Competitive Advantages and Future Market Development Prospects of White Kidney Bean Extract

White Kidney Bean Extract is a standardized functional raw material produced from edible white kidney beans through physical separation, green extraction, and purification processes, which enriches the core active ingredient α-amylase inhibitor. It is widely used in health supplements, functional foods, dietary supplements, foods for special medical purposes, and light medical aesthetics.

As a benchmark product of natural functional ingredients with homology of medicine and food, it has rapidly emerged based on the two rigid demand sectors of weight management and blood glucose regulation. Its competitive advantages cover all dimensions including raw material resources, technology and processes, efficacy and application, industrial policies, and quality standards. Relying on the upgrading of health consumption, expanding population demand, and technological iteration, it will achieve high-quality growth in the future and become a highly competitive core category in the field of natural fat-reducing and glucose-controlling products.

I. Core Competitive Advantages: Building an Industrial Moat through Multi-dimensional Barriers

(I) Resource and Raw Material Advantages: Stable Supply and Controllable Quality

White kidney beans have a long planting history and a wide distribution in China, with sufficient raw material supply and a foundation of large-scale cultivation, forming a stable raw material supply system that does not rely on imports, effectively avoiding risks of supply disruption and price surges. The core producing areas of white kidney beans in China are concentrated in Yunnan, Guizhou, Sichuan, Jilin, Heilongjiang and other regions, mostly planted in plateau mountainous areas and black soil regions with an excellent ecological environment and low application of pesticides and chemical fertilizers, conforming to green and healthy raw material standards.

In 2024, the national planting area of white kidney beans exceeded 1.86 million mu with an annual output of over 400,000 tons, among which the two major producing areas of Yunnan and Guizhou accounted for more than 70% of the output. The raw materials are of outstanding quality with stable content of the core active ingredient α-amylase inhibitor, far higher than that in ordinary producing areas. Leading enterprises in the industry have established GAP standardized planting bases, implemented unified breeding, standardized cultivation, scheduled harvesting and centralized processing, and strictly controlled heavy metals, pesticide residues and microbial indicators to ensure raw material purity and activity from the source. Meanwhile, white kidney beans can be comprehensively utilized, with bean stalks

and residues processed into feed and organic fertilizers, realizing resource recycling, reducing comprehensive production costs and enhancing the profitability of the industrial chain.

(II) Technology and Process Advantages: Full-chain Upgrading and Differentiated Quality

The industry has formed a mature system integrating traditional extraction processes and modern green technologies. Leading enterprises have built profound barriers relying on patented technologies, achieving overall leadership in product purity, activity and stability. Mainstream processes have gradually upgraded from traditional water extraction and alcohol extraction to green technologies such as low-temperature countercurrent extraction, supercritical CO_2 extraction, combined enzymatic hydrolysis-membrane separation, and microwave-assisted extraction. The extraction efficiency has increased by more than 40%, the retention rate of active ingredients has been greatly improved, and solvent residues are close to zero, complying with environmental protection production and food safety requirements.

In the purification stage, high-speed countercurrent chromatography and preparative high-performance liquid chromatography have achieved industrial application. The active ingredient content of food-grade white kidney bean extract is stable at above 2.5%, and the purity of pharmaceutical-grade products can reach over 98%, with batch differences controlled within a minimal range. Aiming at the pain points of easy inactivation of active ingredients and low bioavailability, stabilization technologies such as microcapsule embedding and nano-encapsulation are widely applied, extending the shelf life of products at room temperature to more than 24 months and broadening application scenarios. Some enterprises have laid out research and development in synthetic biology, overcoming the biosynthesis technology of α-amylase inhibitor, which is expected to break away from the restrictions of natural raw materials, realize efficient mass production and further reduce the cost of high-end products in the future.

