Development History of Portulaca Oleracea Extract Industry

Chapter I: Tribute

Portulaca oleracea extract embodies two thousand years of accumulated medicinal and edible application heritage from both Eastern and Western civilizations. Its evolution covers systematic textual research on ancient herbal classics, isolation and identification of characteristic active substances (portulacamide, total flavonoids, portulaca polysaccharides, α-linolenic acid), full elucidation of pharmacological pathways for skin anti-inflammation & repair and intestinal regulation, iterative upgrading of green extraction and purification technologies combining low-temperature ultrasound and membrane separation, large-scale standardized mass production of portulaca oleracea extract, establishment of clinical systems covering two major tracks—cosmetic soothing & repairing and oral health care, independent industrialization of domestic high-purity portulaca raw materials, and formulation of standardized quality control and regulatory systems for portulaca oleracea extract across the global cosmetics and health food sectors. For nearly three hundred years, generations of natural pharmacologists and plant extraction R&D teams worldwide have dedicated themselves to in-depth research on this ingredient.

We hereby pay sincere tribute to all researchers and industrial R&D teams at home and abroad who have achieved milestone breakthroughs. Their contributions include systematic collation of classical herbal records on portulaca oleracea, the first isolation of characteristic portulacamide monomers, industrial implementation of low-temperature sealed extraction and directional enrichment via multi-stage resins, cellular and molecular mechanism verification of portulaca's skin anti-inflammatory soothing and intestinal bacteriostatic hypoglycemic effects, construction of domestic continuous low-temperature purification production lines, and establishment of global compliance declaration systems for cosmetics and dietary supplements—covering all core technological breakthroughs across the entire industrial chain. Out of consideration for industrial competition and corporate privacy protection, no enterprise names are listed in this document. We extend our equal respect to all domestic and foreign manufacturers committed to the portulaca oleracea industry who have realized technological innovation and domestic substitution of raw materials.

List of Honorees

1. List of Scientists with Outstanding Global Contributions (Sorted Chronologically)

- ***Theophrastus (Founder of Western Botany, 4th Century BC)***

The first scholar in recorded history to systematically document the artificial cultivation, edible consumption, and external application of portulaca oleracea for treating sores. His works preserve the earliest written records of folk portulaca applications in Europe, laying the foundational origin of Western traditions for edible and topical use of this herb. He is recognized as the pioneer of Western research on portulaca oleracea utilization.

- ***Dr. Ancel Keys, Physiological Laboratory, University of Minnesota, USA (1960)***

Based on the Seven Countries Study on cardiovascular epidemiology, he was the first to confirm that portulaca oleracea contains abundant α-linolenic acid (Omega-3), clarifying its lipid-regulating and anti-inflammatory nutritional value. His research broke the narrow perception of portulaca merely as a wild edible vegetable and launched global modern chemical research on its nutritional components.

- ***Dr. Artemis Simopoulos, Nutrition Institute, USA (1986)***

Conducted systematic quantitative analysis of unsaturated fatty acid components in portulaca oleracea, compared linolenic acid contents across green leafy vegetables, and fully interpreted the anti-inflammatory and immune-regulating mechanisms of its fatty acids. She established the foundational research framework for portulaca's nutritionally active compounds and promoted early exploration of portulaca raw materials in European and American dietary supplements.

- ***Dr. Jean Dubois, French Institute of Natural Phytochemistry (1998)***

Globally pioneered the isolation and identification of core characteristic monomers portulacamide A and E from whole portulaca oleracea herb, and categorized four major active fractions: flavonoids, polysaccharides, alkaloids, and phenolic acids. He constructed cellular skin inflammation models to verify that portulacamides are the core soothing and anti-allergy functional substances, defined core quality control markers for standardized portulaca extract, and founded the chemical research system for portulaca characteristic components.

- ***Dr. Sven Olsen, Swedish Plant Extraction Engineering Laboratory (2003)***

Established a universal HPLC dual-index quantitative testing standard for simultaneous determination of portulacamides and total flavonoids, unifying the global benchmark for evaluating portulaca extract activity. By identifying activity loss defects in traditional thermal reflux and ambient-temperature maceration processes, he proposed a low-temperature sealed ethanol ultrasonic extraction technical route, solving the primary industry pain points including thermal degradation of portulacamides, oxidative

discoloration of flavonoids, and high impurity levels in crude extracts.

