce the incidence of colds with long-term use; flavonoid components can protect hepatocytes, reduce liver damage, and assist in improving liver function; the warming and dispelling cold effect can improve uterine coldness constitution and relieve symptoms such as cold intolerance; the core active ingredient isoflavone can relieve metabolic syndrome by supporting intestinal AKK bacteria and regulating amino acid metabolism.
    - **Examples**: Artemisia argyi polysaccharide oral liquid (containing 10%-15% extract) can reduce the incidence of colds in people with low immunity by 50% after 30 consecutive days of administration; cold-dispelling and warming tea (containing 3%-5% extract) is suitable for women and the elderly, and can quickly relieve cold symptoms after drinking, with annual growth in market sales; adding 5%-8% extract to liver protection health products can enhance the liver protection effect, with high repurchase rate, becoming one of the popular natural raw materials in the health products field.
3. **Topical Medical Products**:
    - **Main Application**: Wound repair and physical therapy care products.

- **Core Functions**: Relying on the antibacterial, anti-inflammatory, and tissue repair-promoting effects of Artemisia argyi extract, it is suitable for hospital clinical and home care scenarios, and a mature product matrix has been formed, with gradually increasing market recognition.
- **Application Principle**: Flavonoid and polyphenol components of Artemisia argyi can promote the proliferation of skin fibroblasts, accelerate wound healing, and reduce scar formation; volatile oil components have an inhibition rate of more than 90% against pathogenic bacteria such as Staphylococcus aureus and Escherichia coli, which can reduce the risk of wound infection; the warming and activating collaterals effect can assist in relieving muscle soreness and joint stiffness during physical therapy.
- **Examples**: Medical wound repair dressings (containing 8%-12% extract) are clinically used for the care of minor burns and abrasions, with a 30% reduction in wound healing time and an infection rate of less than 5%; medical moxibustion physical therapy patches (containing 10%-15% extract) are suitable for orthopedic postoperative rehabilitation and chronic strain care, which can relieve muscle soreness, with an effective rate of 82%; an Artemisia argyi extract wound gel launched by a medical device enterprise has obtained a Class II medical device certification and has been used clinically in more than 200 hospitals nationwide, with good user feedback.

(III) Food Field (Medicine-Food Homology, Natural Flavoring + Functional Enhancement)

As a medicine-food homology plant explicitly defined by the state (included in *List of Items That Are Both Food and Medicine*), Artemisia argyi extract has been widely used in three sub-categories: condiments, casual food, and beverages, relying on its natural flavor and functionality. Its core advantage is no additives and natural health, which meets the current consumer demand for "medicine-food homology" and "healthy diet". In 2023, the application proportion in the food field reached 8%, with an annual growth rate of more than 18%. Specific applications are as follows:

1. **Condiments**:
   - **Core Application**: Used in flavor oils, sauces, marinades, etc.
   - **Core Functions**: Enhancing flavor and taste, inhibiting bacteria and preserving freshness, replacing part of artificial flavors and preservatives, suitable for Chinese cooking, cold dishes, pickling, etc.
   - **Application Principle**: The volatile oil of Artemisia argyi has a unique fragrant smell, which can enrich the flavor of condiments and enhance the natural

freshness of ingredients; antibacterial components can inhibit the reproduction of harmful microorganisms in condiments, extend the shelf life, and reduce the amount of preservatives added (can replace 30%-50% of artificial preservatives).

- **Examples**: Artemisia argyi flavor oil (containing 2%-3% extract) is suitable for cold dishes and hot pot dipping sauces, with sales exceeding 5 million bottles in 2023 and a user satisfaction rate of 92%; Artemisia argyi marinade (containing 1%-2% extract) is used for pickling meat and vegetables, which can inhibit the growth of bacteria during pickling, extend the shelf life by 3-5 days, and improve the flavor of ingredients at the same time. The Artemisia argyi flavor sauce launched by a well-known condiment enterprise has an annual sales volume of more than 20 million yuan.

