

Ginseng Industry Development & Market Outlook (White Paper)

For more Information about Ginseng Extract, Please Contact the Following:

Emma Hsin
International Business Manager

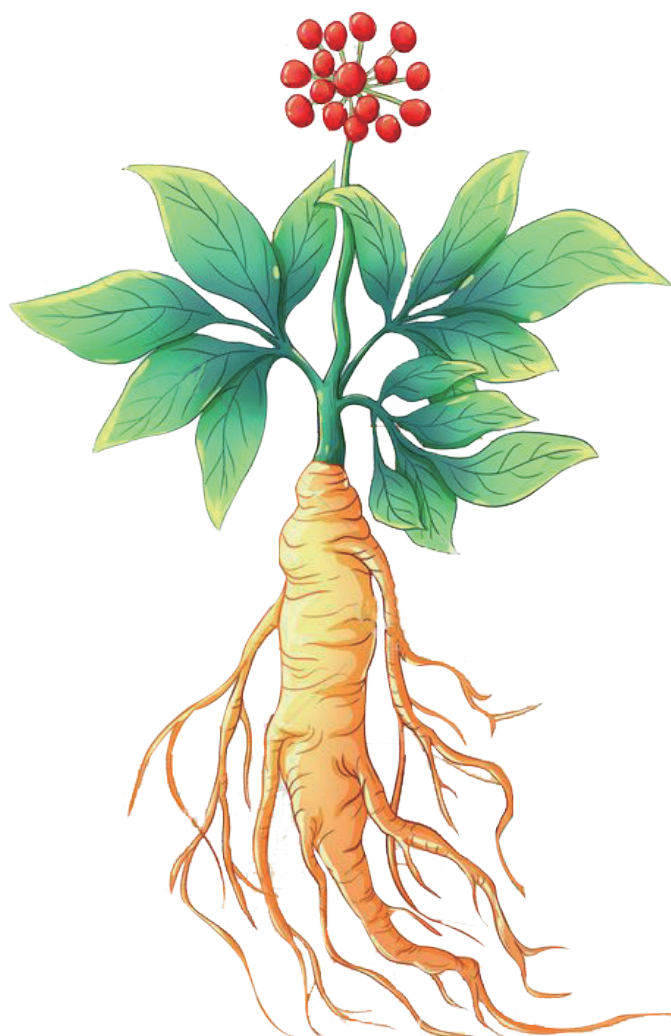
Tel/WhatsApp: +86-15267851650

E-mail: emma.hsin@taiyi-nb.com

Web: www.taiyi-nb.com

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(White Paper)



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Prepared by: Ningbo Tech-Inno Health Industry Co.,Ltd
Co-prepared by: Guangdong Qingyunshan Pharmaceutical Co., Ltd.
Herb Green Health Biotech Co., LTD.

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Preface

Panax ginseng C.A. Mey., as one of the world's most renowned traditional medicinal plants, has consistently occupied a central position in Eastern medicine and wellness culture. As global population aging accelerates, the chronic disease burden continues to rise, consumer health awareness awakens, and the "Adaptogen" theory gains increasing recognition within Western mainstream medicine, the ginseng industry is entering an unprecedented strategic development window.

From a global perspective, the ginseng industry has formed a vast industrial ecosystem spanning cultivation, processing, research, manufacturing, and retail. From a scientific research dimension, the pharmacological foundation of ginseng is transitioning from empirical medicine to the solid stage of evidence-based medicine.

This white paper, grounded in a global perspective, systematically reviews the botanical basis, core active components, scientific efficacy evidence, market landscape, product innovation, technological systems, regulatory environment, investment value, and strategic outlook of the ginseng industry. The report aims to provide an authoritative reference with both depth and breadth for enterprises across the ginseng value chain (cultivation bases, raw material suppliers, extract companies, end-brand manufacturers), investment institutions, regulatory bodies, research institutes, and strategic decision-makers in the health industry.

Executive Summary

Core Finding: The global ginseng industry is at a critical stage of transformation from traditional tonic products to modern functional health ingredients. Driven by scientific research breakthroughs, consumer health awareness, and favorable regulatory policies, the ginseng industry will enter a golden window of high-quality growth during 2025–2030.

I. Current State of the Ginseng Industry

The global ginseng industry currently features four major supply centers: China, South Korea, Canada, and the United States. China's core production area is the Changbai Mountain region of Jilin Province. South Korea excels in branding and standardization. Ontario (Canada) and Wisconsin (USA) are the primary production areas for American ginseng (*P. quinquefolius*). End-consumer markets are progressively expanding from traditional medicinal use toward diversified applications including health foods, functional food and beverages, and beauty and skin-care.

II. Key Market Size Data

Global: Approx. USD 7.5 billion in 2024 → projected to reach USD 14.0 billion by 2030 (CAGR 5.5%–9.2%)

China: Core market approx. RMB 29.9 billion in 2024 → projected to reach RMB 65.0 billion by 2030 (CAGR ~13.8%)

Asia-Pacific: Accounts for 67%–68% of global market revenue, the largest regional market

China Exports: 2,170 tonnes / USD 90.87 million in 2023, YoY growth of 44%/46%

III. Application Track Overview

Ginseng applications have expanded from traditional tonic use to health supplements (35% market share), sports nutrition and energy drinks (CAGR 25%), beauty and skincare (CAGR 22%), medical nutrition (CAGR 18%), and pet health (CAGR 30%).

