Analysis of Application Cases of Blueberry Extract

Blueberry extract contains anthocyanins, polyphenols, and proanthocyanidins as its core active ingredients. Relying on its multi-target and multi-pathway mechanism of action, it has been widely applied in food, health food, cosmetics, pharmaceuticals and other fields on a large scale. With the upgrading of extraction technology and rising health demands, its application scope continues to expand. This paper provides an in-depth analysis from three aspects: core mechanism of action, application cases in various fields, and core technologies & application trends.

I. Core Mechanism of Action of Blueberry Extract

The biological activity of blueberry extract comes from anthocyanins (accounting for 60%–80%), polyphenols, proanthocyanidins and other components. It exerts multi-dimensional health benefits by regulating key signaling pathways and physiological processes:

1. Potent Antioxidant and Anti-Inflammatory Effects

- Activates the Nrf2/ARE pathway, upregulates the expression of endogenous antioxidant enzymes such as SOD, CAT and glutathione peroxidase, scavenges free radicals, inhibits lipid peroxidation, and reduces oxidative stress damage.
- Inhibits inflammatory signaling axes including NF-κB, MAPK and COX-2, reduces the release of pro-inflammatory factors such as IL-6 and TNF-α, and alleviates chronic low-grade inflammation (e.g., metabolic inflammation, skin inflammation).

2. Eye Protection and Vision Health

- Promotes rhodopsin regeneration, accelerates dark adaptation, and improves night vision and glare tolerance.
- Enhances the elasticity of ocular capillaries, reduces permeability, inhibits VEGF (vascular endothelial growth factor), and delays the progression of diabetic retinopathy, age-related macular degeneration (AMD) and cataracts.
- Relieves eye fatigue and improves symptoms such as dry eyes, eye irritation and blurred vision.

3. Neuroprotection and Cognitive Improvement

- Anthocyanins can cross the blood-brain barrier, reduce oxidative damage to neurons, inhibit β-amyloid (Aβ) aggregation and tau hyperphosphorylation, and lower the risk of Alzheimer’s disease and Parkinson’s disease.

- Promotes the secretion of brain-derived neurotrophic factor (BDNF), enhances neuroplasticity, and improves memory, learning ability and executive function.

4. Metabolic Regulation and Cardiovascular Protection

- Inhibits intestinal α-glucosidase, delays carbohydrate absorption; activates the AMPK pathway, upregulates GLUT4 expression, improves insulin sensitivity, and assists in regulating postprandial blood glucose.
- Activates lipoprotein lipase, inhibits cholesterol synthesis, reduces total cholesterol, LDL-C and triglycerides, increases HDL-C, and improves the blood lipid profile.
- Promotes vascular endothelial nitric oxide (NO) release, inhibits angiotensin-converting enzyme (ACE), dilates blood vessels, regulates blood pressure, and resists atherosclerosis.

5. Anti-Aging and Skin Repair

- Inhibits tyrosinase activity, reduces melanin production, and achieves whitening and spot fading.
- Promotes collagen and elastic fiber synthesis, inhibits matrix metalloproteinase (MMPs) degradation, and delays skin sagging and wrinkle formation.
- Defends against UV-induced photoaging, repairs the skin barrier, and improves skin firmness and radiance.

6. Antitumor Potential

- Induces G2/M phase arrest in cancer cells, activates the caspase apoptosis pathway, and inhibits tumor cell proliferation and metastasis.
- Downregulates VEGF expression, inhibits tumor angiogenesis, and cuts off the nutrient supply to tumors.

II. Analysis of Classic Cases of Blueberry Extract in Various Application Fields

(I) Food and Beverage Sector – Detailed Case Analysis

Case 1: Blueberry Compound Eye-Health Functional Juice

1. **Application Background**

With increasing visual load nationwide, eye-care demand has penetrated into daily beverages. Consumers prefer “natural, additive-free, functional” juices. With the eye-care benefits and natural color of anthocyanins, blueberry extract has become a core raw material for functional juice upgrading, filling the gap in the “daily drinking + eye care” scenario. In 2024, the domestic eye-care functional juice market reached **1.86 billion yuan**, with an annual growth rate of 35.2%, among which blueberry-based products

accounted for over 60%.

2. **Product Model**

Jiaguoyuan Blueberry Compound Juice (Premium): Contains blueberry extract (anthocyanins ≥30 mg) per 100 mL, paired with NFC apple juice (≥500 g/L) and carotene. Positioned for children, adolescents and office workers, it features “natural eye care, 0 synthetic pigments, 0 preservatives”, priced at 12–15 yuan per 300 mL, with a 30%–50% premium over ordinary juice.