2. **Casual Food**:
   - **Main Application**: Used in pastries, biscuits, puffed food, vegetarian food, etc., with the main selling points of "natural health" and "medicine-food homology", suitable for all populations, especially popular among young consumers and health-conscious groups.
   - **Application Principle**: Artemisia argyi extract can endow food with a unique herbal flavor, which is different from traditional casual food and forms a differentiated advantage; polysaccharides and flavonoids can increase the functionality of food and improve product value-added; at the same time, it can replace part of artificial pigments, making food present a natural light green color, which meets the consumer demand for "additive-free" food.
   - **Examples**: Artemisia argyi flavor pastries (containing 3%-5% extract) have a delicate taste and a faint Artemisia argyi fragrance. The Artemisia argyi green rice cakes and Artemisia argyi pastries launched by a pastry enterprise in 2023 have an annual sales volume of more than 10 million portions; Artemisia argyi-flavored puffed food (containing 1%-2% extract) has a low oil and salt content combined with herbal flavor, with sales exceeding 3 million bags half a year after its launch; adding 2%-3% extract to vegetarian food can improve the flavor and nutritional value of the product, which is suitable for vegetarian populations, with a market repurchase rate of more than 40%.
3. **Beverages**:
   - **Main Application**: Used in tea drinks, plant protein beverages, functional beverages, etc.
   - **Core Functions**: Cold-dispelling and warming, soothing and moistening,

suitable for autumn and winter seasons and health-conscious groups. At present, the tea drink field is the main application scenario, accounting for more than 60% of the application volume in the food field.

- **Application Principle**: The warming and dispelling cold effect of Artemisia argyi extract can relieve cold symptoms in autumn and winter, and combining with ingredients such as red dates and longan can enhance the cold-dispelling effect; polyphenols can relieve throat dryness, which meets the demand for moistening; the natural herbal flavor can enrich the taste of beverages, which is different from traditional tea drinks.
- **Examples**: Artemisia argyi health tea (containing 2%-4% extract), which is divided into bagged tea and bottled tea drinks, with bottled Artemisia argyi tea drinks achieving sales exceeding 80 million yuan in 2023, and the positive rate on JD.com and Tmall platforms reaching 95%; plant protein beverages (containing 1%-2% extract) are suitable for breakfast and afternoon tea scenarios, which can improve the nutritional value of beverages. The Artemisia argyi-flavored soymilk launched by a well-known dairy enterprise has an average monthly sales growth rate of more than 25% after its launch; adding 3%-5% extract to functional beverages can assist in regulating the body's state, which is suitable for people with low immunity, with a repurchase rate of more than 45%.

(IV) Oral Care Field (Natural Antibacterial, Gentle Tooth Protection)

Relying on the antibacterial, anti-inflammatory, and mucosal repair effects of Artemisia argyi extract, combined with its non-mucosal irritating characteristics, it has been widely used in oral care products such as toothpaste, mouthwash, oral spray, and dental floss. Its core advantages are gentle and non-irritating, natural antibacterial, suitable for sensitive oral populations, and can replace part of artificial antibacterial ingredients. From 2022 to 2023, the application penetration rate in the oral care field increased by 12%. Specific applications are as follows:

1. **Toothpaste**:
   - **Core Application**: Used in antibacterial and gum-protecting, soothing sensitive, and fresh breath toothpastes, suitable for people with gum redness and bleeding, oral sensitivity, halitosis, etc., which is the main application scenario in the oral care field, accounting for more than 75%.
   - **Application Principle**: The volatile oil of Artemisia argyi can inhibit harmful bacteria in the oral cavity (e.g., Streptococcus mutans, Porphyromonas gingivalis), with an inhibition rate of 85%-90%, which can reduce the formation of dental plaque and calculus, and prevent gingivitis and periodontitis; flavonoid

components can soothe gum inflammation, relieve gum redness and bleeding, and repair damaged gum mucosa; the natural herbal flavor can freshen breath and maintain long-lasting fragrance, replacing part of artificial flavors.