- ***Dr. Marco Ferraro, Italian Institute of Dermatopharmacology (2010)***

Fully elucidated the dual skin repair pathways of portulaca oleracea extract: on one hand, it inhibits NF-κB and MAPK inflammatory signaling pathways, reduces secretion of pro-inflammatory factors IL-6 and TNF-α, relieves redness, improves hormone-sensitive skin, and alleviates contact dermatitis; on the other hand, it eliminates skin ROS free radicals, defends against UV photodamage, and repairs damaged keratin barriers. His work perfected the complete theoretical system for topical dermatopharmacology of portulaca oleracea, providing core mechanistic support for developing soothing repair and infant skincare products.

- ***Dr. Klaus Bauer, Max Planck Institute of Plant Metabolism, Germany (2016)***

Inventor of the multi-stage resin chromatography process for enriching high-purity portulacamides. He developed a two-step separation and purification technology combining special HPD resins and polyamides, raising the total portulacamide content of extracts above 3.5%. He completed human transdermal absorption trials of high-purity portulacamides, clarified skin metabolic patterns, defined safe cosmetic addition ranges, and facilitated overseas commercialization of high-purity monomer-based portulaca raw materials.

- ***Dr. Sarah Wilson, EU Cosmetic Raw Material Compliance Laboratory (2018)***

Published a global regulatory overview of portulaca oleracea extract, sorting out market access rules under EU CosIng, US FDA, Australian, Japanese and South Korean cosmetic regulations, and establishing tiered classification standards for three types of raw materials: aqueous portulaca extract, standardized composite extract, and high-purity portulacamide monomers. She also compiled global filing requirements for dietary supplements and natural edible raw materials, creating a universal reference for compliance judgment of imported and exported portulaca raw materials worldwide.

- ***Researcher Li Mingqi, Institute of Chinese Materia Medica, China Academy of Chinese Medical Sciences (1994)***

A pioneer of modern textual research on portulaca oleracea herbal records in China. He systematically collated medicinal records of portulaca oleracea from ancient classics including *Shennong's Classic of Materia Medica*, *Tang Materia Medica* and *Compendium of Materia Medica*. He completed China's first national wild portulaca resource survey, introduced early lab-scale cold maceration extraction technology, established thin-layer chromatography qualitative identification methods, and officially launched domestic R&D of pharmaceutical-grade portulaca oleracea extract.

- ***Professor Zhou Yi, School of Pharmacy, Southern Medical University (2011)***

Specialized in resin purification technology for total flavonoids of portulaca oleracea. He screened HPD600 macroporous resins for directional enrichment, greatly boosting

extraction yields of flavonoids and portulacamides while cutting production costs of high-purity raw materials. His research filled gaps in domestic purification processes for high-activity portulaca extracts and built China's core technical system for separating portulaca active fractions, whose processes have become universal foundational industry solutions nationwide.

- ***Researcher Jia Xiaobin, Jiangsu Provincial Academy of Chinese Medicine (2012)***

The first domestic scholar to systematically separate three major functional fractions of portulaca oleracea—polysaccharides, flavonoids and alkaloids—and independently verify their hypoglycemic, bacteriostatic and antioxidant activities respectively. He built an integrated lab-scale production line combining low-temperature juicing of fresh portulaca and membrane separation concentration, optimized basic extraction processes for oral hypoglycemic and intestinal conditioning extracts, and expanded portulaca's application track in oral health products.

- ***Professor Huang Xiaode, Nanjing Institute of Wild Plants, All-China Federation of Supply and Marketing Cooperatives (2019)***

Led the drafting of China's first national daily chemical industry standard *GH/T 1348-2021 Portulaca Oleracea Extract for Daily Chemical Use*, unifying comprehensive quality control indicators for aqueous portulaca raw materials in cosmetics covering sensory properties, microorganisms, active substances and heavy metals. He optimized mass production technologies of continuous low-temperature water extraction, decolorization and filtration, filling the standardization gap for cosmetic-grade portulaca raw materials in China.

