LICORICE ROOT

A Multifunctional Botanical Ingredient for Dietary Supplements, Food, Flavor, and Cosmeceuticals

An educational B2B white paper for ingredient buyers, formulators, product developers, and quality professionals

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Executive Summary

Licorice root, principally derived from species of the genus Glycyrrhiza and especially Glycyrrhiza glabra L., is one of the world's longest-established botanical ingredients. Its commercial value is unusual because one plant can serve several industrial functions: a traditional botanical medicine and dietary-supplement ingredient; a natural sweetening and flavoring material for foods and beverages; a source of specialized polyphenols for cosmetics and cosmeceuticals; and a component of aroma systems associated with the characteristic "licorice" sensory profile. The chemistry underlying these applications is correspondingly diverse. Triterpenoid saponins, particularly glycyrrhizin, provide intense sweetness and much of the root's pharmacological profile, while flavonoids and prenylated phenolics such as glabridin and glabrene are of particular interest in skin-care and phytoestrogen research. Licorice polysaccharides add another class of macromolecular constituents with emerging functional and formulation interest.

For B2B ingredient buyers, licorice should therefore not be treated as a single-constituent commodity. Species identity, geographic origin, harvest conditions, root age, processing, extraction solvent, standardization, and contaminant controls can materially affect the resulting chemical profile. The same glycyrrhizin that makes licorice valuable as a sweetener also explains why concentrated or excessive oral exposure can produce a mineralocorticoid-like syndrome characterized by sodium retention, potassium loss, hypertension, edema, and, in severe cases, cardiac or neuromuscular complications. Responsible product development requires both appreciation of licorice's functionality and disciplined control of exposure.

1. A Botanical Ingredient with an Ancient Global History

Licorice has been used by human societies for centuries, and probably millennia, before the modern dietary-supplement, food-additive, and cosmetic industries existed. Historical reviews trace documented medicinal use to ancient Assyrian, Egyptian, Chinese, Indian, Greek, and Roman traditions. Greek writers including Theophrastus and Dioscorides described licorice as a useful medicinal plant; the botanical name Glycyrrhiza is derived from Greek words associated with a "sweet root." European traditions employed the root for coughs, throat irritation, digestive complaints, and as a thirst-quenching preparation. Traditional Chinese medicine incorporated licorice extensively into formulas, while South Asian traditions used it for respiratory and gastrointestinal purposes. [1–3]

Over time, these traditional uses expanded into commercial applications. Concentrated licorice extracts became useful in confectionery, beverages, tobacco, chewing gum, and flavor systems because glycyrrhizin is intensely sweet and licorice extracts contribute characteristic color, body, and aroma. Licorice also entered topical preparations because its flavonoid-rich fractions can influence inflammatory and melanogenic pathways. Modern ingredient technology has further separated the plant into standardized fractions—glycyrrhizin-rich extracts, deglycyrrhizinated preparations, flavonoid-rich extracts, glabridin concentrates, and polysaccharide fractions—allowing manufacturers to select chemistry appropriate to the intended application.

Botanically, Glycyrrhiza glabra is a perennial member of the Fabaceae family. Its native range extends across broad portions of Eurasia and western Asia, including the Transcaucasus and Central Asia. The genus contains multiple species of commercial and medicinal interest, so species authentication is an important quality consideration. [4]

2. Chemistry: More Than a Sweet Root

The chemical composition of licorice root is complex. Its major bioactive groups include triterpenoid saponins, flavonoids and other polyphenols, polysaccharides, coumarins, chalcones, and smaller quantities of volatile and semi-volatile compounds. The relative abundance of these constituents varies with species, cultivar or chemotype, geographic origin, soil, climate, harvest stage, storage, and extraction method. Consequently, "licorice extract" is not a chemically uniform specification unless the manufacturer defines the botanical identity and analytical standardization.