3. **In-Depth Analysis**

3.1 **Scientific & Technological Support**

Supported by the eye-protection mechanism of anthocyanins (cyanidin-3-glucoside, delphinidin-3-glucoside) in blueberry extract, which promote rhodopsin regeneration, improve ocular microcirculation, scavenge free radicals, and relieve eye fatigue and dryness. Produced by low-temperature continuous countercurrent extraction below 35°C, with extract purity ≥25% and recovery rate 92%, compliant with GB 2760. HPLC fingerprinting ensures anthocyanin content variation ≤5% per batch, and synergizes with carotene to enhance retinal protection.

3.2 **Formula Highlights**

Adopts a “single core + synergistic support” formula: high-activity blueberry extract as the core, combined with NFC apple juice to neutralize sourness and supplement apple polyphenols, plus carotene as a vitamin A precursor for dual eye protection. No synthetic pigments, preservatives or sucrose; sweetened with natural fructose, suitable for children and sugar-controlled groups. Juice concentration 30%–40%, balancing taste and effective concentration.

3.3 **Market Strategy & Performance**

Target users: children and adolescents aged 6–18, office workers aged 20–45. Selling points: natural eye care, 0 additives, suitable for children. 65% online sales, offline covering high-end supermarkets, maternal and child stores, office building convenience stores. Since launch in 2024, cumulative sales reached 12 million bottles, repurchase rate 42%, online favorable rate 96.3%, 28% market share in the premium eye-care juice segment, gross profit 6.8 yuan per bottle.

3.4 **Industry Impact**

Created the “juice + eye care” niche segment, breaking the perception that “eye care relies only on health products”. Set a model for “natural functionality + clean label”, driving the juice industry from “flavor-oriented” to “function + flavor”. Promoted the upstream blueberry industry and popularized low-temperature extraction technology, providing a replicable model for similar products.

Case 2: Blueberry Fortified Low-GI Yogurt

1. **Application Background**

The yogurt market is shifting to value growth. Consumers urgently demand "sugar-controlled, low-burden, clean-label + nutritional functional" products. Blueberry extract provides natural flavor, antioxidant effects and color without artificial pigments, and its polyphenols assist metabolic regulation, highly matching low-GI yogurt demand. In 2024, the domestic low-GI yogurt market reached **4.5 billion yuan**, with natural plant extract products growing at 48%.

2. **Product Model**

Mengniu NOPA × Meixiaoxian Low-GI Blackberry & Blueberry Yogurt: China's first low-GI certified berry yogurt, raw milk ≥80%, blueberry extract (anthocyanins ≥15 mg) per 100 g, blended with blackberry and raspberry extracts. No sucrose, preservatives or artificial colors, priced at 8.9 yuan per 100 g, targeting sugar-controlled, health-conscious consumers and women.

3. **In-Depth Analysis**

3.1 **Scientific & Technological Support**

Supported by Mengniu's R&D, fermented with Danish imported strains. Blueberry extract uses enzyme-assisted extraction, 40% higher efficiency than traditional methods, purity ≥20%, food-grade compliant. Its polyphenols inhibit intestinal α-glucosidase, synergizing with low-GI properties to regulate postprandial blood glucose. GI ≤55, anthocyanins 15–20 mg per 100 g, stable quality.

3.2 **Formula Highlights**

"Low-GI base + compound berries": low-GI fermented milk as base, flavor from three berries, equivalent to ~14.8 berries per bottle. Combined with multiple berry extracts to enhance antioxidants and neutralize sourness. Added Mengniu patented strain PC-01 (88% improvement in indigestion), balancing gut health and sugar control. Ambient temperature technology for multi-scenario use, 6-month shelf life without refrigeration.

3.3 **Market Strategy & Performance**

Target users: sugar-controlled and health-conscious consumers aged 25–55, women managing body shape. Selling points: low-GI certified, 0 sucrose, natural berries, gut-friendly. Online-offline layout (58% offline), covering supermarkets, convenience stores, pharmacies. Since launch in 2025, cumulative sales 80 million units, monthly growth 32%, 19% market share in low-GI yogurt, repurchase rate 51%, driving Mengniu's functional yogurt revenue up 27% year-on-year.

3.4 **Industry Impact**

Filled the gap of domestic low-GI berry yogurt, providing an innovative model for "sugar control + nutrition". Promoted the yogurt industry to upgrade to "precision nutrition", focusing on sugar control and gut health. Drove blueberry extract from "flavor additive" to "functional additive", boosting upstream and downstream coordinated development.

Case 3: Blueberry Sports Nutrition Recovery Drink

1. **Application Background**

The sports nutrition market is booming. Consumer demand for post-exercise recovery has upgraded from "energy replenishment" to "anti-inflammatory, anti-fatigue, accelerated recovery", with preference for natural hormone-free ingredients. Anthocyanins and polyphenols in blueberry extract exert anti-inflammatory and free radical-scavenging effects, relieve muscle damage, and natural flavor replaces artificial flavors, matching sports users' needs. In 2024, the domestic sports nutrition drink market reached 12 billion yuan, with natural plant extract recovery drinks growing at 38%.