IV. Industry Trends and Strategic Opportunities

Looking ahead over the next five years, the ginseng industry will exhibit several core trends: First, technology-driven deep processing upgrades, with rare ginsenoside biotransformation technology achieving industrial-scale production. Second, China's health food filing system reform accelerating, lowering market entry barriers. Third, accelerating branding and internationalization, with leading enterprises building competitive moats through full value chain integration. Fourth, synthetic biology providing novel technological pathways for synthesis of ginsenosides, potentially breaking through resource bottlenecks.

Chapter 1

Ginseng Overview: Botanical Basis and Historical Heritage

1.1 Botanical Classification and Geo-authenticity

1.1.1 Scientific Name, Taxonomy, and Morphological Characteristics

Panax ginseng C.A. Mey. belongs to the family Araliaceae, genus *Panax*, and is a perennial herbaceous plant. Ginseng grows extremely slowly, typically requiring 4–6 years from sowing to harvest (cultivated ginseng), while wild ginseng may take decades or even over a century. This prolonged growth process allows ginseng roots to accumulate abundant secondary metabolites, particularly ginsenosides, whose content positively correlates with plant age.

1.1.2 Medicinal Parts and Their Value

All parts of the plant contain varying types and quantities of active components. Ginseng root typically contains 2%–8% total saponins. Ginseng stems and leaves may contain 5%–12% total saponins. Ginseng flower buds are rich in Re and Rd. Ginseng berries contain ginsenoside Re and F2, with reported anti-diabetic and anti-obesity activities.

1.2 Classification System of Ginseng

1.2.1 Classification by Growth Environment

Wild Ginseng: Grows and reproduces naturally in primeval forests, typically over 15 years old.

Forest-cultivated Ginseng: Seeds scattered in natural forest understory, simulating wild conditions.

Cultivated Ginseng: Grown at scale in prepared ginseng fields over 4–6 year cycles; constitutes over 95% of global production.

Transplanted Ginseng: Young cultivated ginseng transplanted to mountain forest environments, combining scalability with quality characteristics.

1.2.2 Classification by Processing Method

White Ginseng: Fresh ginseng peeled and sun-dried or oven-dried, retaining natural color and original component profile with mild properties.

Red Ginseng: Fresh ginseng steamed then dried. During steaming, original ginsenosides (e.g., Rb1, Rg1) partially convert to rare ginsenosides (e.g., Rg3, Rh1, Rg5), while Maillard reactions produce the characteristic reddish-brown color.

Black Ginseng: Fresh ginseng subjected to nine cycles of steaming and drying. Through repeated processing, ginsenosides undergo deeper deglycosylation and isomerization, significantly increasing concentrations of rare ginsenosides Rg3, Rg5, and Rk1. Black ginseng represents a flagship innovation in modern deep processing.

Chapter 2

Core Active Components and Biochemical Basis

2.1 Ginsenosides

2.1.1 Chemical Structure and Classification

Ginsenosides are the most representative group of active components in ginseng and the primary material basis for its pharmacological activities. Over 150 ginsenoside monomers have been identified from *Panax* species. They are classified into three major types:

PPD-type (Protopanaxadiol): Dammarane-type tetracyclic triterpene aglycone with sugar moieties at C-3 and/or C-20. Representatives: Rb1, Rb2, Rc, Rd, Rg3, Rh2, Compound K (CK).

PPT-type (Protopanaxatriol): Additional hydroxyl group at C-6, with sugar moieties at C-6 and/or C-20. Representatives: Re, Rg1, Rf, Rg2, Rh1.

Oleanane-type: Oleanolic acid aglycone; representative monomer Ro. Low concentration in ginseng (<0.5%).

2.1.2 Rare Ginsenoside Formation

Rare ginsenosides (Rg3, Rh2, Compound K, Rg5, Rk1) are present in extremely low concentrations in native ginseng (<0.1%) but can be enriched through processing or biotransformation. They feature smaller molecular weight, stronger hydrophobicity, and higher cell membrane permeability, demonstrating superior bioavailability and enhanced biological activity.

2.2 Ginseng Polysaccharides

Ginseng polysaccharides are the second most abundant active component class, comprising approximately 5%–15% of dry weight. Their immunomodulatory activity represents their most significant pharmacological value.

2.3 Ginseng Peptides and Amino Acids

Ginseng contains multiple bioactive peptides and free amino acids. Ginseng peptides are typically prepared through enzymatic hydrolysis or fermentation, with molecular weight distribution of 200–5,000 Da. Small peptides (<1,000 Da) exhibit superior absorption and stronger biological activity.

2.4 Other Functional Components

2.4.1 Volatile Oils

Ginseng volatile oil (0.02%–2.5% dry weight) contains over 100 identified compounds including sesquiterpenes (e.g., β -elemene, panaxynol/falcarinol), fatty acids, aldehydes, and alcohols. Panaxynol exhibits significant antibacterial, anti-tumor, and neuroprotective activities.

2.4.2 Phytosterols, Flavonoids, and Trace Elements

Ginseng contains β -sitosterol, stigmasterol, and campesterol for cholesterol reduction; flavonoids (kaempferol, quercetin glycosides) for antioxidant activity; and trace elements including germanium (Ge), selenium (Se), zinc (Zn), and iron (Fe), with organic germanium being a uniquely distinguishing characteristic.

2.4.3 Multi-component Synergistic Mechanisms

Modern pharmacological research emphasizes ginseng's "whole-component" synergistic effect. The synergy between ginsenosides and polysaccharides is particularly prominent in immunomodulation: ginsenosides regulate T-cell and NK-cell function for adaptive immunity, while polysaccharides activate macrophages and complement systems for innate immunity — the combined effect significantly exceeds either component alone.

