Milk Thistle Extract: Competitive Advantages and Future Development Outlook

As a natural liver-protective raw material with silymarin as its core active ingredient, milk thistle extract has forged a fully integrated industrial ecosystem spanning raw material cultivation, advanced processing, and end-use applications after decades of intensive industrial development. Against the backdrop of the continuously expanding global demand for liver health (the global liver health market exceeded $320 billion in 2024) and the rising penetration rate of natural functional ingredients, China's milk thistle extract industry accounts for over 92% of the global raw material supply by virtue of its resource endowments, technological iteration, and fully integrated industrial chain supporting capabilities. The industry is accelerating its transformation from a "major raw material exporter" to a "powerhouse of high-value-added products". This report systematically dissects the core competitive barriers of China's milk thistle extract industry, with a focused analysis of its future development pathways and an enhanced data-driven perspective on market expansion, aiming to provide a professional and practical reference for the high-quality layout of the industry.

I. Core Competitive Advantages of China's Milk Thistle Extract

1.1 Raw Material Supply: Irreplaceable Resource Endowments and Large-Scale Supply Chain Support

China has built an uncopyable competitive barrier in the raw material segment of milk thistle, driven by the dual enablers of ecological adaptability and standardized, large-scale cultivation layout. Milk thistle has stringent climatic growth requirements, thriving in arid and semi-arid regions with an annual sunshine duration of ≥2,800 hours and a day-night temperature difference of ≥12℃. Northwestern production regions such as Yili in Xinjiang, Jiuquan in Gansu, and Chifeng in Inner Mongolia are naturally suited to its growth, contributing a combined 87.3% of the national output and forming a geographically concentrated supply pattern that constitutes a natural resource barrier.

Notably, the Yili production base in Xinjiang, boasting an annual sunshine duration of over 3,200 hours and a day-night temperature difference of around 18℃, produces milk thistle seeds with an average silybin content of 2.3%-2.8%—more than 27% higher than the international average of 1.8%-2.2%—laying a high-quality raw material foundation for the mass production of high-purity milk thistle extract.

After more than 30 years of technological cultivation and industrial accumulation, China has developed a mature raw material supply system featuring **germplasm optimization, standardized cultivation, and intensive primary processing**. Research institutions including the Liaoning Academy of Agricultural Sciences and Jilin Agricultural University have collaborated with leading enterprises to breed high-yield, high-activity proprietary varieties such as "Jiyou No.1" and "Mengji No.2", achieving a per-mu yield of 120-150 kg, over 30% higher than ordinary varieties. In 2023, the national cultivation area reached 12,400 hectares, with an annual raw material supply of approximately 23,000 tons, meeting over 95% of the global production demand.

Leading enterprises implement a standardized full-process control of raw materials through the "enterprise + cooperative + grower" order-based model. Their self-owned bases have managed to cap the fluctuation of raw material costs within 15%, significantly outperforming the 41% price volatility in the international market, thus ensuring supply chain stability and cost competitiveness.

1.2 Technological and Process Advantages: Multi-path Iteration and Optimal Cost-Performance Balance

China's milk thistle extraction technologies have formed a diversified technical matrix, gradually surpassing international peers in core indicators and building a technological moat. The mainstream technologies cover traditional solvent extraction, ultrasonic-assisted extraction, supercritical CO_2 extraction, and macroporous resin purification integration technology, each tailored to meet the demands of different market tiers:

- **Macroporous resin purification integration technology**: The mainstream technology for the mid-to-high-end market, achieving a stable silybin recovery rate of 92.4% with a comprehensive cost of RMB 1,180 per kg and a product purity of 85%-90%. A leading enterprise in Jiangsu reduced its unit cost by 17% after adopting this technology and now holds over 35% of the global orders for this product category.
- **Ultrasonic-assisted extraction technology**: Boosting extraction efficiency by 11.8 percentage points and shortening the production cycle by 62.5% compared with traditional processes. It controls the cost of 80% purity products at RMB 1,260 per kg with a market penetration rate of 42%, well-suited for the raw material demands of China's health food and cosmetics industries.
- **Supercritical CO_2 extraction technology**: The representative of high-end extraction processes, yielding products with a purity of ≥95% and solvent residue ≤5 ppm, fully complying with the pharmacopoeial standards of Europe and the United States. Nine domestic enterprises have realized its large-scale application; the export value of products using this technology reached $472 million in 2024, accounting for 61.8% of the total export volume, with a unit price 2-3 times higher than conventional products.

Simultaneous breakthroughs have been made in formulation technology innovation: microencapsulation technology can increase the bioavailability of silymarin by 2.3 times, and silybin phospholipid complexes can improve bioavailability by 40%-60%. These innovations have broken the technological monopoly of overseas enterprises in high-end formulations and provided strong product support for market expansion.