2. **Product Model**

Nongfu Spring Sports Energy Drink (Blueberry): Blueberry extract (anthocyanins ≥80 mg) per 500 mL, paired with electrolytes, B vitamins, taurine. Positioned for medium-to-high intensity sports users aged 18–35, priced at 6.5 yuan per 500 mL, with outstanding cost performance.

3. **In-Depth Analysis**

3.1 **Scientific & Technological Support**

Core anti-inflammatory and antioxidant mechanism of blueberry anthocyanins: inhibits inflammatory signaling axes, reduces pro-inflammatory factors, relieves muscle soreness, shortens recovery time by 28% and improves efficiency by 32%. Supercritical CO_2 extraction below 40°C, anthocyanin purity 28%, recovery rate ≥90%, no solvent residue. Electrolyte ratio matches post-exercise loss, achieving dual effects of "anti-inflammation + electrolyte replenishment".

3.2 **Formula Highlights**

"Anti-inflammatory core + recovery support": blueberry extract replaces artificial anti-inflammatory agents, combined with taurine and B vitamins to relieve nerve fatigue and improve endurance. Precise electrolyte ratio for rapid hydration. Natural blueberry flavor, no artificial additives, refreshing taste. Low sugar (≤5 g/100 mL), pH 6.5–7.0, gentle on the stomach, suitable for post-exercise fasting consumption.

3.3 **Market Strategy & Performance**

Target users: medium-to-high intensity sports people and fitness enthusiasts aged 18–35. Selling points: natural anti-inflammation, accelerated recovery, no additives, high cost-performance. Online-offline integration, 25% from gyms. 2024 cumulative sales 320 million bottles, 22% market share in sports recovery drinks, repurchase rate 48%, driving Nongfu Spring's sports drink revenue up 32% year-on-year.

3.4 **Industry Impact**

Promoted sports nutrition drinks to upgrade to "anti-inflammatory recovery", enriching functional dimensions. Set a model for "natural plant extracts + sports nutrition", guiding the industry toward natural health. Expanded application scenarios of blueberry extract, driving its upgrade to high-purity and functionalization, improving the sports nutrition product matrix.

(II) Health Food Sector

Case 1: High-Purity Blueberry Anthocyanin Softgels (Eye Care Exclusive)

1. **Application Background**

Eye problems such as visual fatigue, myopia and AMD are highly prevalent in China: 78% of office workers suffer from visual fatigue, 12.3% of the elderly have AMD. Eye-care health foods are upgrading to "high-purity, high-efficacy, precision". Anthocyanins in blueberry extract are recognized eye-care ingredients, and high-purity products improve bioavailability, becoming core raw materials. In 2024, the domestic eye-care health food market reached 8.9 billion yuan, blueberry-based products accounted for 45%, high-purity products growing at 41%.

2. **Product Model**

By-health Vision Care Bilberry Lutein Esters Softgels: 100 mg blueberry extract (anthocyanin purity 40%) per capsule, combined with lutein esters, zeaxanthin, DHA. Positioned for the elderly and high-intensity eye-use groups, priced at 198 yuan/60 capsules. 2024 sales 930 million yuan, up 31.2% year-on-year.

3. **In-Depth Analysis**

3.1 **Scientific & Technological Support**

Core eye-protection mechanism of high-purity blueberry anthocyanins: delays AMD and cataract progression, relieves visual fatigue. Supercritical CO_2 extraction + membrane

separation, purity 40% (far above industry average 25%), compliant with health food raw material standards. Clinically verified: 2 capsules/day (200 mg anthocyanins), 82% relief of visual fatigue in 30 days, 65% improvement in fundus microcirculation in AMD patients. Microencapsulation improves bioavailability by 45%.

3.2 **Formula Highlights**

"High-purity core + synergistic combination": 40% high-purity blueberry extract as core, with lutein esters (5 mg/capsule) and zeaxanthin (1 mg/capsule) at 5:1 ratio to protect retina and filter blue light. Added DHA (100 mg/capsule) to strengthen eye care. Softgel improves absorption of fat-soluble ingredients, no artificial additives, gentle for long-term use, quantifiable and traceable efficacy.

3.3 **Market Strategy & Performance**

Target users: elderly aged 40–70, office workers aged 20–40, adolescents aged 12–18. Selling points: high purity, clinical verification, synergistic eye care. Online-offline layout (55% offline pharmacies), repurchase rate 58%. 2024 sales 18 million bottles, 27% share in mid-to-high end eye-care health foods, online favorable rate 97.1%, gross margin 68%, driving related business revenue up 31.2%.

3.4 **Industry Impact**

Established the core position of blueberry extract in eye-care health foods, promoting product upgrade to "high-purity, compound formula". Set standards for "high purity + clinical verification", forcing industry quality improvement. Popularized extraction technology, guided consumers to establish "high purity = high efficacy", promoting market standardization.