(III) Efficacy and Application Advantages: Precise Targeting and Full Scenario Coverage

The core efficacy of white kidney bean extract has been verified by numerous pharmacological experiments and clinical trials, with a clear mechanism of action, strong targeting, no obvious side effects and wide adaptability to populations. Its core component α-amylase inhibitor can specifically inhibit intestinal amylase activity, block the decomposition of starchy foods such as rice, pasta, tubers and pastries, reduce glucose absorption and calorie intake, assisting weight management and stabilizing postprandial blood glucose, achieving dual effects of fat reduction and glucose control. Clinical data show that high-quality white kidney bean extract can block 50%-65% of starch absorption, reducing 150-200 kcal of calorie intake per single consumption, without affecting the absorption of nutrients such as protein, vitamins and dietary fiber, avoiding problems such as metabolic decline, fatigue and hair loss caused by dieting.

Application scenarios cover all fields, penetrating daily consumption and professional health care scenarios:

- **Dietary supplements**: Made into tablets, capsules, powders, chewable tablets and gummies, focusing on pre-meal carbohydrate blocking, serving as rigid demand products for weight management groups. In 2024, the domestic application proportion in this field reached 58.3%, with e-commerce sales growing rapidly year after year.
- **Functional foods**: Added to meal replacement shakes, low-GI bread, healthy biscuits, sugar-controlling beverages and leisure snacks to create daily healthy foods, conforming to the consumption trend of natural and additive-free products. The market scale was nearly 1 billion yuan in 2024.
- **Pharmaceutical and FSMP fields**: Used for pre-diabetes intervention and auxiliary conditioning of obesity, developing foods for special medical purposes and over-the-counter auxiliary glucose-lowering and fat-reducing products, with steadily increasing market demand.
- **Cosmetics and personal care**: Relying on antioxidant, oil-controlling and soothing effects, applied in oil-controlling skin care products and body care products, conforming to the trend of clean beauty and becoming an emerging growth track.

(IV) Industrial and Policy Advantages: Formed Clusters and Supported Dividends

The domestic white kidney bean extract industry has formed a large-scale cluster effect, with a large number of leading enterprises gathered in Shaanxi, Yunnan, Sichuan and other regions, forming a full-industrial chain layout of "planting base + R&D and extraction + finished product production + channel sales". The industry concentration has continuously improved, with the top five enterprises accounting for over 60% of the market in 2024. Relying on advantages in production capacity, technology and customer resources, leading enterprises lead the standardized development of the industry and eliminate small and medium-sized inferior production capacities.

Continuous favorable policies have been introduced. As a substance with homology of medicine and food, white kidney beans conform to the national development orientation of the great health industry and are included in the support scope of the *Healthy China 2030 Initiative*. The state has continuously standardized industry standards for plant extracts, strictly controlled product quality and promotional compliance, accelerated industry reshuffle and boosted the development of high-quality enterprises. After the entry into force of the RCEP trade agreement, export tariffs have been reduced and trade procedures simplified, promoting domestic white kidney bean extract to enter markets in Southeast Asia, Japan, South Korea, Europe and the United States, broadening market space.

(V) Quality and Standard Advantages: Complete Compliance and Strong Credibility

The industry has established a sound quality control system, taking active ingredient content, heavy metals, solvent residues, microorganisms and moisture as core quality control indicators, and dividing into three grades: food-grade, health supplement-grade and pharmaceutical-grade to meet the needs of different scenarios. Leading enterprises strictly implement national standards, synchronize with international pharmacopoeia standards such as USP (United States Pharmacopeia) and EP (European Pharmacopoeia), strictly control the limits of harmful substances, and the heavy metal residues of pharmaceutical-grade products are far lower than national standard limits.

Mainstream enterprises have obtained authoritative certifications such as GMP, HACCP, ISO22000 and organic product certification, with full-process product traceability and high batch stability. China has gradually taken the lead in improving industry standards for white kidney bean extract, promoting the integration of domestic standards with international standards, enhancing the international voice of domestic products, breaking away from low-price competition, and the average export price of high-end products has increased year by year.

II. Current Market Status: Steady Expansion of Scale and Continuous Optimization of Pattern

(I) Market Scale: Steady Global Growth and Leading Domestic Growth Rate

Globally, the continuous surge in obese and hyperglycemic populations has driven the explosive demand for natural calorie-controlling and glucose-controlling products, and the white kidney bean extract market has maintained steady growth. The global market scale was approximately 178 million US dollars in 2023, and is expected to reach 296 million US dollars by 2030, with a compound annual growth rate of 7.6% from 2024 to 2030.