2.1 Glycyrrhizin: The Principal Sweet Triterpenoid Saponin

Glycyrrhizin is the principal commercially important triterpenoid saponin of licorice. The terms glycyrrhizin, glycyrrhizic acid, and glycyrrhizinic acid are commonly encountered as synonymous or near-synonymous names in scientific and commercial literature; glycyrrhizin is also frequently abbreviated GL. Chemically, it is a glycoside of the triterpenoid aglycone 18β-glycyrrhetinic acid (18β-glycyrrhetic acid), with a sugar moiety consisting of glucuronic acid units. In regulatory and analytical documentation, buyers should confirm exactly which

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chemical form and assay convention is being reported rather than assuming that all "glycyrrhizin" values are directly interchangeable. [5,6]

Glycyrrhizin can be roughly 50–150 times sweeter than sucrose by weight, depending on the comparison method and matrix. This exceptional sweetness explains its historical and continuing importance in foods, confectionery, beverages, tobacco-related products, and flavor systems. It is also a major pharmacologically active constituent of licorice, which is why a material optimized for sweetening cannot automatically be treated as equivalent to a low-glycyrrhizin or deglycyrrhizinated botanical extract.

After oral ingestion, intestinal bacteria hydrolyze glycyrrhizin to metabolites including 18β-glycyrrhetinic acid. These metabolites can inhibit renal 11β-hydroxysteroid dehydrogenase type 2 (11β-HSD2), the enzyme that normally converts cortisol to cortisone in mineralocorticoid-sensitive tissues. The resulting increase in cortisol activity at mineralocorticoid receptors provides the biochemical basis for licorice-induced pseudoaldosteronism. [5,7]

2.2 Glabridin and Glabrene

Glabridin is a prenylated isoflavan found in licorice root, particularly in Glycyrrhiza glabra. It is one of the most commercially interesting licorice polyphenols for topical and cosmetic applications. Experimental studies have shown that glabridin can inhibit tyrosinase, an enzyme central to melanin biosynthesis, and can influence several signaling pathways involved in melanogenesis and inflammation. Recent research continues to identify glabridin as a principal contributor to the depigmenting activity of G. glabra extracts, although formulation stability, aqueous solubility, skin penetration, and clinical efficacy remain important development considerations. [8,9]

Glabrene is a related prenylated isoflavene/isoflavonoid constituent. It has attracted attention for two reasons: its ability to inhibit tyrosinase-dependent melanin formation in experimental models and its estrogen-receptor activity in cell-based systems. Research has shown that glabrene and isoliquiritigenin inhibit tyrosinase activity and melanin formation in melanocyte models. Glabrene-rich licorice fractions have also demonstrated estrogenic responses, especially through ERα in certain experimental systems. These findings help explain the broad interest in licorice as a source of bioactive polyphenols, but they should not be translated automatically into clinical hormone claims. [10,11]

2.3 Triterpenoids, Polyphenols, and Polysaccharides

Beyond glycyrrhizin, licorice contains triterpenoid constituents and a broad spectrum of flavonoids, isoflavonoids, chalcones, and related polyphenols. Reported compounds include liquiritin, liquiritigenin, isoliquiritin, isoliquiritigenin, licochalcones, glabridin, glabrene, and numerous additional phenolic constituents. Their relative abundance depends strongly on extraction conditions and plant material. This chemical diversity is relevant to manufacturers seeking antioxidant, anti-inflammatory, antimicrobial, or skin-care positioning, but the strength of evidence differs considerably among individual compounds and indications. [1,12]

Licorice also contains polysaccharides composed principally of monosaccharides such as arabinose, glucose, galactose, rhamnose, mannose, xylose, and galacturonic acid in varying

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ratios and structural arrangements. Research on Glycyrrhiza polysaccharides has reported antioxidant, immune-modulatory, antimicrobial, anti-inflammatory, and intestinal-microbiota-related activities in experimental systems. For ingredient developers, these macromolecules represent a different functional fraction from glycyrrhizin and flavonoids and may contribute to the physical and biological properties of aqueous or polysaccharide-rich extracts. [13]

3. Dietary Supplements and Natural Botanical Medicine

Licorice has a long history as a botanical medicine and remains relevant to the modern dietary-supplement industry. Traditional and experimental uses have centered on the gastrointestinal tract, respiratory system, oral health, inflammatory conditions, and general botanical support. Modern reviews describe anti-inflammatory, antioxidant, antimicrobial, antiviral, and other activities for licorice extracts and isolated constituents. However, evidence ranges from traditional use and in-vitro experiments to animal studies and human clinical trials; a commercial white paper should therefore distinguish mechanistic potential from demonstrated clinical efficacy. [1,2]

Two broad ingredient strategies are particularly important. A glycyrrhizin-containing extract retains the characteristic chemistry of whole licorice and can be useful when the formulation specifically calls for the traditional botanical profile. A deglycyrrhizinated licorice (DGL) material, by contrast, reduces or removes much of the glycyrrhizin fraction and is selected when developers want licorice-derived constituents while limiting systemic glycyrrhizin exposure. These materials should not be considered interchangeable from either a pharmacological or analytical standpoint.