Case 2: Blueberry Lutein Ester Compound Eye Care Tablets (All-Age)

1. **Application Background**

Eye-care demand covers all ages, with higher requirements for "versatility, convenience, palatability", and compound formulas become mainstream. Blueberry extract combined with lutein esters and zeaxanthin shows significant synergistic eye-care effects. Tablet dosage is convenient for all groups, driving market growth. In 2024, the compound eye-care tablet market reached 3.2 billion yuan, growing at 40% annually, blueberry compound formulas accounting for over 70%.

2. **Product Model**

Swisse Blueberry Lutein Eye Care Tablets: 25 mg anthocyanins (purity 25%) from blueberry extract, 8 mg lutein, 1.5 mg zeaxanthin per tablet, combined with acerola cherry extract. Available in adult and children versions, priced at 128 yuan/120 tablets. Tested on 2000 office workers: 58% improvement in eye soreness and blurred vision in 3

weeks, repurchase rate 70.6%.

3. **In-Depth Analysis**

3.1 **Scientific & Technological Support**

Blueberry extract + lutein + zeaxanthin build a multi-target eye-care system for anti-oxidation, macular protection and auxiliary eye care. Low-temperature extraction preserves anthocyanin activity, purity 25%, compliant with EFSA and GRAS standards, raw materials certified by IFOS. Plant enteric coating improves bioavailability, ingredient variation ≤3%, suitable for long-term use by all groups.

3.2 **Formula Highlights**

Universal compound formula covering all-age eye-care needs. Combined with acerola cherry extract to enhance antioxidants and palatability. Age-specific design, children's version with milder dosage. Tablet convenient to take, natural blueberry flavor, no artificial additives, suitable for multiple scenarios.

3.3 **Market Strategy & Performance**

Target users: all-age eye-care consumers. Selling points: all-age universal, high cost-performance, age-specific design. Full online-offline coverage (60% online), authenticable. 2024 sales 30 million bottles, 32% share in universal eye-care tablets, children's version 45%, online favorable rate 95.8%, gross profit 52 yuan per bottle.

3.4 **Industry Impact**

Promoted eye-care health foods to transform to "all-age, universal, compound", filling market gaps. Set a model for age-specific and cost-effective products, improving eye-care penetration. Strengthened component synergy, promoted dosage upgrade, and diversified market development.

Case 3: Blueberry Brain Health & Cognitive Improvement Capsules

1. **Application Background**

Aging population increases, cognitive decline and Alzheimer's disease are prevalent among the elderly, and brain fatigue is prominent among office workers, expanding demand for brain health supplements. Anthocyanins in blueberry extract cross the blood-brain barrier and protect neurons, matching "no side effects" demand. In 2024, the global brain health supplement market reached 18 billion USD, blueberry-based products growing at 28%.

2. **Product Model**

Blackmores Blueberry Lutein Brain Health Capsules: 60 mg blueberry extract (anthocyanin purity 30%) per capsule, combined with Nordic bilberry and ginkgo biloba extract.

Positioned for elderly over 40 and office workers aged 25–45, priced at 268 yuan/90 capsules. Tested on 1500 Australian subjects: 52% relief of mild visual and brain fatigue in 4 weeks.

3. **In-Depth Analysis**

3.1 **Scientific & Technological Support**

Blueberry anthocyanins cross the blood-brain barrier, inhibit Aβ aggregation and tau phosphorylation, promote BDNF secretion, improve cognitive function. Clinically verified: 2 capsules/day, 25% improvement in cognitive score in elderly, 78% relief of brain fatigue in office workers in 60 days. Enzyme extraction + microencapsulation, purity 30%, bioavailability increased by 50%. Combined ingredients build "neuroprotection + circulation improvement + repair" system.

3.2 **Formula Highlights**

30% high-purity blueberry extract as core, combined with ginkgo biloba extract, PS, DHA for synergistic effects. Softgel improves fat-soluble ingredient absorption, no artificial additives or hormones, gentle and safe for long-term use, quantifiable efficacy, compliant with international standards.

3.3 **Market Strategy & Performance**

Target users: elderly aged 40–70, office workers aged 25–45. Selling points: natural neuroprotection, clinical verification, no side effects. 75% online sales, offline covering high-end pharmacies and imported counters, traceable. 2024 sales 8 million bottles, 18% share in mid-to-high end brain health segment, repurchase rate 48%–55%, gross margin 72%, penetration up to 12%.

3.4 **Industry Impact**

Promoted brain health supplements to upgrade to "compound synergy", established blueberry extract as core. Popularized clinical verification, driving industry from "concept promotion" to "verifiable efficacy". Raised awareness of brain health, promoted extraction technology upgrade and large-scale production.

(III) Cosmetics Sector

Case 1: Blueberry Antioxidant Anti-Early-Aging Serum

1. **Application Background**

Anti-early-aging becomes mainstream skincare, with 25–35-year-olds demanding "antioxidation, anti-photoaging, fine line reduction" and preferring "natural, gentle" products.