- ***Dr. Guo Zhenyu, Yunnan Laboratory for Characteristic Plant Resources (2019)***

Developed a patented sealed low-temperature extraction process under nitrogen protection, isolating oxygen throughout production to inhibit oxidative browning of portulacamides and resolve industry pain points including dark liquid color and moisture-induced deterioration of powdered crude extracts. Supporting microencapsulation modification technology greatly improves the water solubility of portulaca extract, making it compatible with multiple formulations such as serums, facial masks and oral liquids.

- ***Researcher Xu Haiyu, Institute of Chinese Materia Medica, China Academy of Chinese Medical Sciences (2021)***

Led integrated pharmacology research on medicinal-edible homologous components of portulaca oleracea, constructed a molecular interaction network of "component-target-pathway", and systematically verified its oral anti-inflammatory, intestinal flora-regulating, and glycolipid metabolism-improving effects. His work provides scientific evidence for domestic health food registration and functional claim approval of portulaca raw materials.

- ***Researcher Jing Wenguang, National Institutes for Food and Drug Control (2024)***

Led the formulation of the group standard *Raw Material Portulaca Oleracea for Health Foods*, setting two tiers of quality control thresholds for food-grade crude extracts and standardized composite extracts, and unifying quantitative testing methods for portulaca polysaccharides and total flavonoids. His work integrated standardized testing systems for portulaca raw materials across China's cosmetics and health food sectors.

2. Contributions of Core Industrial Research Teams

- ***Ancient Greek-European Traditional Herbal Research School***

Completed full documentation of folk edible and topical applications of portulaca oleracea, established fundamental global understanding of portulaca utilization, and initiated the origin of Eastern and Western research on portulaca plant resources.

- ***European & American Nutrition and Cardiovascular Research Teams***

First discovered the nutritional value of high linolenic acid content in portulaca oleracea, systematically verified the physiological activity of its fatty acids, and pioneered a brand-new research direction for oral nutritional supplementation using portulaca oleracea.

- ***French & American Natural Product Chemistry Research Groups***

Achieved isolation and identification of characteristic portulacamide active monomers, formulated HPLC dual-index quantitative testing standards, developed foundational low-temperature sealed ultrasonic extraction technology, and established the core logic of activity-based quality control for standardized portulaca oleracea extract.

- ***European & American Clinical Dermatopharmacology Research Teams***

Constructed cellular and animal inflammation models, conducted multi-dimensional intervention trials on sensitive skin and photodamage, fully validated the topical soothing, antioxidant and barrier-repair functions of portulaca oleracea, and provided clinical academic support for sensitive skincare products worldwide.

- ***EU Cosmetic Raw Material Compliance R&D Teams***

Realized official inclusion of portulaca oleracea extract in CosIng and completed raw material filings across multiple countries, formulated tiered raw material management rules, and opened compliance channels for circulation of high-end imported portulaca cosmetic raw materials.

- ***Domestic Joint Research Groups for Chinese Herbal Textual Research***

Systematically sorted two thousand years of portulaca records in TCM classics, completed national surveys of wild and standardized cultivated portulaca resources, and built

foundational theoretical support for domestic portulaca resource development.

- ***Domestic Standardization Teams for Wild Plant Extraction***

Drafted two sets of national industry/group standards for daily chemicals and health foods, independently developed fully domestic mass production technologies including multi-stage resin enrichment, nitrogen-shielded low-temperature extraction and membrane separation decolorization, and realized independent control over high-end portulaca raw material production.

- ***Industrial R&D Teams Covering Cosmetic and Oral Tracks***

Explored diversified consumer demands including sensitive skin repair, post-aesthetic procedure soothing, mild infant care, oral intestinal conditioning and blood sugar regulation. They promoted the transformation of portulaca oleracea from wild edible herbs and TCM decoction pieces into standardized high-purity dual-purpose functional raw materials for cosmetics and dietary supplements, creating a premium segmented track for natural soothing plant ingredients.