4. Licorice as a Natural Sweetener in Food

The food industry has used licorice extracts for sweetness, flavor, color, and formulation character. Glycyrrhizin is responsible for the characteristic intense sweetness, while the root's broader extract contributes a more complex sensory profile. Concentrated extracts may be supplied as liquids, syrups, pastes, blocks, powders, or standardized preparations. They have been used in confectionery, beverages, chewing gum, dark beers, tobacco-related products, and other flavored foods. [1,14]

From a formulation standpoint, licorice can function as both a flavor-active and sweet-tasting botanical. Its sweetness profile differs from sucrose, and the extract can produce lingering and characteristic sensory notes. This can be advantageous where a manufacturer wants a recognizable botanical identity rather than a purely caloric sweetener. At the same time, glycyrrhizin concentration must be controlled because food use can contribute materially to total dietary exposure.

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5. Anethole and the Flavoring Sector

An important terminology distinction is necessary. The familiar "licorice" aroma of many foods is strongly associated with trans-anethole, an aromatic ether that is abundant in anise, star anise, and fennel. Licorice root itself can contain anethole at very low levels, but anethole is not the principal sweet constituent of Glycyrrhiza glabra. Glycyrrhizin supplies the intense sweetness; anethole supplies an anise-like aromatic character. Commercial licorice-flavored products frequently use anethole-containing anise or fennel flavor materials, either alongside licorice extract or as part of a flavor system designed to reproduce the expected sensory profile. [14,15]
For flavor houses, this distinction matters because a buyer specifying "licorice flavor" may actually require a combination of botanical extract, glycyrrhizin-derived sweetness, and anethole-rich aroma chemistry. Anethole is also widely used in flavor formulations beyond licorice, including confectionery, beverages, oral-care products, and other applications where anise-like, sweet, warm, or herbaceous notes are desired. The raw-material specification should therefore identify whether the requested material is licorice root, licorice extract, anethole, or a finished flavor system.

6. Cosmeceutical and Skin-Care Applications

Licorice is especially well established as a botanical source for skin-brightening and depigmenting ingredients. Glabridin and glabrene are central to this interest, together with other flavonoids and chalcones such as isoliquiritigenin. Experimental research demonstrates that these compounds can inhibit tyrosinase and reduce melanin formation. More recent work suggests that glabridin may affect multiple stages of melanogenesis, including transcriptional regulation and melanosome-related pathways, while also modulating inflammatory signaling. [8–10]

In commercial cosmeceutical development, "skin whitening" is increasingly framed as skin brightening, tone-evening, reduction of the appearance of hyperpigmentation, or support for a more uniform complexion. The choice of terminology should follow the intended market's regulatory requirements. Glabridin-rich fractions can be attractive where a formulator wants a defined marker compound, while broader licorice extracts may provide a more complex spectrum of polyphenols. Formulation science is critical because glabridin has limited aqueous solubility and bioavailability; delivery system, solvent, pH, light exposure, oxidation control, and packaging can influence performance.

7. Phytoestrogen Properties: A Relevant but Nuanced Feature

Licorice contains several flavonoids and isoflavonoids capable of interacting with estrogen receptors or estrogen-responsive biological systems. Experimental studies have identified liquiritigenin, isoliquiritigenin, glabrene, and other constituents with estrogenic or anti-estrogenic activity. Some fractions display receptor-mediated responses, while individual compounds can differ substantially in potency and receptor selectivity. [11,16]

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These findings support describing licorice as containing phytoestrogenic constituents, but the term should not be interpreted as evidence that ordinary licorice consumption is equivalent to estrogen therapy. Human pharmacokinetics, dose, extract composition, metabolism, receptor selectivity, and tissue exposure all matter. For products intended for hormonally sensitive populations, ingredient standardization and appropriate safety assessment are particularly important.