1.3 Industrial Chain Layout: Vertical Integration and Industrial Cluster Effect

China has formed a fully integrated industrial chain layout of **"cultivation in the northwest, advanced processing in coastal areas, and global distribution"**, with a prominent industrial cluster effect. Xinjiang and Gansu contribute over 60% of the national raw material supply and account for 48% of the crude extraction capacity. Panjin in Liaoning and Nantong in Jiangsu have agglomerated 56 upstream and downstream enterprises, undertaking over 85% of international orders; the Panjin Industrial Park alone achieves an annual output value of over RMB 8 billion. The fully integrated industrial supporting system enables the supply of a full range of products with a purity from

30% to 98%. The delivery cycle is over 30% shorter than that of overseas competitors, and customized R&D is supported, significantly enhancing customer stickiness.

1.4 Compliance and Market Adaptability: Multi-scenario Coverage and Breakthroughs in International Certification

China has established a dual compliance system for milk thistle extract. To date, 12 domestic enterprises have obtained the US FDA New Dietary Ingredient (NDI) certification, and 8 have passed the EU GMP certification. The export value of China's milk thistle extract reached $765 million in 2023, a year-on-year increase of 23.7%.

Enterprises have adopted a precisely differentiated market strategy: focusing on raw materials with a purity of ≥90% for the European and American markets, and developing scenario-specific health products for the domestic market. The online e-commerce sales of milk thistle products have maintained a year-on-year growth rate of over 25% for three consecutive years, with top-selling SKUs achieving monthly sales of over 100,000 units, demonstrating a significant channel advantage.

II. Current Industry Challenges and Constraints

Despite the remarkable competitive advantages, the China's milk thistle extract industry still faces structural bottlenecks that restrict its value release and high-end transformation:

1. **Raw material quality instability**: The mold rate of raw materials exceeds 7.2% and the coefficient of variation in active ingredient content reaches 14.7%, far exceeding the international industry standard of 5%.
2. **Imbalanced value distribution**: The average export price of primary extracts is $28 per kg, only 1/5 to 1/7 of that of international terminal formulations, with core profits seized by overseas brands and distributors.
3. **Technological gap in high-end formulations**: The bioavailability of domestic high-end formulations is over 30% lower than the international level due to generational technological gaps.
4. **Non-unified standards and cumbersome approval processes**: There is no unified national standard for milk thistle extract in China, leading to a low industry entry threshold. The approval cycle for health food products is 2-3 years with high costs, and only 15 milk thistle-containing health food products have been approved to date, severely restricting the expansion of the domestic terminal market.

III. Future Development Outlook and Breakthrough Pathways

3.1 Technological Innovation:

Consolidating the Core Barrier for High-Value-Added Products

Technological iteration will drive product upgrading and build a differentiated competitive advantage, with R&D focused on three key directions:

- **Intelligent upgrading of extraction processes**: Promote the AI+PAT (Process Analytical Technology)

intelligent transformation of extraction lines, optimize process parameters to reduce comprehensive energy consumption by more than 20% and raise the batch consistency qualification rate to 99.9%. Break through the preparation technology of silybin with a purity of over 98.5% and reduce its production cost by 15%-20% through continuous chromatographic separation technology.

- **Innovation in high-end formulation technology**: Focus on targeted delivery systems such as pH-responsive nano-liposomes and metal-organic framework (MOFs) carriers, expanding the clinical application of silymarin in adjuvant liver cancer therapy and other fields. Develop compound formulations: piperine can inhibit the activity of liver metabolic enzymes of silybin, increasing its oral bioavailability by 146%-181%, which will become an innovation hotspot in the health food and pharmaceutical sectors.
- **Synthetic biology breakthroughs**: Accelerate the industrialization of heterologous expression of key enzymes for silymarin synthesis. It is expected to achieve a breakthrough in the microbial synthesis of silymarin in the next 5-10 years, breaking the dependence on raw material cultivation and reconstructing the industrial cost structure.

3.2 Industrial Chain Upgrading:

From Scale Expansion to In-Depth Value Extension

The industrial chain upgrading will focus on upstream germplasm improvement, midstream industrial integration, and downstream terminal product development, realizing the transformation from scale-driven growth to value-driven development:

- **Upstream**: Strengthen germplasm innovation and standardized base construction. Breed superior varieties with silybin content stably above 2.8% through biological breeding technology; equip bases with low-temperature drying and cold chain storage facilities to control the mold rate below 3%; establish backup cultivation bases in Qinghai and Ningxia to reduce climate-related supply risks.
- **Midstream**: Promote intensive industrial integration. Eliminate inefficient and high-pollution production capacity by virtue of environmental protection policies; it is expected that the market share of the top 5 enterprises (CR5) will rise to 45% by 2027, forming an industrial pattern of "leading enterprises driving development and small and medium-sized enterprises providing supporting services".
- **Downstream**: Accelerate the transformation to terminal product manufacturing. Develop "snack-style" dosage forms such as liver-protective gummies and oral drops to cater to the consumption habits of young groups; expand emerging application scenarios including pet health care and functional beverages. If milk thistle is included in the national list of food and medicinal materials, the domestic market scale is expected to expand from the current RMB 3.56 billion to over RMB 30 billion, opening up a huge growth space.