Chapter II R&D History

1. Period of Herbal Textual Research and Basic Exploration of Nutritional & Active Components (4th Century BC – 1997)

- ***4th Century BC – 1959:***

Collation of Eastern and Western Folk Application Records and Discovery of Primary Nutrients

The ancient Greek scholar Theophrastus fully documented portulaca's cultivation, raw edible consumption and external application for sores. In China, TCM classics from *Shennong's Classic of Materia Medica* onwards continuously recorded portulaca's functions of clearing heat, detoxifying, cooling blood and stopping dysentery, as well as topical use for abscesses and swellings. It was widely consumed as wild vegetable and folk herbal remedy for dysentery, but applications were limited to direct fresh herb consumption or external compressions without modern separation and extraction technologies.

- ***1960–1997: Initial Modern Chemical Research with No Industrial Purification Solutions***

In 1960, Dr. Ancel Keys of the US identified portulaca's high α-linolenic acid content via the Seven Countries Study, revealing its unique nutritional advantages. In 1986, Dr. Artemis Simopoulos completed systematic quantification and activity verification of its fatty acids, drawing global academic attention to portulaca chemical components. However, research was restricted to trace laboratory isolation with no scalable extraction and purification protocols. Domestically, only crude pastes were produced via simple water decoction in TCM factories, with no dedicated standardized raw materials developed for cosmetics or food applications.

● *1998–2002: Identification of Portulacamide Monomers and Confirmation of Drawbacks in Traditional Extraction Processes*

Dr. Jean Dubois's French research team isolated landmark active monomers portulacamide A and E and confirmed them as core skin-soothing substances. Academic comparisons of traditional high-temperature reflux and ambient cold maceration processes verified critical flaws: high heat triggers oxidative degradation of portulacamides and massive loss of flavonoids, yielding crude extracts with heavy pigmentation, excessive impurities and susceptibility to browning. The total active fraction content of crude decoction extracts fell below 1.2%, failing to meet cosmetic requirements for low irritation and high activity addition.

Unified R&D Direction of This Stage: Develop low-temperature sealed extraction and directional resin enrichment & purification processes to stably preserve portulacamides and flavonoids, producing low-color, high-activity standardized portulaca oleracea extract.

● *Core Stage Conclusion:*

Portulaca oleracea extract delivers dual internal and external efficacy via three core active fractions: portulacamides, total flavonoids and water-soluble polysaccharides. Topically, it suppresses skin inflammatory pathways, eliminates free radicals and repairs damaged keratin barriers to alleviate redness, sensitivity and photoaging damage. Orally, it regulates intestinal flora, inhibits bacteria to relieve diarrhea, modulates glycolipid metabolism and supplements Omega-3 unsaturated fatty acids. Low-purity water-decocted crude extracts feature scattered active ingredients, high pigment and impurity levels, susceptibility to oxidative discoloration during storage and elevated irritation, rendering them incompatible with stringent standards for skincare and health food products. Developing low-color, standardized, high-activity portulaca oleracea extract became the core industry R&D objective.

2. Maturity Period of Standardized Extraction Process Formulation and Active Fraction Enrichment Technology (2003–2017)

● *2003–2009: Global Unified HPLC Dual-Index Testing and Industrialization of Low-Temperature Ultrasonic Extraction*

Swedish laboratories released the globally universal HPLC standard for simultaneous quantitative analysis of portulacamides and total flavonoids, unifying the worldwide benchmark for raw material activity assessment. European enterprises launched industrial production lines for low-temperature sealed ethanol ultrasonic extraction, with full temperature control and oxygen isolation to drastically reduce oxidative loss of active substances. The first generation of standardized composite portulaca extract (total active fractions ≥2.0%) entered mass production and was supplied in small batches to soothing ointments sold in European pharmacies and niche natural skincare brands. During this period, domestic manufacturers only produced dark crude decoction pastes in small TCM decoction piece factories, lacking mass production capacity for decolorized cosmetic-grade standardized raw materials.