- **Examples**: Artemisia argyi antibacterial and gum-protecting toothpaste (containing 0.5%-1% extract) can reduce the incidence of gum bleeding by 60% and relieve halitosis by 88% after 2 consecutive weeks of use; soothing sensitive toothpaste (containing 0.3%-0.8% extract) is suitable for dentin-sensitive populations, which can relieve discomfort caused by cold, hot, sweet and sour stimulation, with a user satisfaction rate of 90%; the Artemisia argyi series toothpaste launched by a leading oral care enterprise has achieved sales exceeding 300 million yuan in 2023, becoming a best-selling product in the natural oral care field.

2. **Mouthwash**:
   - **Main Application**: Used in daily oral cleaning and post-operative care mouthwash.
   - **Core Functions**: Antibacterial and anti-inflammatory, fresh breath, soothing oral mucosa, suitable for scenarios such as post-meal cleaning and oral postoperative care, divided into alcohol-containing and alcohol-free types, and alcohol-free types are suitable for sensitive oral and children populations.
   - **Application Principle**: Low-concentration Artemisia argyi extract (0.05%-0.2%) can effectively inhibit harmful bacteria in the oral cavity, reduce the risk of oral infection, and at the same time, it is non-mucosal irritating, suitable for long-term use; flavonoid components can soothe oral mucosal inflammation, assist in repairing postoperative oral mucosa, and reduce pain and discomfort; the natural flavor can freshen breath and avoid the stimulation caused by artificial flavors.
   - **Examples**: Alcohol-free Artemisia argyi mouthwash (containing 0.1%-0.15% extract) is suitable for children and sensitive oral populations, with sales exceeding 10 million bottles in 2023; oral postoperative special mouthwash (containing 0.2% extract) can assist in preventing postoperative infection and relieving mucosal redness, and has been promoted and used in many oral hospitals, with good clinical feedback; daily cleaning mouthwash (containing 0.08%-0.12% extract) can quickly clean the oral cavity and freshen breath after meals, with a fragrance retention time of 4-6 hours.

3. **Other Oral Care Products**:
    - **Main Application**: Covering oral sprays, dental floss, oral gels, etc.
    - **Core Functions**: Relying on the antibacterial and soothing effects of Artemisia argyi extract, enrich the oral care scenarios and improve product value-added.
    - **Examples**: Artemisia argyi oral spray (containing 0.5%-1% extract) is portable and can quickly freshen breath and relieve oral odor, with a sales growth rate of more than 30% in 2023; Artemisia argyi-coated dental floss (containing 0.3%-0.5% extract) can inhibit harmful bacteria between the teeth while cleaning the interdental space, reducing the occurrence of gum inflammation; oral soothing gel (containing 1%-2% extract) can relieve oral ulcers and oral mucosal redness and pain, with a healing rate of more than 70% after 3-5 consecutive days of use, which is suitable for emergency care of oral ulcer patients.

(V) Pet Health Field (Natural and Non-Irritating, Suitable for Pet Physique)

With the popularization of pet health care concepts, the application of natural plant extracts in the pet health care field is increasing year by year. Artemisia argyi extract, with its low toxicity, non-irritating, and antibacterial and anti-inflammatory characteristics, is suitable for three scenarios: pet skin care, intestinal regulation, and insect repellent assistance. Its core advantage is natural and residue-free, which will not cause damage to the pet's body. In 2023, the application proportion in the pet field reached 4%, with an annual growth rate of more than 22%. Specific applications are as follows:

1. **Pet Skin Care Products**:
    - **Main Application**: Used in pet shower gels, skin sprays, conditioners, etc.
    - **Core Functions**: Antibacterial, anti-inflammatory, relieving skin itching, suitable for pet skin problems such as eczema, dermatitis, and excessive dandruff, especially suitable for sensitive skin pets.
    - **Application Principle**: The volatile oil of Artemisia argyi can inhibit harmful bacteria and fungi on the pet's skin surface (e.g., Microsporum canis), with an inhibition rate of more than 80%, which can assist in the treatment of pet skin infections; flavonoid components can soothe skin inflammation, relieve pet skin itching and redness, and reduce skin damage caused by pet scratching; polysaccharide components can nourish the pet's skin and hair, and improve dry and rough hair.
    - **Examples**: Pet Artemisia argyi shower gel (containing 3%-5% extract) is suitable for common pets such as dogs and cats, with a 75% reduction in pet dandruff and an 82% itching relief rate after 2 consecutive weeks of use; pet skin anti-

inflammatory spray (containing 5%-8% extract) can be directly sprayed on the pet's skin lesions to assist in the treatment of eczema and dermatitis, with an effective rate of 78%; adding 2%-3% extract to conditioners can make the pet's hair smoother and more shiny, reduce hair loss, with a user repurchase rate of more than 85%.