Chapter 3

Core Efficacy and Mechanisms of Action

3.1 Anti-fatigue and Energy Metabolism Regulation

Ginseng's anti-fatigue activity is one of its most widely recognized traditional functions with robust evidence support. Mechanisms include: promoting mitochondrial biogenesis via PGC-1 α upregulation; modulating AMPK pathway to optimize glycogen balance; suppressing oxidative stress-induced muscle damage (reducing MDA and LDH); and regulating the HPA axis to alleviate stress-related fatigue.

3.2 Antioxidant and Anti-aging Effects

Ginsenosides exert anti-aging effects through multi-level antioxidant defense mechanisms. In skin anti-aging applications, ginseng extract inhibits MMP-1 and MMP-3 expression, promotes type I and III collagen synthesis, and enhances skin barrier function, achieving reduction of fine lines, improved elasticity, and brighter complexion.

3.3 Immune Modulation and Defense Enhancement

Ginseng's regulatory effects span both innate and adaptive immunity. Ginseng polysaccharides and ginsenosides activate macrophage phagocytic function and promote secretion of NO, TNF- α , IL-1 β , and IL-6. Ginsenoside Rg1 enhances NK cell cytotoxic activity, the body's first line of defense against viruses and tumors.

3.4 Neuroprotection and Cognitive Enhancement

Ginsenosides Rb1 and Rg1 are the primary neuroprotective effector molecules. Rb1 activates the PI3K/AKT survival pathway, upregulates Bcl-2/Bax ratio, and inhibits caspase-3-dependent neuronal apoptosis. Rg1 enhances BDNF expression and secretion, promoting hippocampal synaptic plasticity.

3.5 Metabolic Regulation: Glycemic and Lipid Management

Ginseng's glucose regulatory mechanisms involve improving pancreatic β -cell function, promoting insulin secretion, enhancing insulin sensitivity, inhibiting hepatic gluconeogenesis, and modulating AMPK pathway. In lipid metabolism, Rb1 and Rg1 activate PPAR γ and AMPK pathways to promote fatty acid β -oxidation while inhibiting lipogenic enzymes (FAS, ACC).

3.6 Cardiovascular Protection and Microcirculation

Mechanisms include promoting NO production for improved vasodilation, inhibiting ROS-mediated cardiomyocyte damage, modulating lipid profiles, and inhibiting atherosclerotic plaque formation.

3.7 Anti-tumor Adjuvant Activity

Ginsenoside Rg3 is the only ginseng-derived anti-tumor adjuvant drug approved by China's NMPA. At least six ginsenoside monomers (Rg3, Rh4, Rd, Rh2, Rg5, Rk1) and Compound K inhibit PI3K/AKT/mTOR pathway hyperactivation.

3.8 Adaptogenic and Anti-aging Mechanisms

As a classic adaptogen, ginseng modulates HPA axis function: supporting appropriate CRH and ACTH secretion during acute stress while preventing glucocorticoid receptor desensitization during chronic stress. Ginseng's anti-aging mechanisms involve multiple conserved longevity pathways. Ginsenosides activate DNA repair proteins (NEIL1,NEIL3) and enhance autophagy flux to clear accumulated damaged proteins and dysfunctional mitochondria.

3.9 Comparison with Other Adaptogenic Plants

	Ginseng	Ashwagandha	Rhodiola rosea	Eleutherococcus
History of consumption (year)	2000+	3000+	~400	~2000
Active Components	Ginsenosides (150+)	Withanolides	Salidroside	Eleutheroside
RCT	100+	300+	15+	10+
Meta	10+	5+	2+	/
Efficacy evidence	Anti-fatigue(A) Immunity(A) Blood sugar(A) Cognition(B)	Anti-anxiety(A) Sleep(B) Exercise(B)	Anti-fatigue(B) Anti-depression(B)	Anti-fatigue(C) Immunity(C)

Tab.3-1 Ginseng vs. other adaptogens: comparative efficacy profiles

Chapter 4

Market Industry Status and Consumer Insights

4.1.1 Global Market Size and Growth

4.1.1 Global Market Size and Growth

The global ginseng market was valued at approximately USD 7.5–8.4 billion in 2024, projected to reach USD 12.6–14.0 billion by 2030 (CAGR 5.5%–9.2%).

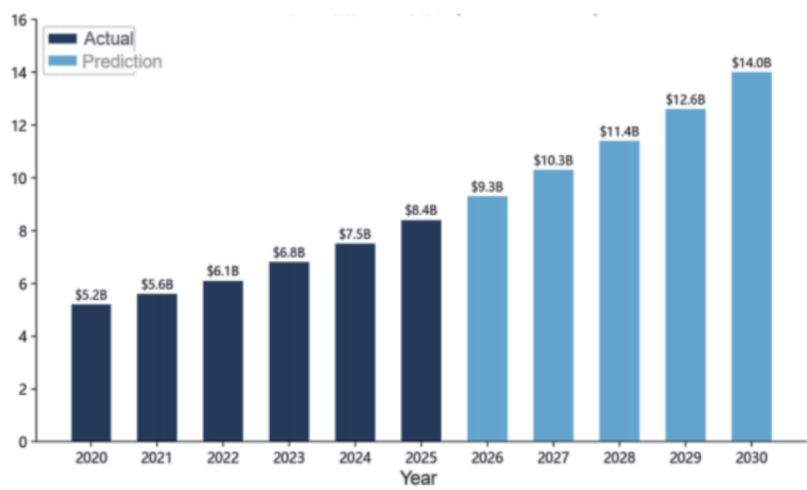


Figure 4-1: Global ginseng market size and forecast (2020–2030, USD billion)

4.1.2 Major Producing and Exporting Countrie

China holds approximately 70% of global cultivation area and production. South Korea achieves far higher unit values through branding and standardization.