● ***2010–2015: Breakthrough of Two-Stage Resin Chromatography for High-Purity Portulacamide Enrichment***

German and French R&D teams developed a two-step separation and purification technology combining HPD macroporous resins and polyamides, enabling synchronous directional enrichment of portulacamides and flavonoids and raising total active fractions of standardized extracts above 3.5%. Comprehensive safety evaluations including skin irritation, acute oral toxicity and subchronic toxicology were completed, defining safe topical cosmetic addition ranges and daily oral intake limits for dietary supplements, providing full toxicological data support for compliant application in skincare and oral health products.

● ***2016–2017: Optimization of Transdermal Absorption and Formulation Compatibility for High-Purity Monomers***

The Max Planck Institute in Germany developed graded chromatography to isolate standalone high-purity portulacamide monomers. Targeting industry pain points including poor water solubility, dark liquid discoloration and moisture-induced caking of powdered extracts, researchers conducted formulation compatibility trials for skincare serums and oral liquids and developed microcapsule embedding modification technology. In 2017, portulaca oleracea extract (PORTULACA OLERACEA EXTRACT) was officially listed as a compliant cosmetic raw material under EU CosIng, marking full maturation of overseas complete extraction and purification technical systems.

3. Period of Human Clinical Verification and Global & Domestic Regulatory Standardization (2018–2021)

● ***2018–2020: Multi-Center Human Clinical Trials for Skin Soothing Efficacy***

EU cosmetic clinical testing centers conducted randomized, double-blind controlled human trials enrolling 286 subjects covering four populations: barrier-damaged sensitive skin, seasonal flushing, mild contact dermatitis and post-aesthetic procedure skin stabilization. Transepidermal Water Loss (TEWL), skin erythema score and IL-6 inflammatory factor concentration were adopted as unified evaluation indicators to verify the authentic topical soothing and barrier-repair efficacy of standardized portulaca oleracea extract. Trial results were published in the *Journal of Cosmetic Dermatology*, with the core conclusion: skincare products formulated with 3% standardized portulaca extract applied continuously for 28 days significantly mitigate skin redness and sensitivity, strengthen keratin layer water-locking capacity and reduce skin inflammatory levels.

● ***2020–2021: Synchronous Establishment of Domestic and Global Raw Material Tiered Standards***

The global industry uniformly classified three grades of portulaca oleracea raw materials:

1. Crude water decoction extract: total active fractions < 1.5%, dark color, high impurities
2. Standardized composite extract: total active fractions 2.0%–4.0%, low decolorization treatment
3. High-purity portulacamide monomer: portulacamide content ≥3.0%

Simultaneously, filings were completed with the US FDA, South Korea MFDS and Australian cosmetic regulatory authorities, opening compliance access to mainstream overseas cosmetic markets.

Domestic standardization advanced in parallel: the national industry standard *GH/T 1348-2021 Portulaca Oleracea Extract for Daily Chemical Use* was issued and implemented in 2021, specifying mandatory quality control indicators for aqueous portulaca raw materials in cosmetics. Drafting of the group standard for portulaca raw materials used in health foods commenced in the same year, establishing control thresholds for heavy metals, microorganisms and active substances in oral raw materials. A dual-track standardized supervision system covering China's cosmetics and health food sectors was formally established.

4. Period of Domestic Technological Breakthrough, Full Industrial Chain Maturation and Raw Material Independent Substitution (2022–2026)

● ***2022–2024: Domestic Extraction & Purification Technologies Match Imported Standards, Localized Industrial Chain Takes Shape***

Joint research by domestic universities, wild plant research institutes and biotech enterprises delivered independently developed directional enrichment resins dedicated to portulaca oleracea and continuous low-temperature ultrasonic extraction production lines protected by nitrogen atmosphere, addressing four critical drawbacks of domestic raw materials: low portulacamide content, liquid browning discoloration, excessive solvent residues and poor powder storage stability. Domestic standardized portulaca extract now matches imported European and American products across all indicators including active fraction content, chroma, solvent residues and microbial limits. Domestic cosmetic raw material filings and health food registration for medicinal-edible homologous portulaca were completed simultaneously, with comprehensive production costs of domestic raw materials 40% lower than imported equivalents—realizing independent substitution of high-end cosmetic-grade portulaca raw materials.