The domestic market growth rate far exceeds the global level. The market scale reached 1.66 billion yuan in 2023, a year-on-year increase of 9.8%; it rose to 1.87 billion yuan in 2024, up 12.4% year on year; it is expected to exceed 2.1 billion yuan in 2025, with a compound annual growth rate of over 12% from 2025 to 2030. Among them, dietary supplements are the core application scenario, functional foods have the fastest growth rate, and the proportion of pharmaceutical and cosmetic fields continues to rise.

(II) Competitive Pattern: Leading Agglomeration and Hierarchical Competition

The industry presents a pattern of leading concentration and hierarchical competition. Leading enterprises occupy the high-end market and bulk orders relying on full-industrial chain, patented technology and brand advantages, with continuously increasing market share. In 2024, CR5 of the industry exceeded 60%. Leading enterprises such as Chenguang Biotech, Tianbaohua Biotech and Jiahe

Biotech have a production capacity of over 1,000 tons, with products covering high-end markets at home and abroad, and export shares accounting for more than 70%.

Small and medium-sized enterprises focus on segmented tracks, focusing on organic certification, customized purity and niche scenario products to achieve differentiated breakthroughs. Cross-border enterprises continue to enter the market, and food giants, health supplement brands and biotechnology companies cut into the track through cooperation and mergers and acquisitions, intensifying market competition while promoting industrial innovation and upgrading.

(III) Export Pattern: Diversified Markets and Considerable Increment

In 2024, the export value of domestic white kidney bean extract was 530 million yuan, a year-on-year increase of 14.7%, with an export volume of 1,240 tons, mainly exported to developed countries such as the United States, Japan, Germany and South Korea, among which the North American market accounted for nearly 40%. Relying on cost and quality advantages, the competitiveness of domestic white kidney bean extract in the international market continues to strengthen, and demand in emerging markets such as Southeast Asia and Latin America grows rapidly, becoming a new engine for export increment.

III. Future Market Development Prospects (2025-2030)

(I) Technology Development Trends: Greenization, High-endization and Intellectualization

In the future, industrial technology will upgrade towards green efficiency, high-end refinement and intelligent control. Green extraction technologies will fully replace traditional processes, and the popularity of low-pollution and high-activity processes such as supercritical CO_2 extraction and membrane separation will be greatly improved, complying with the dual carbon strategy and environmental protection requirements. The popularization of high-purity monomer preparation and targeted delivery technologies will improve product bioavailability, strengthen efficacy implementation and promote the volume expansion of pharmaceutical-grade and FSMP-grade products.

Synthetic biology technology will achieve industrial breakthroughs, realizing large-scale production of highly active α-amylase inhibitor and reducing raw material dependence and production costs. AI and Internet of Things technologies will be applied to production control, online monitoring of component content and optimization of extraction parameters, realizing intelligent and standardized production, improving product consistency and production efficiency. Leading enterprises will accelerate the construction of intelligent factories, leading the transformation of industrial production models.

(II) Application Scenario Expansion: Refinement, Diversification and Dailyization

Products will extend refinedly from the weight management track to all populations and multiple scenarios, developing customized compound products for segmented groups such as glucose control for the elderly, calorie control for sedentary office workers, postnatal recovery, healthy weight management for children, and glucose control and muscle gain for fitness groups. Product forms will upgrade towards portability and snacking, with the proportion of gummies, ready-to-drink beverages, portable powders and chewable tablets continuously increasing, weakening the health supplement attribute and integrating into daily diet.

Application in catering, takeaway and baking fields will accelerate, launching light meals, staple foods and sauces added with white kidney bean extract to create new categories of healthy catering. Emerging scenarios such as pet health, sports nutrition and precision skin care will gradually land, opening up new incremental markets and further broadening industrial boundaries.