8. Sodium, Potassium, Blood Pressure, and Excess Consumption

The principal safety issue associated with conventional glycyrrhizin-containing licorice is excessive or prolonged exposure. Glycyrrhizin metabolites inhibit 11β-HSD2, allowing cortisol to exert greater mineralocorticoid-like effects at the kidney. The physiological result can include increased sodium retention and increased potassium excretion. Consequently, excessive licorice consumption can produce hypertension and hypokalemia—low serum potassium—along with fluid retention and edema. [5,7,17]

Reported manifestations of licorice-induced pseudoaldosteronism include headache, weakness, fatigue, muscle pain or weakness, cramps, thirst, edema, elevated blood pressure, and cardiac rhythm disturbances. More severe hypokalemia can cause paralysis, marked muscle dysfunction, electrocardiographic abnormalities, and potentially life-threatening arrhythmias. Metabolic alkalosis and increased urinary potassium loss have also been documented. Effects generally improve after cessation, but recovery can require medical management in severe cases. [17,18]

Risk is influenced by dose and duration as well as individual susceptibility. People with hypertension, cardiovascular disease, kidney disease, pre-existing electrolyte abnormalities, or conditions affected by mineralocorticoid activity may be particularly vulnerable. Potential interactions with diuretics, corticosteroids, antihypertensives, digoxin, and other medicines also warrant professional review. Pregnancy is another setting in which high licorice exposure should be approached cautiously. [2,18]

For B2B developers, the practical implication is straightforward: glycyrrhizin should be treated as an analytically controlled active constituent, not simply as a marker of botanical identity. Specifications should state assay methodology and target range, and finished-product exposure should be evaluated against the intended use, serving size, duration, and applicable regulatory requirements. Deglycyrrhizinated materials can be considered when the formulation objective does not require glycyrrhizin.

9. Quality, Traceability, and the South Caucasus Opportunity

Glycyrrhiza glabra is native to the Caucasus, including Georgia, Armenia, and Azerbaijan, as well as to broad areas extending through western Asia and Central Asia. The South Caucasus is therefore not merely a trading location for licorice; it is part of the plant's documented native geographic range. [4]

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For premium B2B sourcing, this geographic provenance can be commercially meaningful when it is supported by documented collection areas, botanical authentication, harvest controls, traceability, and analytical testing. South Caucasian material can offer a compelling proposition where roots are sourced from appropriately selected, relatively low-impact collection areas rather than from locations affected by intensive industry, mining, wastewater irrigation, or contaminated soils. The quality advantage should therefore be expressed as a controlled sourcing proposition, not as an unsupported assumption that every South Caucasian root is automatically contaminant-free.

This distinction is especially important for root botanicals because roots are in direct contact with soil and can accumulate contaminants. Scientific reviews emphasize that medicinal plants can acquire lead, cadmium, arsenic, mercury, and other potentially toxic elements through soil uptake, atmospheric deposition, irrigation water, or processing contamination. Consequently, a high-quality supplier should establish a sampling plan and routinely test representative lots using validated analytical methods such as ICP-MS or ICP-OES, as appropriate. [19]

A South Caucasus sourcing program can be designed around geographic traceability: defined harvest zones; avoidance of industrial and mining sites; assessment of soil and irrigation or groundwater where relevant; controlled drying and storage; botanical authentication; microbial testing; pesticide-residue testing where required; and heavy-metal panels covering at minimum lead, cadmium, arsenic, and mercury. This approach provides a stronger quality argument than geography alone.

10. Challenges Associated with Alternative Central and South Asian Supply Chains

Licorice is also native to Uzbekistan, Kazakhstan, Afghanistan, and other parts of Central and Western Asia, so these countries are legitimate botanical sources. However, origin alone cannot determine quality. Several regional environmental conditions illustrate why location-specific due diligence is essential.