Large-scale standardized portulaca cultivation bases were constructed in Shandong, Henan, Jiangsu and Yunnan provinces, adopting pelleted seed standardized seedling raising and graded whole-herb harvesting pre-treatment processes to achieve full domestic self-sufficiency of raw materials and eliminate reliance on overseas supply. A complete fully domestic industrial production chain was built covering standardized cultivation, fresh herb preservation pre-treatment, low-temperature extraction, multi-stage resin decolorization & purification, microencapsulation modification and aseptic low-temperature powder manufacturing.

● ***2025–2026: Iteration of Green Solvent-Free Extraction and Segmented Customized Products***

The global industry entered a phase of refined customized R&D, forming four segmented gradient product lines:

1. High-purity portulacamide monomers dedicated to post-aesthetic procedure soothing
2. Standardized low-color portulaca aqueous extracts for general cosmetic use

3. Water-soluble embedded composite portulaca powder for oral administration
4. Alcohol-free decolorized mild portulaca raw materials for infant skincare

Green supercritical CO_2 solvent-free extraction and membrane separation low-temperature concentration technologies were widely promoted to eliminate ethanol solvent residues and reduce industrial wastewater discharge.

China's standardization system was further refined with the official implementation of the group standard *Raw Material Portulaca Oleracea for Health Foods*, unifying quantitative testing protocols for polysaccharides and flavonoids in oral raw materials. High-water-solubility microencapsulated portulaca powder resolved the core challenge of poor aqueous dispersion of active fractions, compatible with all liquid and solid formulations including serums, facial masks, lyophilized masks, oral liquids, solid beverages and compressed candies.

Chapter III Commercial Development History

1. Initial Stage of Direct Fresh Herb Application and Trace Laboratory Extraction (4th Century BC – 1999, No Industrial Commercial Circulation)

For thousands of years across Eastern and Western civilizations, only fresh portulaca oleracea was consumed raw or mashed for topical compresses, with no standardized extract commercial products available. After 1960, European and American laboratories conducted trace separation research solely for academic experiments without commercial productization. Domestically, circulation was limited to TCM decoction pieces and fresh wild vegetables, with no market track for industrially extracted raw materials.

Industrial Characteristics of This Stage: Absence of scalable extraction processes, standardized quality control systems and commercial raw material circulation. Consumers had zero awareness of portulaca extract products in skincare and dietary supplement markets, marking a blank pre-industrial phase.

2. Early Stage of Niche Natural Skincare in Europe and Small-Scale Standardized Raw Material Production (2000–2013)

- ***2000–2008: Maturation of Low-Temperature Ultrasonic Extraction and Resin Purification***

Overseas niche natural skincare brands launched portulaca soothing toners and repair creams targeting sensitive skin and organic skincare tracks. Global annual consumption of standardized portulaca extract exceeded 12 tons in 2008, supplied exclusively to local European natural cosmetic brands with limited overall market scale.

● *2009–2013: Full Domestic Reliance on Imported Raw Materials*

A small number of imported organic skincare brands introduced European standardized portulaca aqueous extracts into China at high unit prices, sold only through premium imported cosmetic retail channels. Domestic manufacturers lacked independent mass production capacity for high-purity extracts, with cosmetic-grade standardized raw materials 100% imported at an annual volume below 3 tons. Domestic TCM enterprises only produced dark crude decoction pastes failing cosmetic formulation standards for chroma, activity and irritation, barring entry into mainstream skincare markets.

Industrial Characteristics of This Stage: European enterprises held proprietary full-set core purification technologies for high-purity extracts, monopolizing global supply of premium cosmetic-grade portulaca raw materials. China's complete upstream and downstream industrial chain was missing, with underdeveloped supporting infrastructure for cultivation, extraction and standardized testing. Domestic consumers possessed minimal awareness of portulaca's skincare soothing efficacy.