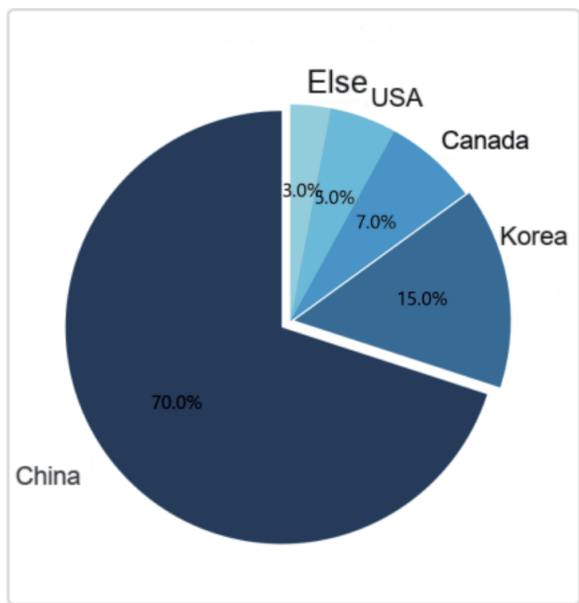


Figure 4-2: Global ginseng production by country

4.2 Consumer Profiles and Demand Insights

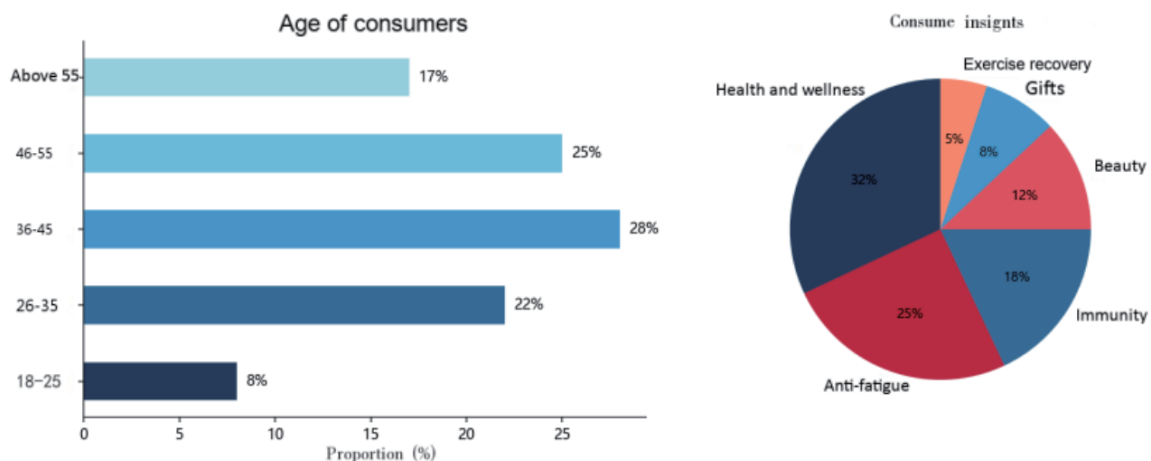


Figure 4-3: Ginseng consumer profiles and demand insights

4.2.1 Traditional Tonic Consumers

Middle-aged and elderly (45+) represent approximately 42% of total consumption, motivated by health maintenance and gift-giving, preferring traditional forms with high brand loyalty.

4.2.2 Urban Professionals: Anti-fatigue Segment

Urban workers aged 25–45 are the fastest-growing segment, facing work pressure, sleep deprivation, and chronic fatigue. Male trial rates exceed female by ~29%, but female consumption of beauty ginseng products grows faster.

4.2.3 Immunity and Post-surgical Recovery

Post-pandemic, immune health is a universal concern. This group is heavily influenced by physician recommendations with extremely high quality and brand trust requirements.

4.2.4 Anti-aging and Beauty

Women aged 25–40 are the core beauty track target. The "ingredient-conscious" trend drives ginsenoside application in premium skincare. The "in-side-out" approach combining oral and topical products is rapidly growing.

4.2.5 Sports Nutrition

As a natural adaptogen, ginseng provides not only immediate energy boost but also improved post-exercise recovery and long-term endurance performance, differentiating it from caffeine-based stimulants.

Chapter 5

Product Forms, Dosage Innovation, and Application Tracks

5.1 Product Classification

5.1.1 Ingredient-level Products

Core midstream outputs: ginseng extracts (standardized raw material); high-purity ginsenoside monomers (>95%); ginseng polysaccharides (50%–70%); and ginseng peptide powder (200–5,000 Da).

5.1.2 Consumer Products

Spanning dietary supplements, functional foods (ginseng coffee, ginseng chocolate, etc.), beverages, and beauty/skincare products.

5.1.3 Pharmaceutical-grade Products

Including Shenyi Capsule (Rg3, adjuvant NSCLC), Shenfu Injection (cardiovascular), Shengmai Injection (cardiogenic shock), and Dushen Granules (Qi deficiency emergencies).