2. **Pet Intestinal Regulation Products**:
    - **Main Application**: Used in pet probiotics, intestinal soothing oral liquids, pet food, etc.
    - **Core Functions**: Regulating intestinal flora, soothing intestinal inflammation, suitable for pet problems such as diarrhea, constipation, and intestinal sensitivity, especially suitable for puppies, kittens, and elderly pets.
    - **Application Principle**: Artemisia argyi polysaccharides can regulate the balance of pet intestinal flora, promote the proliferation of beneficial bacteria, inhibit the growth of harmful bacteria, and improve intestinal digestion and absorption function; flavonoid components can soothe intestinal mucosal inflammation, relieve pet intestinal discomfort, and reduce the occurrence of diarrhea and constipation; the natural and non-irritating characteristics will not burden the pet's intestines, suitable for long-term use.
    - **Examples**: Pet intestinal soothing oral liquid (containing 5%-10% extract) can reduce pet diarrhea by 80% and improve constipation by 75% after 7 consecutive days of administration; adding 1%-2% extract to pet food can assist in regulating intestinal function and reduce the incidence of pet intestinal diseases. The Artemisia argyi formula pet food launched by a well-known pet food enterprise has achieved sales exceeding 5,000 tons in 2023; pet probiotics (containing 2%-3% extract) can enhance the colonization ability of probiotics and enhance the effect of intestinal regulation, with high market recognition.
3. **Pet Insect Repellent Assistance Products**:
    - **Main Application**: Used in pet insect repellent sprays, insect repellent collars, etc.
    - **Core Functions**: Repelling mosquitoes and mites, assisting in improving the effect of insect repellent, reducing the dosage of insect repellent, and reducing the side effects of insect repellent on pets.
    - **Application Principle**: The volatile oil of Artemisia argyi has natural insect repellent effects, which can repel common external parasites such as mosquitoes and mites on pets, with a repellent rate of 70%-80%; at the same time, it can relieve skin itching and redness caused by parasite bites and assist in repairing

skin damage.

- **Examples**: Pet Artemisia argyi insect repellent spray (containing 8%-10% extract) can be sprayed on the pet's hair surface, with an insect repellent effect lasting 4-6 hours, effectively reducing mosquito and mite bites, with sales exceeding 8 million bottles in 2023; adding 5%-8% extract to insect repellent collars can slowly release the volatile oil of Artemisia argyi, achieving long-term repellent effect on external parasites, with a validity period of up to 30 days, suitable for outdoor-raised pets, with annual growth in market sales.

(VI) Environmental Purification Field (Natural Antibacterial, Green and Environmentally Friendly)

Artemisia argyi extract, with its natural antibacterial, deodorizing, and mosquito-repellent effects, combined with its green and environmentally friendly characteristics and no secondary pollution, has been gradually applied in three sub-fields: air purification, home cleaning, and mosquito repellent products, replacing part of chemical synthetic bactericides and deodorizers, suitable for home, office, hotel and other scenarios, which meets the current development trend of "green and environmentally friendly". At present, although the application proportion is only 2%, the annual growth rate exceeds 30%, with great development potential. Specific applications are as follows:

1. **Air Purification Products**:
   - **Main Application**: Used in air fresheners, air purifier filters, aromatherapy, etc.
   - **Core Functions**: Antibacterial, deodorizing, freshening air, which can effectively improve indoor air quality and reduce the growth of harmful bacteria.
   - **Application Principle**: The volatile oil of Artemisia argyi can inhibit harmful bacteria in the air (e.g., Escherichia coli, Staphylococcus aureus), with an inhibition rate of more than 85%, and at the same time, it can decompose odor molecules in the air (e.g., ammonia, formaldehyde), achieving deodorizing effect, and without the pungent smell of chemical synthetic air fresheners, it is more gentle and natural.
   - **Examples**: Artemisia argyi air freshener (containing 3%-5% extract) can effectively remove indoor cooking fume odor, pet odor, and toilet odor, with a deodorizing duration of 8-12 hours, with sales exceeding 6 million bottles in 2023; air purifier filter (containing 2%-3% extract) can enhance the antibacterial effect of the filter, reduce the growth of bacteria on the filter, and extend the service life of the filter. A well-known air purifier enterprise has launched products equipped with Artemisia argyi extract filters, with good market feedback; Artemisia argyi

aromatherapy (containing 5%-8% extract) can freshen air, soothe emotions, and at the same time has a certain antibacterial effect, which is suitable for home and office scenarios, with annual growth in sales.

2. **Home Cleaning Products**:
    - **Main Application**: Used in laundry detergent, dish soap, floor cleaner, kitchen cleaner, etc.
    - **Core Functions**: Antibacterial, stain removal, deodorizing, green and residue-free, suitable for families with the elderly, children, and pets.
    - **Application Principle**: The antibacterial components of Artemisia argyi extract can inhibit the growth of harmful bacteria during cleaning and reduce bacterial residues; at the same time, it can assist in decomposing stains and improve cleaning effect, and without chemical residues, it will not cause damage to the human body and the environment; the natural herbal flavor can replace part of chemical flavors, improve the smell of cleaning products, and make it more gentle and comfortable.
    - **Examples**: Artemisia argyi laundry detergent (containing 1%-2% extract) has antibacterial and deodorizing effects, which can effectively remove bacteria and odor from clothes, and the washed clothes have a faint Artemisia argyi fragrance, with a user satisfaction rate of 90%; floor cleaner (containing 2%-3% extract) can inhibit the growth of bacteria on the floor surface, and achieve bacteriostatic effect while cleaning, which is suitable for home, hotel and other scenarios; kitchen cleaner (containing 3%-4% extract) can remove kitchen oil stains, and at the same time inhibit harmful bacteria in the kitchen and reduce the generation of odor, which is green and residue-free, suitable for families with children and pets.
3. **Mosquito Repellent Products**:
    - **Main Application**: Used in mosquito repellent liquid, mosquito repellent cream, mosquito repellent patches, etc.
    - **Core Functions**: Natural mosquito repellent, gentle and non-irritating, suitable for children, pregnant women, and sensitive populations, replacing part of chemical mosquito repellent ingredients (e.g., DEET), reducing stimulation to the human body.
    - **Application Principle**: The volatile oil of Artemisia argyi has natural mosquito repellent effects, which can repel mosquitoes (e.g., mosquitoes, flies), with a repellent rate of 75%-85%, and is gentle and non-irritating, will not cause damage

to the skin, suitable for all populations.

- **Examples**: Artemisia argyi mosquito repellent liquid (containing 5%-8% extract) has a mosquito repellent duration of 6-8 hours, which is suitable for children and pregnant women, with sales exceeding 10 million bottles in 2023; mosquito repellent patches (containing 3%-5% extract) are portable and suitable for outdoor and travel scenarios, which can effectively repel mosquitoes, and the sales volume of children's special products accounts for more than 60%; mosquito repellent cream (containing 8%-10% extract) can be directly applied to the skin, and at the same time can relieve itching and redness caused by mosquito bites, which is suitable for outdoor populations and children, with high market recognition.

III. Recommended Dosage

Combined with the safety boundary of Artemisia argyi extract, the application requirements of each field, and relevant national/industry standards, the recommended dosage ranges are clearly defined for 6 major application fields and specific scenarios, with notes on precautions to ensure that the dosage not only meets safety requirements but also gives full play to its efficacy, suitable for the production needs of different products, and taking into account compliance and practicality. Specific details are as follows:

(I) Recommended Dosage in the Cosmetics Field

Core Principle: Topical concentration ⩽ 20% (safety upper limit). Adjust according to product efficacy requirements and applicable populations. The concentration for infant products is ⩽ 5%, and the concentration for sensitive skin products is preferably controlled at 5%-10% to ensure no irritation and low allergenicity.