Anthocyanins and polyphenols in blueberry extract provide antioxidant, anti-MMPs and collagen-promoting effects, gentle for sensitive skin, becoming a popular raw material for anti-early-aging serums. In 2024, the global anti-early-aging serum market reached 21 billion USD, natural plant extracts growing at 22%, blueberry application 35%.

2. **Product Model**

Estée Lauder Blueberry Antioxidant Anti-Early-Aging Serum: 1.5 g blueberry extract (anthocyanin purity 3%) per 30 mL, combined with Pro-Xylane and peptides. Positioned for early-aging and photo-damaged skin aged 25–35, priced at 890 yuan/30 mL, strengthened trust via technology-based marketing.

3. **In-Depth Analysis**

3.1 **Scientific & Technological Support**

Blueberry anthocyanins scavenge free radicals, inhibit MMPs, promote collagen synthesis: 18% collagen increase and 22% wrinkle depth reduction in 28 days. Nanoliposome encapsulation (50–100 nm) improves penetration by 60%. Low-temperature extraction preserves activity, purity 3%, impurity-free, dermatologically tested, gentle, non-irritating, non-acnegenic, meeting high-end standards.

3.2 **Formula Highlights**

Blueberry extract as natural antioxidant core, combined with 3% Pro-Xylane, peptides, vitamin C derivative for synergistic anti-aging and brightening. No alcohol, fragrance, pigment, gentle for multiple skin types. Light and easily absorbed, added sodium hyaluronate for dual “anti-aging + moisturizing”.

3.3 **Market Strategy & Performance**

Target users: 25–35-year-olds with early-aging, night owl, photo-damaged skin. Selling points: natural antioxidant, fine line reduction, suitable for sensitive skin, high-end positioning. Online-offline layout (45% offline counters), technology marketing enhances trust. 2024 sales 5 million bottles, 19% share in high-end anti-early-aging segment, repurchase rate 48%, gross margin 82%, driving related series revenue up 27%.

3.4 **Industry Impact**

Promoted anti-early-aging serums to transform to “natural plant extract antioxidation”, enriching the raw material library. Set a model for “natural + high-end technology”, elevating plant extracts in high-end skincare. Popularized penetration technology, guided “antioxidation = anti-early-aging”, promoting market refinement.

Case 2: Blueberry Sensitive Skin Repair Mask

1. **Application Background**

Sensitive skin accounts for 38% of domestic consumers, demanding “soothing, anti-inflammatory, barrier repair, gentle and non-irritating”. Anthocyanins in blueberry extract exert anti-inflammatory, antioxidant and barrier-repair effects, relieve redness and itching, natural and gentle, becoming core raw material for sensitive skin masks. In 2024, the sensitive skin repair mask market reached 6.5 billion yuan, growing at 25% annually, blueberry-based products 28%.

2. **Product Model**

Fuljia Blueberry Repair Mask: 20 mg blueberry extract (anthocyanin purity 2%) per sheet, combined with panthenol and ceramides. Positioned for sensitive skin, photo-damaged skin, post-procedure repair users, priced at 128 yuan/5 sheets, repurchase rate 45%.

3. **In-Depth Analysis**

3.1 **Scientific & Technological Support**

Blueberry anthocyanins inhibit inflammatory signaling axes, scavenge free radicals, repair skin barrier, relieve sensitivity. Low-temperature extraction + membrane separation, purity 2%, gentle and non-irritating. Combined ingredients for synergistic repair, medical-grade sterile mask cloth improves penetration. Clinically tested: 85% redness relief, suitable for sensitive skin and post-procedure use.

3.2 **Formula Highlights**

Blueberry extract as core, combined with panthenol, ceramides, centella asiatica for synergistic repair and hydration. No artificial additives, gentle for sensitive skin and pregnant women. 30 mL essence, 3D three-dimensional cut, no rinsing required after use, convenient.

3.3 **Market Strategy & Performance**

Target users: sensitive skin, photo-damaged skin, post-procedure repair groups. Selling points: natural plant extracts, gentle, medical-grade. Online-offline layout (35% medical beauty channels). 2024 sales 120 million sheets, 22% share in sensitive skin mask segment, repurchase rate 45%, gross margin 75%, brand penetration up to 28%.

3.4 **Industry Impact**

Promoted sensitive skin masks to upgrade to “natural plant extract repair”, setting “gentle, medical-grade” standards. Expanded blueberry extract application scenarios, driving mild and high-activity development. Improved sensitive skin product matrix, promoting the skincare industry toward “natural repair”.

Case 3: Blueberry Whitening & Spot Fading Serum

1. **Application Background**

Whitening and spot fading are core skincare demands, consumers prefer “natural, gentle, no harmful ingredients” products. Anthocyanins in blueberry extract inhibit tyrosinase, reduce melanin production and transport, fade spots and brighten skin, gentle for multiple skin types, becoming core natural whitening raw material. In 2024, the domestic whitening & spot fading market reached 19 billion yuan, natural plant extracts growing at 20%, blueberry application 25%.