5.2 Mainstream and Innovative Dosage Forms

Traditional forms (capsules, tablets, oral liquids, pastes) continue to dominate. Emerging formats include ginseng gummies, energy bars, solid beverages, and transdermal patches. Topical formats feature 0.5%–5% ginsenoside concentration.

5.3 Application Track Assessment

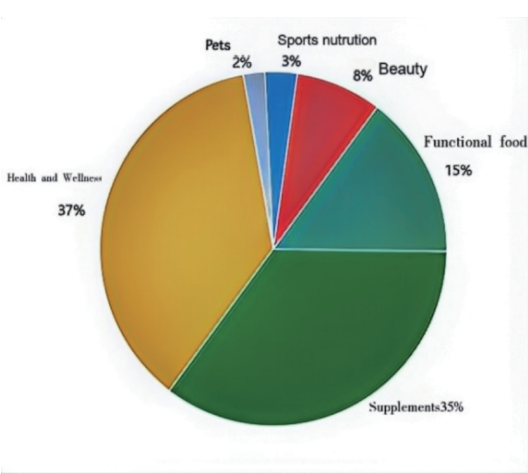
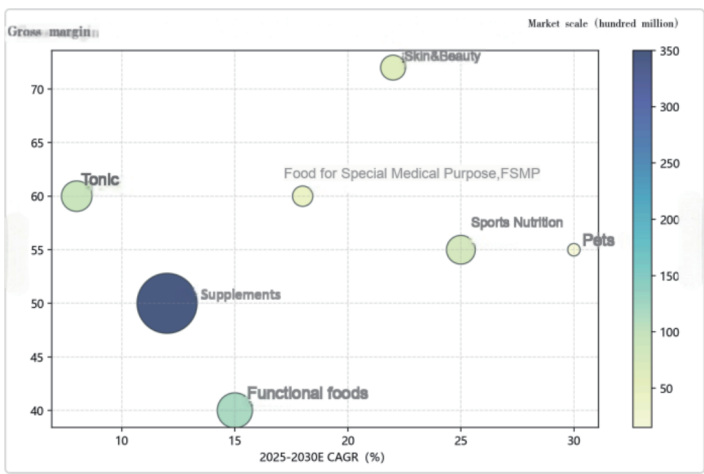


Figure 5-1: Ginseng application track potential assessment (bubble size = market size)

Figure 5-2: Global ginseng product category market share

5.4 Exemplary Formulation Concepts

5.4.1 Energy & Vitality Formula

Target: Working professionals aged 25-45

Ginseng extract (20%) 300mg+CoQ10 100mg+L-Carnitine 500mg + B-vitamin complex

Rationale: Synergistic energy metabolism enhancement via AMPK/PGC-1 α (ginseng), electron transport chain (CoQ10), and fatty acid β -oxidation (L- Carnitine).

5.4.2 Cognitive Focus Formula

Target: Students, knowledge workers, elderly

Ginseng extract 200 mg + Ginkgo biloba 120 mg + PS 100 mg + DHA 200 mg

Rationale: Rg1 promotes BDNF for synaptic plasticity; Ginkgo improves cerebral microcirculation; PS supports neural membranes; DHA is a key brain phospholipid.

5.4.3 Immune Defense Formula

Target: Immunocompromised, post- surgical recovery

Red ginseng concentrate 3g+ Astragalus 500 mg + β -Glucan 250 mg + Zinc 15 mg + Vitamin C 200 mg

Rationale: Ginseng activates NK and T cells; Astragalus enhances macrophage phagocytosis; β -Glucan activates innate immunity.

5.4.4 Sports Recovery Formula

Target: Athletes, fitness enthusiasts, marathon runners

Ginseng extract(10%) 500mg+BCAA 5g +Electrolytes+Taurine 1g + Glutamine 3g

Rationale: Ginseng reduces post-exercise CK and LDH; BCAA inhibits protein catabolism; Taurine and Glutamine support muscle repair.

5.4.5 Beauty & Rejuvenation Formula

Target: Women aged 25–50

Ginseng extract (40%) 200mg + Collagen peptides 5g + Astaxanthin 4 mg + Hyaluronic acid 120 mg + Vitamin E 30 mg

Rationale: Ginsenosides inhibit MMP-1/MMP-3 and activate Nrf2.

Chapter 6

Product Forms, Dosage Innovation, and Application Tracks

6.1 Extraction and Deep Processing Technology

6.1.1 Mainstream Extraction Technologies

Current technologies include: traditional water extraction and ethanol precipitation; ultrasound-assisted extraction (UAE) achieving >82% efficiency; enzymatic hydrolysis using cellulase and pectinase; supercritical CO₂ fluid extraction (SFE-CO₂); and membrane separation for staged purification.

6.1.2 Rare Ginsenoside Biotransformation

Enzymatic biotransformation has achieved commercialization: Rb1 → Rd → F2 → Compound K, with >90% total conversion.

6.1.3 Flavor and Solubility Improvement

De-bittering technologies include β-cyclodextrin inclusion, enzymatic debittering, and optimized formulation. Solubility enhancement through liposomes, microencapsulation, and nano-sizing increases water solubility 5–20 fold and bioavailability 3–8 fold.

6.2 Quality Control and Testing Standards

6.2.1 Core Quality Parameters

Total saponin content and ginsenoside monomer profiles serve as core indicators. Ginsenoside Rf, unique to *P. ginseng* and absent in American ginseng, serves as a species-differentiating marker.