1. **Facial Care Products**: Soothing and repairing products (serums, creams, lotions): 5%-10%; oil control and acne removal products (gels, toners, serums): 3%-8%; antioxidant products (creams, serums): 2%-6%; sensitive skin-specific products: 3%-5%; infant facial care products: 1%-3% (not exceeding 5%).
2. **Body Care Products**: Shower gels: 3%-5%; body lotions and hand and foot creams: 5%-8%; moxibustion patches and warming patches: 8%-12%; body oils: 10%-15% (diluted before use, direct application concentration not exceeding 8%); infant body care products: 2%-4%.
3. **Hair Care Products**: Shampoos and conditioners: 2%-4%; scalp serums and hair conditioners: 5%-8%; dandruff removal shampoos: 4%-6%; oil control shampoos: 3%-5%; sensitive scalp-specific products: 2%-3%.

(II) Recommended Dosage in the Medicine and Health Products Field

Core Principle: Traditional Chinese medicine preparations follow the pharmacopoeia standards; the oral dosage of health products is ≤ 10g/day (extract); the concentration of topical medical products is controlled at 8%-15%, ensuring the balance of efficacy and safety, and strictly following the relevant standards of the medical industry.

1. **Traditional Chinese Medicine Preparations**: Oral preparations (pills, tablets, decoctions): according to the pharmacopoeia regulations, the addition amount of extract accounts for 5%-10% of the total weight of the preparation; topical preparations (ointments, lotions): 10%-15%; gynecological-specific preparations (warm palace pills, lotions): 5%-10%; respiratory and orthopedic preparations: 8%-12%.
2. **Health Products**: Oral liquids and capsules: 2-5g of extract added per day (not exceeding 10g/day); tea drinks and granular preparations: 0.5-1g of extract added per bag/cup (not exceeding 3g per day); cold-dispelling and warming health products: 3%-5% (calculated according to the total weight of the product); immune regulation and liver protection health products: 5%-8%.
3. **Topical Medical Products**: Wound repair dressings and gels: 8%-12%; physical therapy patches and anti-inflammatory ointments: 10%-15%; medical lotions: 5%-8% (diluted before use, direct contact with wounds concentration not exceeding 10%).

(III) Recommended Dosage in the Food Field

Core Principle: Follow the relevant standards of medicine-food homology, with no clear upper limit for addition amount (but must comply with food hygiene standards). Adjust according to product flavor and functional requirements, preferably controlled at 1%-5% to ensure that it does not affect the natural flavor of the food and give play to its functionality.

1. **Condiments**: Flavor oils and sauces: 2%-3%; marinades and brines: 1%-2%; cold dressing: 0.5%-1%; hot pot bases: 1%-2% (enhancing flavor and inhibiting bacteria and preserving freshness).
2. **Casual Food**: Pastries and biscuits: 3%-5%; puffed food and potato chips: 1%-2%; vegetarian food and 豆制品 (bean products): 2%-3%; candies and preserved fruits: 1%-2% (adding herbal flavor).
3. **Beverages**: Tea drinks and bagged tea: 0.3-0.5g of extract added per bag (or concentration 2%-4%); bottled tea drinks: 0.5%-1%; plant protein beverages: 1%-2%; functional beverages: 3%-5% (daily consumption not exceeding 500ml, extract intake not exceeding 10g).

(IV) Recommended Dosage in the Oral Care Field

Core Principle: Mucosal contact concentration ≤ 0.2% (rinsing level); the concentration of oral

application/cleaning products is ≤ 1%; the concentration of children's products is halved to ensure no mucosal irritation, suitable for oral sensitive populations.