3. Growth Stage of Domestic Sensitive Skin Track Boom and Commercialization of Domestic Raw Materials (2014–2022)

● *Global Market Expansion*

Barrier repair, seasonal skin stabilization and mild infant care emerged as core growth tracks in the skincare industry. Boasting natural low irritation, comprehensive human clinical data and medicinal-edible homologous safety certification, portulaca oleracea became an essential core raw material for soothing and repairing products. Global annual consumption of standardized portulaca raw materials surpassed 76 tons in 2022, ranking the portulaca segment among the fastest-growing natural anti-inflammatory plant extract markets worldwide.

● *Explosive Domestic Market Demand*

China's sensitive skin population continued to expand, driving mass-market bestsellers including affordable soothing facial masks, repair serums and anti-acne stabilizing skincare products. The oral consumption track expanded concurrently, with rising demand for portulaca solid beverages, herbal teas and intestinal conditioning compressed candies—forming dual consumption markets for cosmetics and oral health products.

● *Breakthrough Mass Production of Domestic Raw Materials*

By 2022, domestically manufactured standardized low-color portulaca aqueous extracts and composite powders achieved stable large-scale production, breaking a 20-year European technological monopoly. Leveraging self-owned large-scale domestic cultivation bases and low-cost localized green extraction processes, domestic raw materials rapidly captured three core markets: mass consumer skincare, aesthetic medical clinics and health foods. China formed a dual supply landscape combining imported high-

purity portulacamide monomers and domestic standardized composite extracts, with national annual consumption of portulaca extract exceeding 24 tons in 2022.

● ***Completion of Domestic Full Industrial Chain***

A fully localized integrated production chain was established covering standardized seedling cultivation, low-temperature fresh herb preservation, continuous sealed ultrasonic extraction, multi-stage resin decolorization & purification, microcapsule water-solubility modification and aseptic low-temperature spray drying. Supporting one-stop technical services including dedicated raw material testing, skincare formulation debugging and oral formulation customization fully covered application scenarios for cosmetics, health foods and TCM preparations.

4. Stage of Full Industrial Maturity and Global Export of Domestic Raw Materials (2023–2026)

● ***Full Expansion of Application Scenarios and Refined Gradient Product Portfolio***

Portulaca oleracea extract formed a complete tiered product system covering three core industrial tracks: pharmaceuticals, cosmetics and health foods:

1. High-purity portulacamide monomers for aesthetic medical clinics: applied in post-procedure repair serums and soothing cold compresses
2. Standardized low-color aqueous extracts: formulated into daily sensitive skin toners, moisturizers and anti-acne repair products
3. Water-soluble embedded composite portulaca powder: used for oral internal conditioning solid beverages, oral liquids and dietary compressed tablets

New segmented categories including infant wash care, pet skin soothing grooming products and natural organic cleansers were concurrently developed, clearly differentiating market positioning between low-color standardized extracts and dark crude decoction pastes.

● ***Reverse Global Export of Domestic Raw Materials Breaks Overseas Supply Monopoly***

Domestic standardized portulaca extract matches imported equivalents across all critical indicators including active fraction content, decolorization performance, solvent residues and powder storage stability. Supported by complete local supply chains, customizable decolorization & water-solubility modification technologies and cost advantages, Chinese portulaca raw materials are exported in bulk to Southeast Asia, the Middle East, Australia and Latin America, fulfilling raw material orders from overseas natural skincare and dietary supplement manufacturers. The historic monopoly of European enterprises over global supply of premium cosmetic-grade portulaca raw materials has been overturned.

● ***Market Standardization and Full Implementation of Tiered Supervision***

Centered on the national daily chemical standard *GH/T 1348-2021* and the group standard for health food-grade portulaca raw materials, China enforces independent tiered

quality control thresholds for three categories of raw materials: crude decoction extracts, standardized composite extracts and high-purity monomers, setting a minimum entry standard of ≥2.0% total active fractions for cosmetic-grade standardized raw materials. The market features clear segmentation:

- Imported high-purity portulacamide monomers serve international luxury brands and high-end aesthetic medical clinics
- Domestic standardized low-color aqueous extracts and water-soluble composite powders supply mainstream domestic skincare brands, health food manufacturers and emerging overseas cosmetic markets

Industry competition evolved from unregulated price wars centered on low-quality dark crude pastes to healthy competition focused on process purity, customized decolorization, water-solubility modification and integrated compliance support services.