6.2.2 Analytical Methods

HPLC (Chinese Pharmacopoeia 2020) is the gold standard for simultaneous Rg1, Re, and Rb1 quantification. UV spectrophotometry for rapid total saponin screening. TLC for qualitative identification and authenticity confirmation.

6.3 Tech Inno: Ginseng Application Capabilities

Tech Inno Health has established a comprehensive quality control methodology covering the entire process from raw material sourcing to finished product, encompassing fingerprint comparison, multi-indicator ginsenoside quantification (Rg1, Re, Rb1, Rc, Rd), and Rf analysis. Over 20 patents filed covering equipment, process optimization, and applications.

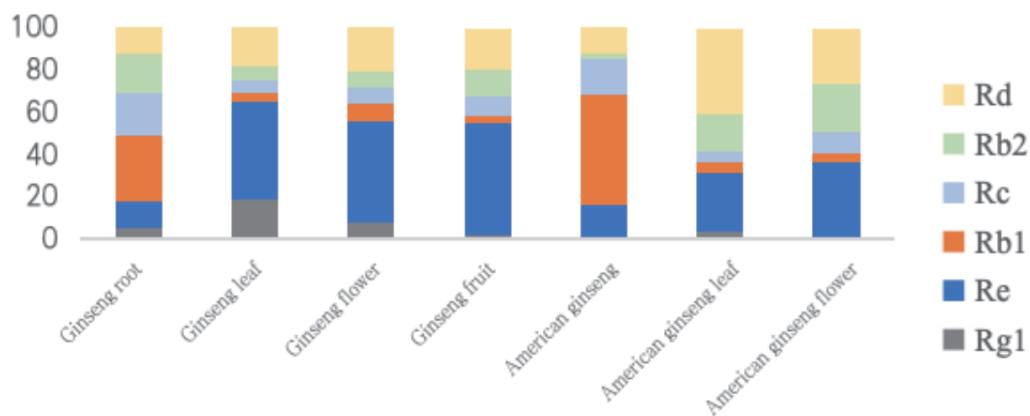


Fig.6-1 Comparison of ginsenosides in ginseng products

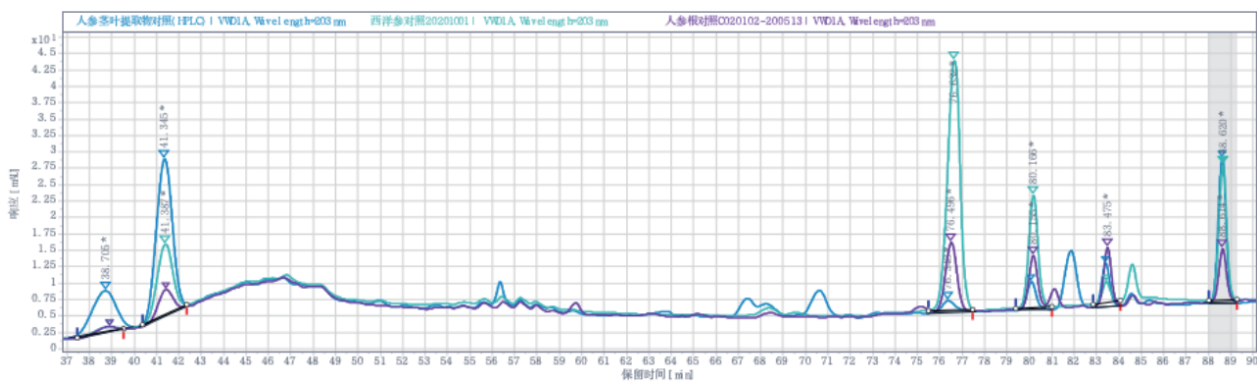


Fig.6-2 HPLC comparison: Ginseng root, American ginseng, and Ginseng stem/leaf

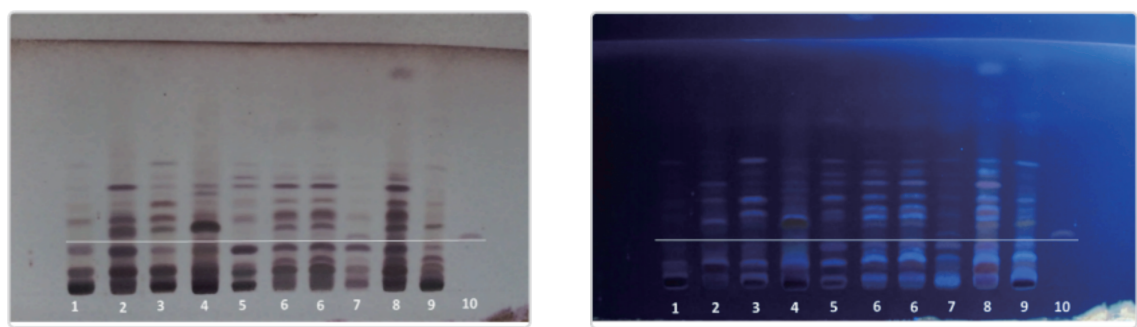


Fig.6-3 TLC of the Panax Series Products

- 1. Ginseng Extract A
- 2. Ginseng Stem and Leaf Extract
- 3. American Ginseng Extract
- 4. American Ginseng Stem and Leaf Extract
- 5. Noto Ginseng Extract
- 6. Ginseng Extract B
- 7. Ginseng Reference Herb
- 8. Ginseng Stem and Leaf Reference Extract
- 9. American Ginseng Reference Extract
- 10. Rf Standard

6.3.1 Limit Substance Control

6.3.1.1 Pesticide Residue Control

Ginseng's 4-6 year cultivation cycle makes it susceptible to disease, with long-term pesticide use leading to residue accumulation — a core compliance bottleneck. Tech Inno Health utilizes specific adsorbent materials matched to pesticide molecular structures to achieve: (a) **Standards compliance**: 100% USP 561 and EC 396 conformity; (b) **Zero-residue grade**: All pesticides below detection limits (ND, LOQ≤0.01 mg/kg); (c) **Quality preservation**: Core active component retention ≥95%, solvent-free, no chemical additives.