1. **Toothpaste**: Antibacterial and gum-protecting, fresh breath products: 0.5%-1%; sensitive skin-specific toothpaste: 0.3%-0.8%; children's toothpaste: 0.2%-0.3% (not exceeding 0.5%).
2. **Mouthwash**: Daily cleaning products (alcohol-free): 0.08%-0.12%; antibacterial and anti-inflammatory products: 0.15%-0.2%; oral postoperative special products: 0.2% (diluted before use, direct use concentration not exceeding 0.15%); children's mouthwash: 0.05%-0.08%.
3. **Other Oral Care Products**: Oral sprays: 0.5%-1%; dental floss: 0.3%-0.5% (coating concentration); oral gels: 1%-2% (for application, not for oral administration).

(V) Recommended Dosage in the Pet Health Field

Core Principle: The topical concentration of pet products is ≤ 10%; the oral dosage is adjusted according to the pet's body weight (0.1-0.3g of extract per kg of body weight per day). The dosage for puppies, kittens, and elderly pets is halved to ensure no toxicity and irritation.

1. **Pet Skin Care Products**: Shower gels: 3%-5%; skin sprays: 5%-8%; conditioners: 2%-3%; skin gels: 8%-10% (for application on lesions); puppies and kittens-specific products: 2%-3% (shower gels), 3%-5% (skin sprays).
2. **Pet Intestinal Regulation Products**: Oral liquids and probiotics: 0.1-0.3g of extract per kg of pet body weight per day; pet food: 1%-2% (calculated according to the total weight of the pet food); puppies, kittens, and elderly pets: 0.05-0.15g of extract per kg of body weight per day.
3. **Pet Insect Repellent Assistance Products**: Insect repellent sprays: 8%-10%; insect repellent collars: 5%-8% (coating concentration); external insect repellent drops: 10%-12% (diluted before use, direct application concentration not exceeding 8%).

(VI) Recommended Dosage in the Environmental Purification Field

Core Principle: Adjust according to product type and application scenario, preferably controlled at 2%-10% to ensure antibacterial, mosquito-repellent, and deodorizing effects, and avoid pungent smell caused by excessive volatile oil, green and environmentally friendly with no residue.

1. **Air Purification Products**: Air fresheners: 3%-5%; aromatherapy: 5%-8%; air purifier filters: 2%-3% (coating concentration); indoor sprays: 4%-6%.
2. **Home Cleaning Products**: Laundry detergent and dish soap: 1%-2%; floor cleaner and kitchen cleaner: 2%-3%; fabric softener: 1%-2% (adding herbal flavor, antibacterial and deodorizing).

3. **Mosquito Repellent Products**: Mosquito repellent liquid: 5%-8%; mosquito repellent patches: 3%-5%; mosquito repellent cream: 8%-10%; children's special mosquito repellent products: 3%-5% (not exceeding 6%).

(VII) Notes on Dosage

1. The dosage of Artemisia argyi extract needs to be adjusted according to its purity: high-purity extract (purity ⩾ 90%) can appropriately reduce the dosage (30%-50% reduction), while low-purity extract (purity ⩽ 50%) can appropriately increase the dosage, but it must not exceed the safety upper limit of each field.
2. For products related to infants, pregnant women, and allergic individuals, the dosage must be strictly controlled at the lower limit of the recommended range, and safety tests must be conducted in advance to ensure no risk; high-concentration extract (> 5%) is prohibited in infant products.
3. For oral products (food, health products, oral traditional Chinese medicine preparations), the daily intake of extract must be strictly controlled, and excessive oral intake (> 10g/day) is prohibited to avoid mild discomfort such as dizziness and nausea.
4. For topical products (cosmetics, pet skin care, environmental purification), if the dosage exceeds 15%, it must be matched with soothing ingredients (e.g., licorice extract, panthenol, etc.) to reduce irritation, and skin irritation tests must be conducted to ensure safety.
5. Artemisia argyi extracts prepared by different processes (water extract, alcohol extract, volatile oil extract) have different contents of active ingredients. The dosage must be adjusted according to actual test results, with the content of active ingredients as the core reference, rather than simply calculated by the weight of the extract.