In Uzbekistan and the broader Aral Sea basin, decades of intensive irrigation and Soviet-era agricultural practices have produced severe environmental degradation in some areas, including salinity, pesticide residues, and localized trace-element contamination. Recent environmental sampling in Karakalpakstan documented substantial organochlorine-pesticide concerns and elevated salinity, while research in the Aral region has identified localized accumulation of several metals. These findings do not mean that Uzbek licorice is inherently contaminated; they mean that collection geography and lot-specific testing are important. [20,21]

Kazakhstan likewise contains both clean agricultural and wild-collection environments and areas with substantial industrial and mining legacies. Research in East Kazakhstan has documented extremely elevated concentrations of lead, cadmium, zinc, and copper in soils around long-term mining and metallurgical activity. Studies of agricultural soils elsewhere in Kazakhstan have also identified areas with elevated ecological risk from metals including arsenic, cadmium, mercury, and lead. A responsible buyer should therefore distinguish

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remote collection areas from industrially influenced landscapes and require analytical verification rather than relying solely on country-of-origin documentation. [22,23]

Afghanistan presents a different combination of challenges. Environmental monitoring in Kandahar has demonstrated heavy-metal accumulation in soils and crops associated with wastewater irrigation and naturally mineralized groundwater, including elevated lead. Infrastructure, water-quality variability, fragmented supply chains, and limited access to consistent analytical and traceability systems can further complicate procurement. Again, these conditions do not make Afghan licorice categorically unsuitable; they make source-zone verification, chain-of-custody documentation, and independent testing particularly important. [24]

Accordingly, the strongest commercial distinction for South Caucasian licorice is not the claim that geography by itself guarantees the lowest heavy-metal burden. Rather, it is the combination of native botanical provenance, carefully selected collection areas, transparent traceability, and documented analytical control. When those elements are demonstrated, South Caucasus-origin licorice can be positioned as a premium botanical raw material with a credible low-contamination risk profile relative to material collected from known industrial, mining, or wastewater-affected areas.

11. What B2B Buyers Should Specify

For dietary-supplement, food, flavor, and cosmeceutical applications, a robust licorice-root specification should include more than botanical name and country of origin. Buyers should consider specifying:

- Botanical identity to species level, with authentication appropriate to the risk profile.
- Plant part: root and/or stolon, with clear definitions for whole root, cut root, chips, powder, or other grades.
- Geographic origin and harvest/collection zone, supported by traceability records.
- Harvest year or season and post-harvest handling conditions.
- Glycyrrhizin assay and analytical method where relevant to the intended application.
- Target marker compounds such as glabridin for cosmetic applications when a standardized extract is required.
- Moisture, foreign matter, microbial limits, and other basic quality parameters.
- Pesticide-residue testing appropriate to the intended market.
- Heavy-metal testing, preferably by ICP-MS or another validated elemental method.
- Identity and purity documentation, including certificate of analysis and batch/lot traceability.
- Extraction ratio, solvent system, and DER where the product is an extract rather than raw root.
- Regulatory and allergen documentation appropriate to the destination market.

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12. Conclusion

Licorice root is a rare example of a botanical raw material whose commercial relevance spans multiple industries without relying on a single application. Its traditional medicinal history has evolved into modern dietary-supplement development; its glycyrrhizin content makes it a powerful natural sweetening and flavoring material; its broader extract chemistry supports flavor and aroma systems; and its prenylated polyphenols, particularly glabridin and glabrene, have made licorice a significant botanical source for contemporary skin-brightening and cosmeceutical research. Its polysaccharides and wider flavonoid spectrum add further opportunities for functional-food and botanical innovation.

The same chemical complexity demands disciplined sourcing. Glycyrrhizin is valuable, but excessive oral exposure can disturb sodium and potassium homeostasis through mineralocorticoid-like activity. Glabridin and glabrene are commercially interesting, but their biological activities require appropriate characterization and formulation. And because roots interact directly with soil, geographic provenance must be supported by contaminant testing rather than used as a substitute for quality assurance.

For ingredient buyers seeking a premium botanical supply, South Caucasus-origin licorice offers a particularly interesting proposition because G. glabra is native to the region and the area contains established botanical resources. The strongest proposition is a traceable, responsibly harvested, analytically verified raw material sourced from defined low-impact collection zones. When combined with standardized glycyrrhizin or polyphenol specifications, rigorous heavy-metal and pesticide controls, and documented chain of custody, South Caucasian licorice can serve as a high-value B2B ingredient for dietary supplements, food and flavor applications, and modern cosmeceutical formulations.

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B2B Ingredient-Development Note

This paper is intended for educational and commercial ingredient-development purposes. It is not a medical treatment guideline, does not establish a recommended daily intake, and should not be used to substantiate disease-treatment claims. Final specifications, claims, labeling, and permitted uses should be evaluated against the laws and regulatory requirements of the destination market and the actual analytical profile of the supplied material.

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