6.3.1.2 Plasticizer Control

Tech Inno Health addresses plasticizer contamination through cultivation monitoring, reduced dissolution, and specific adsorption across raw materials, processing, and finished products. Core component retention ≥95%, USP compliant, no chemical additives.



Fig.6-4 Selected pesticide control patents



Fig.6-5 Selected plasticizer control patents

6.3.2 Application Improvement

6.3.2.1 Flavor Improvement

Tech Inno Health's proprietary ginseng process extracts natural nutrients from ginseng root, achieving significantly higher levels of ginseng polysaccharides, amino acids, vitamins, and minerals compared to conventional products, with excellent beverage applicability while maintaining ginseng's core functional benefits.

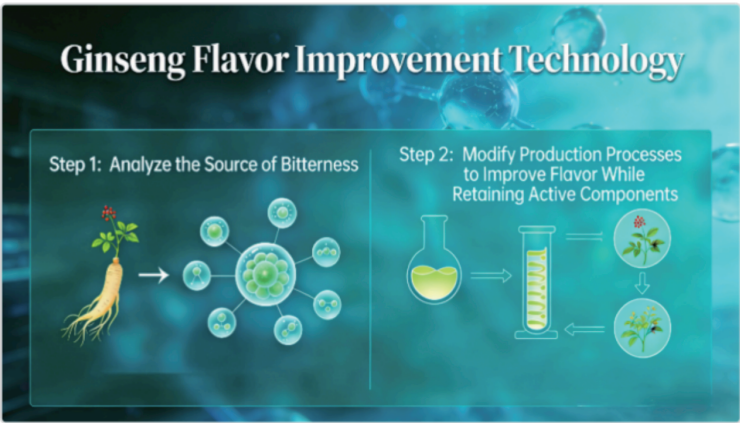


Fig.6-6 Flavor improvement technology diagram

6.3.2.2 Solubility Improvement

Taiyi Health employs extraction, enzymatic hydrolysis, membrane separation, and physical carrier technologies to significantly improve solubility. Mature products include water-soluble rare ginsenosides, ginseng peptides, and CLEAN-GINSENG®.



Fig.6-7 Selected application improvement patents

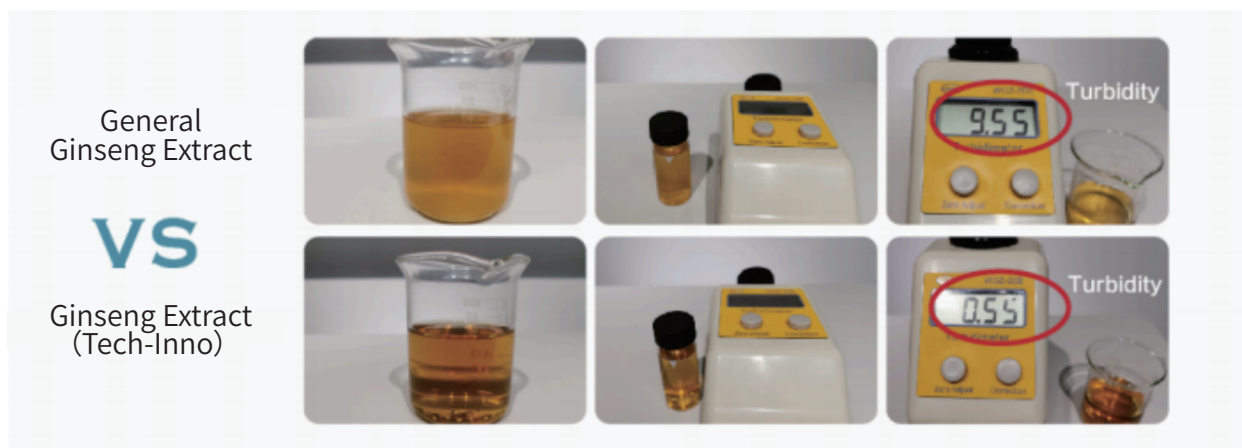


Fig.6-8 Comparison of Solubility & Clarity of Different Ginseng Extracts

Chapter 7

Global Regulatory Framework and Market Access

7.1 China 🇨🇳

Cultivated ginseng (≤ 5 years) was approved as a novel food ingredient in 2012. In 2023, SAMR included ginseng in the health food filing catalog.

7.2 United States 🇺🇸

Ginseng products are primarily sold as dietary supplements under DSHEA, without pre-market FDA approval. Structure/function claims are permitted.

7.3 European Union 🇪🇺

Two pathways: Traditional Herbal Medicinal Products via simplified registration; and Food Supplements, where ginseng root is freely used.

7.4 South Korea 🇰🇷

Ginseng has officially recognized health function claims including immune enhancement, anti-fatigue, memory improvement, and antioxidant effects.

7.5 Japan 🇯🇵

Ginseng can make functional claims through the Foods with Function Claims (FFC) system. In pharmaceuticals, ginseng is a key component of 148 insurance-covered Kampo prescriptions.