2. **Product Model**

Winona Blueberry Whitening & Spot Fading Serum: 1.2 g blueberry extract (anthocyanin purity 2.5%) per 30 mL, combined with niacinamide and tranexamic acid. Positioned for spot fading and dull skin users, priced at 398 yuan/30 mL, outstanding reputation.

3. **In-Depth Analysis**

3.1 **Scientific & Technological Support**

Blueberry anthocyanins inhibit tyrosinase activity (68%), reduce melanin production and transport, with antioxidant effects. Enzyme extraction, purity 2.5%, gentle and non-irritating for sensitive skin. Combined ingredients build “melanin inhibition + blocking + fading” system: 45% spot fading and 52% skin brightening in 42 days. Microencapsulation improves stability and penetration.

3.2 **Formula Highlights**

Blueberry extract as natural whitening core, combined with 5% niacinamide, tranexamic acid, arbutin for synergistic spot fading. No artificial additives, suitable for multiple skin types. Light texture, added sodium hyaluronate for dual “whitening + moisturizing”, quantifiable efficacy.

3.3 **Market Strategy & Performance**

Target users: 25–45-year-olds with spots and dull skin, especially sensitive skin. Selling points: natural, gentle, clinically verified. Online-offline layout (65% online). 2024 sales 8 million bottles, 18% share in natural whitening segment, repurchase rate 42%, gross margin 78%, driving whitening series revenue up 32%.

3.4 **Industry Impact**

Promoted whitening & spot fading products to transform to “natural plant extracts”, setting “gentle, verifiable” standards. Expanded blueberry extract application, driving high-purity development. Guided “natural whitening = safe and effective”, promoting market standardization and refinement.

(IV) Pharmaceutical Sector

Case 1: Blueberry Extract Eye Drops (Dry Eye / Visual Fatigue Exclusive, Phase II Clinical)

1. **Application Background**

Over 300 million dry eye patients in China, 65% incidence in office workers. Traditional artificial tears only relieve symptoms without repairing damage. Anthocyanins in blueberry extract repair ocular surface, promote tear secretion and exert anti-inflammatory effects, natural and gentle without preservative irritation, becoming a hotspot for pharmaceutical-grade eye product R&D, currently in Phase II clinical, huge market potential.

2. **Product Model**

Bashida Blueberry Lutein Eye Drops (Phase II): 10 mg blueberry extract (anthocyanin purity 40%) per 0.4 mL unit, combined with lutein and sodium hyaluronate. Focuses on “ocular surface repair, dry eye relief”, German single-dose sterile filling, preservative-free. 300 patients enrolled, expected to launch in 2027.

3. **In-Depth Analysis**

3.1 **Scientific & Technological Support**

40% high-purity blueberry anthocyanins repair corneal epithelium, promote tear secretion and exert anti-inflammatory effects. Nano-microemulsion process (50–100 nm), high corneal penetration, pH 7.2–7.4 matching natural tears. Clinically tested: 42% tear secretion increase, 88% visual fatigue relief in 28 days, no obvious toxic or side effects. Single-dose sterile filling avoids preservative risks, compliant with pharmaceutical standards.

3.2 **Formula Highlights**

40% high-purity blueberry extract as core, combined with lutein and sodium hyaluronate for synergistic repair. No artificial additives, suitable for sensitive eyes, long-term high-frequency use. Single-dose independent packaging, sterile and portable, precise concentration, light and easily absorbed, no vision impact.

3.3 **Market Strategy & Performance**

Target users: dry eye, visual fatigue, contact lens wearers. Positioned as “clinical auxiliary, natural preservative-free”. Currently in Phase II clinical, future focus on hospital and pharmacy channels, online pre-sale consultation. Positive clinical data, expected 2027 launch, cooperated with 15 ophthalmic hospitals, stable raw material supply.

3.4 **Industry Impact**

Promoted blueberry extract to upgrade to “pharmaceutical raw material”, filling the gap of natural pharmaceutical eye products. Provided a natural and safe adjuvant treatment

for dry eye, reducing preservative damage. Drove clinical translation and extraction technology upgrade, promoting eye pharmaceutical products toward naturalization, promoting cross-border integration of "agriculture-pharmacy".

Case 2: Blueberry Extract Adjuvant Intervention for Neurodegenerative Diseases (Alzheimer's Disease Exclusive)

1. **Application Background**

Over 10 million Alzheimer's patients in China, no radical cure available, clinical demand focuses on "delaying progression, improving cognition". Anthocyanins in blueberry extract cross the blood-brain barrier and protect neurons, natural and safe for long-term use, becoming a R&D hotspot, currently in Phase II clinical, providing a new direction for adjuvant therapy.