(III) Evolution of Industrial Pattern: Clustering, Globalization and Closed-loopization

The industrial cluster effect will be further released, with coordinated development of raw material bases in Yunnan and Guizhou and processing bases in Shandong and Shaanxi, forming a full-industrial chain closed loop of "raw material cultivation – extraction and purification – finished product processing – by-product utilization". Industry concentration will continue to rise, inferior small and medium-sized production capacities will be cleared rapidly, and leading enterprises will consolidate advantages through patented technologies, brand building and overseas layout, promoting the industry to shift from price competition to value competition.

The globalization process will accelerate, with leading enterprises shifting from raw material export to finished product export, brand output and overseas factory construction, breaking through trade barriers and increasing international market share. China will promote the global dissemination of white kidney bean extract standards, enhance international discourse power, and realize the transformation from "Chinese raw materials" to "Chinese standards and Chinese brands".

(IV) Growth Drivers: Resonance of Demand, Technology and Policy

The global base of overweight, obese and pre-diabetic populations continues to expand, the concept of health consumption is deeply rooted, and natural, side-effect-free functional ingredients have become the preferred choice for consumption, with rigid demand supporting long-term market growth. Health consumption sinks, and demand in third- and fourth-tier cities and county markets releases, opening up incremental space. Technological iteration reduces costs, improves quality, broadens application scenarios and activates potential demand.

The state continues to support the great health industry, standardize industrial development, and relax

policies on substances with homology of medicine and food, helping products enter the common food sector. Trade agreements such as RCEP continue to exert efforts, reducing export costs and expanding overseas markets. Multiple favorable factors overlap to promote the long-term and steady growth of the white kidney bean extract market.

IV. Core Challenges and Countermeasures

(I) Core Challenges

1. **Serious homogeneous competition**: Overcapacity in the low-end and middle-end markets, most small and medium-sized enterprises have low product purity, no patents and no characteristics, falling into vicious low-price competition and compressing industry profit margins.
2. **Raw material fluctuation risks**: Affected by climate, planting area and harvesting standards, the price and quality of white kidney bean raw materials fluctuate, affecting production stability and product consistency.
3. **Strict international barriers**: Europe, the United States, Japan and South Korea have stringent standards for solvent residues, heavy metals and active ingredients of imported plant extracts, with high certification costs and long cycles, restricting exports of small and medium-sized enterprises.
4. **Non-standard efficacy promotion**: Some enterprises exaggerate efficacy and conduct false publicity, triggering consumer trust crises and damaging the overall reputation of the industry.

(II) Countermeasures

1. **Raw material end**: Expand GAP standardized planting bases, implement order agriculture to stabilize raw material supply and quality; establish a raw material classification system, strictly control pesticide residues and heavy metals, and support a traceability system; accelerate the industrialization of synthetic biology to reduce dependence on natural raw materials.
2. **Technology end**: Increase R&D investment, overcome high-purity and high-stability technologies to build patent barriers; develop compound formulas and customized products to avoid homogeneous competition; deepen industry-university-research cooperation and accelerate the transformation of scientific and technological achievements.
3. **Market end**: Standardize efficacy promotion and establish credibility based on clinical data; expand emerging markets and optimize export structure; strengthen brand building, enhance product added value and take a high-end route.
4. **Compliance end**: Strictly implement domestic and international quality standards and

promote international certification; participate in the formulation of industry standards to promote industrial standardization; strictly control product quality, put an end to false publicity and maintain industrial reputation.

V. Future Summary

With the core advantages of controllable resources, mature technology, precise efficacy, wide application and favorable policies, white kidney bean extract firmly occupies the core position in the natural glucose-controlling and calorie-controlling track, with a solid market foundation and sufficient growth momentum. Driven by the improvement of national health awareness, consumption upgrading, technological iteration and regulatory standardization, the industry will bid farewell to extensive growth and enter a new stage of high-end, green, intelligent and global development.

As the world's core producer and consumer of white kidney bean extract, China has full-industrial chain advantages. In the future, enterprises need to focus on technological innovation, product segmentation, brand building and compliant operation, seize market opportunities, solve problems such as homogeneity and export barriers, and promote high-quality industrial development. White kidney bean extract is not only expected to become a pillar category of the great health industry, but also help national health management, achieving a win-win situation of commercial value and social value.