7.6 Canada 🇨🇦

Managed through Natural Health Products Regulations (NHP). Ginseng is not permitted as a supplemental food ingredient; restricted to NHP product formats only.

Appendix A

Ginseng Product Specifications Reference

Specification	Content(%)	Marker	Rec.Dose(mg/d)	Typical Application
Standard Extract (Low)	5–10	Rb1+Rg1	500–2,000	Daily health/ Food additive
Standard Extract (Mid)	20	Rb1+Rg1+Re	200–600	Health food/ Dietary supplement
Standard Extract (High)	40–50	Multi-indicator	100–400	Premium health/ Functional formulas
High-purity Extract	80	Full-spectrum	50–200	Pharmaceutical R&D / Premium
Rg3-enriched	Rg3 $\geq$ 50	20(S)-Rg3	20–60	Anti-tumor adjuvant/ Premium
CK-enriched	CK $\geq$ 30	Compound K	20–100	Immunomod./ Anti-tumor R&D
Polysaccharide	$\geq$ 50	Acidic poly.	200–500	Immune enhancement/ Food
Peptide Powder	Peptide $\geq$ 80	Small-mol. peptide	1,000–3,000	Antioxidant / Sports recovery
Red Ginseng Conc.	3–5(liquid)	Rg3-enhanced	10–30mL	Traditional tonic / Gift
Cosmetic Extract	10–30	Re+Rg1	0.5–5%	Anti-aging / Brightening

Appendix B

Disclaimer

This white paper is prepared by Ningbo Tech Inno Health Industry Co., Ltd. for industry research, academic exchange, and business decision-making reference purposes only.

Data Accuracy: All market data and statistics are sourced from publicly available channels. No guarantee is made regarding absolute accuracy, completeness, or timeliness. Forward-looking Statements: Market forecasts and projections are based on current trends and reasonable assumptions. Actual results may differ materially. Readers should not place undue reliance on such statements.

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Appendix C

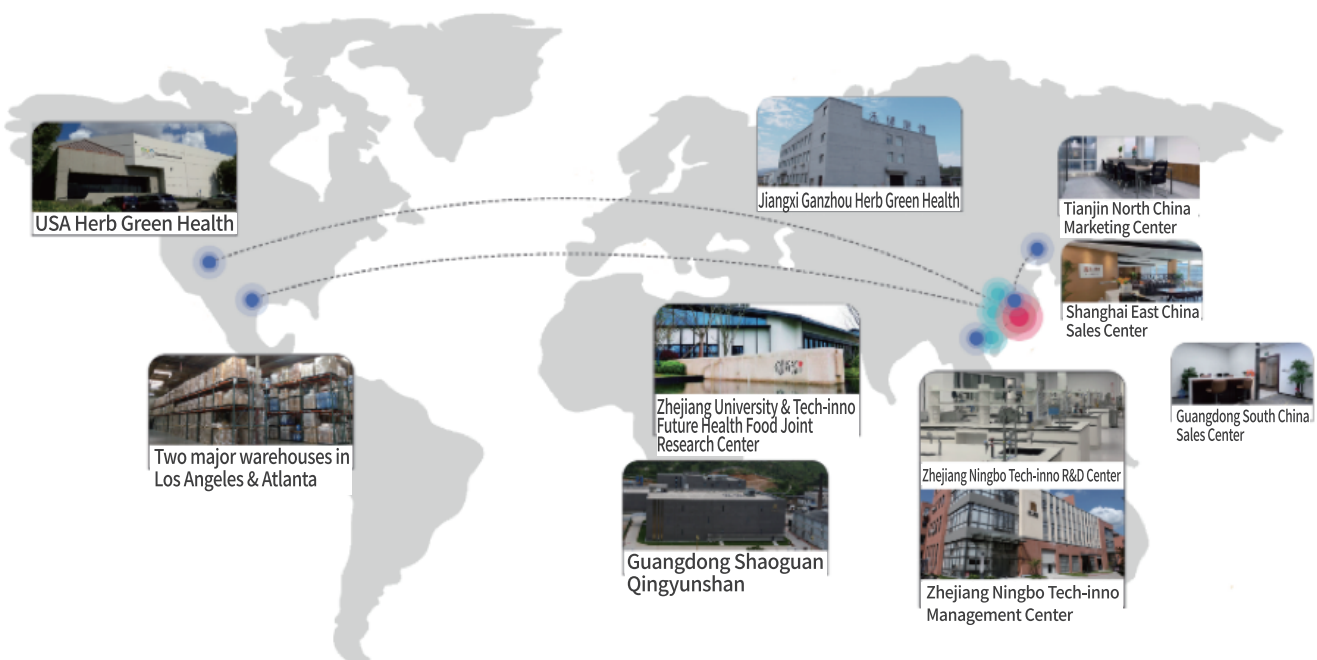
Ningbo Tech-inno Health Industry

We have insight into consumers' demands for health, take innovation as the core driving force and help customers' business growth through full case services to better integrate health into life.

Founded in 2016, we are committed to be a "professional health product supply chain full case service provider"



We have established a natural health product whole industry chain service system, which integrates customized planting, raw material supply, technical support, health product development and production, functional food ODM, market insight and online promotion strategic support.



Celebrating More Than 36 Years Of Quality Health Products

GMP Certified
cGMP Certified
ISO22000 Certified
HACCP Certified
ISO9001 Certified
KOSHER Certified
HALAL Certified
NOP/EU ORGANIC

 Qingyunshan Pharma
Shaoguan, Canton, CHN