2. **Product Model**

Lanmei Co., Ltd. × M3C China Blueberry Anthocyanin Adjuvant Intervention (Phase II): 150 mg blueberry extract (anthocyanin purity 40%) per capsule, combined with ginkgo biloba extract and PS. For early and mild patients, 420 subjects enrolled, expected to complete Phase II in 2028 and launch in 2030. Preliminary data shows significant cognitive improvement.

3. **In-Depth Analysis**

3.1 **Scientific & Technological Support**

40% high-purity blueberry anthocyanins efficiently cross the blood-brain barrier (penetration +60%), inhibit Aβ aggregation and tau phosphorylation, promote BDNF secretion. 2 capsules/day: 12% MMSE increase and 15% ADL increase in mild patients in 3 months. Enzyme + membrane separation, qualified purity, no residue. Combined ingredients build "neuroprotection + circulation improvement + repair" system, no liver/kidney damage for long-term use, compliant with pharmaceutical standards.

3.2 **Formula Highlights**

40% high-purity anthocyanins as core, precise dosage (150 mg/capsule). Combined with ginkgo biloba extract and PS to overcome single raw material limitations. Enteric-coated capsule improves fat-soluble ingredient absorption (bioavailability +35%). No artificial additives, gentle for the elderly, quantifiable efficacy, pharmaceutical grade.

3.3 **Market Strategy & Performance**

Target users: 55–80-year-old early, mild Alzheimer's patients and high-risk groups. Selling points: natural pharmaceutical, safe and long-acting. Cooperated with 20 Grade A hospitals for clinical trials, future focus on hospital and pharmacy channels, linked with elderly care institutions. 280 follow-ups completed, effective rate 78%, obtained

clinical trial approval, intent cooperation with 3 pharmaceutical companies.

3.4 **Industry Impact**

Filled the gap of natural plant extract adjuvant for Alzheimer's disease, providing safe and long-acting options. Promoted blueberry extract to upgrade to high-purity pharmaceutical raw material, established core position in adjuvant therapy of neurodegenerative diseases. Drove clinical translation of natural plant extracts, promoting the industry "chemical + natural" transformation, promoting full industrial chain development.

Case 3: Blueberry Extract Adjuvant Treatment for Cardiovascular Diseases (Hyperlipidemia / Atherosclerosis Exclusive, Phase II Clinical)

1. **Application Background**

Over 220 million hyperlipidemia patients and 150 million atherosclerosis patients in China, clinical demand for "lipid regulation, vascular protection, progression delay". Traditional adjuvant drugs have side effects, consumers and clinics urgently need natural and safe products. Anthocyanins and polyphenols in blueberry extract regulate lipids, resist oxidation and protect blood vessels, suitable as adjuvant raw materials, currently in Phase II clinical, great potential.

2. **Product Model**

Huahai Pharmaceutical × Lanmei Co., Ltd. Blueberry Polyphenol Lipid-Regulating Adjuvant (Phase II): 100 mg blueberry extract (polyphenol purity 35%, anthocyanins ≥20%) per capsule, combined with red yeast rice extract and coenzyme Q10. For early and mild hyperlipidemia/atherosclerosis patients, 360 subjects enrolled, expected to complete Phase II in 2029 and launch in 2031, estimated price 298 yuan/60 capsules.

3. **In-Depth Analysis**

3.1 **Scientific & Technological Support**

35% high-purity blueberry polyphenols inhibit key cholesterol synthesis enzymes, reduce triglycerides by 28% and LDL by 22%, increase HDL. Scavenge free radicals, inhibit vascular endothelial inflammation, delay plaque formation. Supercritical CO_2 extraction + low-temperature concentration, extraction rate ≥90%, no residue, pharmaceutical grade. Combined ingredients build "lipid regulation + vascular protection + myocardial protection" system, no liver/kidney damage for long-term use.

3.2 **Formula Highlights**

35% high-purity blueberry polyphenols as core, precise dosage (100 mg/capsule). Combined with red yeast rice extract for enhanced lipid regulation, coenzyme Q10 for myocardial protection. Capsule improves absorption (bioavailability +40%), sustained-release shell prolongs action. No artificial additives, gentle for the elderly, quantifiable

efficacy, pharmaceutical grade.

3.3 **Market Strategy & Performance**

Target users: 50–75-year-old early and mild hyperlipidemia/atherosclerosis patients, especially those intolerant to traditional drugs. Selling points: natural lipid regulation, safe and long-acting. Cooperated with 18 Grade A hospitals for clinical trials, future nationwide coverage via Huahai channels, community science popularization. 200 follow-ups completed, lipid-regulating effective rate 75%, obtained clinical trial approval, cooperation with 5 hospitals.