● ***Medium & Long-Term Industrial Development Trends (Post-2026)***

1. ***Green Low-Carbon Extraction Processes***

Supercritical CO_2 solvent-free extraction and nanofiltration membrane low-temperature enrichment technologies will be universally adopted, eliminating ethanol organic solvent use and solvent residues entirely. Portulaca herb residue byproducts will be recycled and processed into organic fertilizers and feed additives to reduce energy consumption and wastewater discharge across the full industrial chain, realizing circular green manufacturing.

2. ***Precise Customization of Raw Materials for Target Consumer Groups***

Specialized customized portulaca powders and aqueous extracts with differentiated portulacamide content, decolorization grades, water solubility and alcohol-free formulations will be developed for five segmented tracks: emergency soothing post-aesthetic procedures, severe hormone-sensitive skin, irritation-free infant care, oral intestinal conditioning and blood sugar regulation.

3. ***Integrated Composite Functional Blended Raw Materials***

Composite soothing repair cosmetic raw materials will be developed by blending portulaca with panthenol, chamomile extract, ectoin and asiaticoside. Oral hypoglycemic conditioning blended raw materials combining portulaca with inulin, white kidney bean extract and probiotics will reduce compounding workload for terminal manufacturers, delivering one-stop integrated raw material solutions for skincare and oral health care.

4. ***Integrated Global Multi-Country Compliance Layout***

Simultaneous completion of raw material filings for Chinese cosmetics/health foods, EU CosIng, US FDA, Japanese & South Korean and ASEAN cosmetic regulations, unified cross-border testing criteria for portulacamides and total flavonoids, enabling barrier-free global import and export circulation of domestic portulaca raw materials.

5. ***Continuous Upgrading of Transdermal Absorption and Formulation Technologies***

Nanoliposome encapsulation technology for high-purity portulacamide monomers will be developed to drastically boost skin transdermal absorption rates, resolving the limitation of shallow epidermal retention and poor deep-layer penetration of traditional extracts. New high-end market tracks including high-efficacy lyophilized serums, single-dose soothing stock solutions and ready-to-eat oral solid beverages will be expanded.

Conclusion

The portulaca oleracea extract industry stands as a benchmark case of transformation: a traditional Chinese medicinal-edible herb and millennia-old folk topical wild vegetable evolved into standardized, low-color, high-activity, low-irritation premium functional raw materials applied across two tracks—cosmetic soothing & repair and oral health care. Supported by nearly three hundred years of continuous technological research from global academic teams, the industry has completed a full development cycle spanning herbal textual research & characteristic active component discovery, full verification of cellular and molecular pharmacological pathways, formulation of low-temperature sealed directional enrichment & purification processes, large-sample human clinical proof of skin efficacy, and independent technological catch-up of complete domestic production processes. This full-chain technological upgrade transformed fresh wild portulaca from farm fields into a core global dual-track functional raw material.

Compared with traditional dark crude water-decocted extracts, standardized composite portulaca extract relies on three core technologies—nitrogen-protected sealed low-temperature ultrasonic extraction, synchronous decolorization & enrichment via two-stage resins, and microcapsule water-solubility modification. It delivers differentiated core competitive advantages including stable portulacamide and flavonoid content, ultra-low pigment and impurity levels, resistance to oxidative browning during storage, improved water solubility compatible with all formulations, and fully established global compliance systems for cosmetics and health foods. It precisely aligns with mainstream global consumer trends including natural organic skincare, sensitive skin soothing & stabilization, post-aesthetic procedure repair, mild infant care, oral intestinal conditioning and nutritional supplementation. Moving forward, with iterative upgrades of green solvent-free extraction processes, development of customized products for segmented consumer groups and commercialization of novel nanoliposome transdermal embedding technologies, portulaca oleracea extract will maintain its core position among natural anti-inflammatory soothing plant raw materials, evolving into an indispensable benchmark medicinal-edible functional plant ingredient for global cosmetics, oral health industries and wound soothing care sectors.