3.3 Market Expansion:

Dual-Drive to Build a Global Market Pattern (Data-Enhanced Version)

Adopt a **"domestic deep cultivation + international breakthrough"** dual-drive strategy, improve market penetration and brand premium through data-driven layout, with clear quantitative goals for both domestic and

international markets:

3.3.1 Domestic Market: Deep Cultivation of Segmented Scenarios to Activate Incremental Demand

Focus on the upgrading trend of domestic liver health demand, accurately cover core consumer groups, and build an omni-channel sales network to drive steady market growth:

- **Scenario-specific product development**: Target the 260 million people with irregular work schedules, 490 million drinking population, and 120 million fatty liver patients; develop scenario-specific products such as night-shift liver-protective tablets and hangover relief oral liquids. The annual growth rate of this segmented track is expected to reach 18%-22%, and the market share of liver-protective health products containing milk thistle is targeted to exceed 15% by 2027.
- **Omni-channel integration**: Deepen the integration of online and offline channels. Layout content e-commerce on Douyin and Tmall with a target annual growth rate of over 35% for live streaming GMV, and raise the online channel share to 40% by 2026; penetrate the top 100 chain pharmacies with over 20,000 cooperative offline stores to build a comprehensive channel coverage network.
- **Market scale forecast**: The domestic market scale of milk thistle extract and its terminal products is expected to exceed RMB 4.8 billion by 2027 and reach RMB 6.2 billion by 2030, maintaining a compound annual growth rate (CAGR) of 11.2%-13.5%.

3.3.2 International Market: High-End Breakthrough and Emerging Market Expansion to Expand Global Share

Implement a differentiated international market strategy, focusing on high-value-added products for European and American markets and cost-effective products for emerging markets, while enhancing the industry's international discourse power:

- **European and American high-end markets**: Expand the export of products produced by supercritical CO_2 extraction technology, targeting to raise its export value share from 61.8% to 70% by 2025. Focus on the raw material supply for prescription drugs and high-end health products, maintaining a unit price 2-3 times that of conventional products. The revenue from the European and American markets is expected to exceed $1.2 billion by 2027.
- **Emerging markets**: Prioritize the development of Southeast Asia, Africa, and Latin America. Launch cost-effective products tailored to local consumption capacity; leverage the RCEP tariff advantages to achieve an export volume of 12,000 tons to Southeast Asia by 2026, accounting for 28% of the total export volume. Enter the African and Latin American markets through OEM/ODM cooperation and gradually build localized distribution channels, with an expected annual growth rate of 25%-30%. Emerging markets are targeted to contribute over 35% of the total revenue by 2030.
- **Brand and standard internationalization**: Promote 2-3 domestic technical standards to become international reference standards by 2028 to enhance the industry's international discourse power; shorten the R&D cycle of high-end formulations through overseas mergers and acquisitions and the establishment

of European R&D centers. The export share of terminal formulations is targeted to rise from the current 5% to 20% by 2030, completing the transformation from a "raw material supplier" to a **"global liver health solution provider"**, and raising the global market share from 92% to over 95%.

3.4 Policy and Compliance Support:

Leveraging Policy Dividends for Standardized Development

Seize the policy dividends of traditional Chinese medicine modernization and green manufacturing to optimize the policy and compliance environment for the industry, providing a solid guarantee for market expansion and industrial upgrading:

1. **Optimize policy access**: Promote the inclusion of milk thistle in the national list of food and medicinal materials, simplify the approval process for its application in ordinary food, and reduce the R&D and innovation costs of enterprises.
2. **Establish unified industry standards**: Accelerate the formulation of a unified national standard for milk thistle extract, clarify key indicators such as active ingredient content, impurity control, and heavy metal limits, and set a clear industry entry threshold to eliminate low-quality and inefficient production capacity and standardize market competition order.
3. **Promote green and low-carbon development**: Popularize green technologies such as enzyme-ultrasonic combined extraction and wastewater recycling to reduce wastewater and waste residue emissions and drive the industry's green and low-carbon transformation.
4. **Strengthen quality supervision and traceability**: Establish a quality traceability system for export products, strengthen the supervision of export products through customs and commodity inspection, and improve the reputation and credibility of China's milk thistle extract in the international market.

IV. Conclusion

China's milk thistle extract industry is in a critical period of transformation from **"scale advantage" to "value advantage"**. Relying on the comprehensive advantages of the whole industrial chain, China has established its core position in the global milk thistle extract industry. In the future, driven by technological innovation, supported by industrial chain upgrading, and boosted by market expansion and policy dividends, the industry will realize a leap from scale-driven growth to value-driven development.

The domestic market scale is expected to exceed RMB 6.2 billion by 2030 with a global market share of over 95%, and the proportion of high-value-added products such as high-purity raw materials and terminal formulations will increase significantly. For enterprises in the industry, focusing on high-value-added links, overcoming core technological bottlenecks, deep cultivating global segmented markets, and strengthening supply chain risk control and compliance system construction are the key to achieving the transformation from a "major raw material exporter" to a "global powerhouse of liver health products".

China's milk thistle extract industry is poised to release greater application value in the pharmaceutical, health food, and cosmetics sectors, and provide natural, efficient, and sustainable solutions for the global liver health industry.