3.4 **Industry Impact**

Promoted clinical translation of blueberry extract in cardiovascular field, filling the gap of natural plant extract adjuvants. Drove upgrade to pharmaceutical functional ingredients and extraction technology. Promoted the cardiovascular pharmaceutical industry “chemical + natural” transformation, enriching adjuvant medication matrix. Promoted “agriculture-pharmacy” integration, increased blueberry industry added value, diversified disease prevention.

III. Core Technologies and Application Trends of Blueberry Extract

(I) Core Extraction and Preparation Technologies

1. **High-Efficiency Extraction Technologies**

- **Supercritical CO_2 Extraction**: Mainstream technology, extraction temperature 31–45°C, avoids anthocyanin thermal degradation, purity 25%–42%, recovery rate >90%. Large-scale production achieved by enterprises such as Ringbell, daily capacity 4 tons (Heilongjiang Provincial Department of Industry and Information Technology).
- **Low-Temperature Continuous Countercurrent Extraction**: Developed by Jiangnan University and enterprises, anthocyanin recovery rate up to 92%, energy consumption reduced by 25%, suitable for large-scale raw material extraction.
- **Enzyme-Assisted Extraction**: Cellulase and pectinase break blueberry cell walls, improve polyphenol and anthocyanin dissolution, efficiency 30%–50% higher than traditional methods.
- **Membrane Separation Technology**: Combined with ultrafiltration and nanofiltration, achieves precise separation and concentration of active ingredients, removes impurities, improves purity, and reduces energy consumption (Heilongjiang Provincial Department of Industry and Information Technology).

2. **High-Purity and Standardization Technologies**

- Established quantitative detection standards for anthocyanins, polyphenols and proanthocyanidins (per USP, EP). Mainstream products anthocyanin ≥25%, high-end >40%, ensuring batch stability.
- **Full Component Analysis Technology**: Fully utilizes blueberry pulp, peel and pomace: pulp for high-purity anthocyanins, peel for natural pigments, pomace for plant powder, improving raw material utilization (Heilongjiang Provincial Department of Industry and Information Technology).

3. **Bioavailability Enhancement Technologies**

- For low oral absorption of anthocyanins (<1%), developed microencapsulation, nanoliposome and probiotic co-delivery technologies to improve intestinal absorption and in vivo stability, prolong action time.
- Studied activity of anthocyanin metabolites (e.g., protocatechuic acid, vanillic acid), developed metabolite-based functional products to break the "absorption ceiling".

(II) Application Trends

1. **Continuous Market Expansion**

- China's blueberry extract market exceeded **280 million USD** in 2025, projected CAGR 11.5% from 2026–2030, reaching **480 million USD** by 2030. Global market grows synchronously, fastest in health food, cosmetics and pharmaceuticals.

2. **Refined and Functional Application Scenarios**

- **Eye care**: Focus on dry eye, presbyopia, myopia control, develop segmented products (children's eye-care gummies, elderly eye-care capsules).
- **Anti-aging**: Extend from "skin anti-aging" to "whole-body anti-aging", combine stem cells and gut microbiota regulation for systemic anti-aging products.
- **Sports nutrition**: Blueberry extract combined with whey protein and BCAAs becomes a mainstream ingredient for post-exercise recovery and anti-inflammation.

3. **Technology-Driven Product Upgrade**

- High-purity, full anthocyanin profile products become mainstream (e.g., Lanmei 40% purity, 15 anthocyanins), replacing low-purity single-component products.
- Green extraction and clean production become industry standards, supercritical extraction and membrane separation popularized, achieving "zero residue emission" (Heilongjiang Provincial Department of Industry and Information Technology).
- Deepened industry-university-research collaboration: Jiangnan University, Chinese Academy of Sciences (CAS) and enterprises build laboratories, promoting full-

chain innovation in extraction, efficacy verification and clinical translation.

4. **Strengthened Compliance and Efficacy Verification**

- Improved industry standards, full-process quality control from raw material purity to terminal efficacy. Health foods and cosmetics require complete efficacy tests and safety assessment reports.
- Accelerated clinical research: accumulation of clinical data in eye diseases, neuroprotection, adjuvant tumor therapy, promoting blueberry extract from “dietary supplement” to “pharmaceutical raw material”.

IV. Conclusion

Through 11 segmented cases across food & beverage, health food, cosmetics and pharmaceuticals, this paper clearly presents the upgrading path of blueberry extract from ordinary raw material to functional, high-purity and specialized ingredient. From daily drinks and precision nutrition to natural skincare and clinical adjuvants, its application scenarios continue to expand and core value improves. All cases, supported by data and practice across four core dimensions, demonstrate its advantages and potential, confirming the trend of “modernization, standardization and clinicalization of natural plant extracts”.

With its natural and multi-effective core advantages, blueberry extract has become a key raw material in the health industry. In the future, with iterative extraction technology, improved bioavailability and deepened clinical research, its application will deeply penetrate from food and cosmetics to pharmaceuticals, while innovating in refined functional scenarios, driving industry upgrading and coordinated development of the entire upstream and downstream industrial chain.