Analysis of Unique Properties of Mogrosides

Overview

Mogrosides (also known as Siraitia grosvenorii Saponin, Mogroside V, CAS: 88901-36-4) is a natural triterpenoid glycoside high-intensity sweetener extracted and refined from the fruit of *Siraitia grosvenorii*, a plant of the Cucurbitaceae family. The core sweet component is **Mogroside V**, with the chemical structure: **(2R,3R,4S,5S,6R)-2-[[(2S,3S,4S,5R,6R)-6-[[(3S,8S,9R,10R,11R,13R,14S,17R)-17-[(2R,5R)-5-(hydroxymethyl)-2-(2-hydroxypropyl)-1,3-dioxan-5-yl]hexadecahydro-3,6,6,12,12,14-hexamethyl-8,10-epoxybenzocycloocten-9-yl]oxy]-3,4,5-trihydroxytetrahydropyran-2-yl]methoxy]-6-(hydroxymethyl)tetrahydropyran-3,4,5-triol**.

It is uniquely and naturally present in Siraitia grosvenorii, a specialty of Guangxi, China. The main industrial source is refined from fresh Siraitia grosvenorii fruits via water boiling extraction, membrane separation, purification and concentration, and spray drying. Since the 1990s, it has obtained regulatory recognition from global authoritative institutions including China, the United States, the European Union and JECFA. It is a natural multi-functional sweet raw material with zero calorie, ultra-high sweetness, thermal and acid-base stability, pure flavor, anti-caries property and medicinal and edible homology.

It possesses core advantages such as nearly zero calorie, zero glycemic rise, extreme thermal stability, broad-spectrum acid and alkali resistance, pure sweetness, no after-bitterness, anti-caries and anti-oxidation. It serves as a high-end natural sugar substitute in the fields of sugar-free and sugar-reduced food, functional beverages, baked goods, infant food, middle-aged and elderly health products, and oral care. It has irreplaceable natural sweetening value especially in sugar-controlled food, healthy beverages and high-end confectionery.

I. Physicochemical Characteristics

1. Basic Chemical Information

- Chinese Name: Mogrosides (Siraitia grosvenorii Saponin, Mogroside V, Total Mogrosides)
- English Name: Mogrosides (Mogroside V, Luo Han Guo Extract, Monk Fruit Extract)
- Molecular Formula: $C_{60}H_{102}O_{29}$ (Mogroside V)
- Molecular Weight: 1287.43 (Mogroside V)
- Structure: Cucurbitane-type tetracyclic triterpenoid glycoside, the molecule contains multiple glucosyl side chains without reducing aldehyde groups, belonging to non-sugar natural sweet substances
- Source: 100% derived from the fruit of Siraitia grosvenorii, a specialty of Guangxi, China. Industrially made from mature fresh fruits through water extraction, purification, concentration and drying, mainly in powder form (high-purity grade is white/off-white, regular grade is light yellow to brown)

2. Sensory and Physical Properties

- Appearance: White / light yellow / yellow to light brown crystalline powder, odorless or slightly with Siraitia grosvenorii fragrance, good fluidity
- Sweetness: 250–350 times that of sucrose (based on 100% sucrose); among them, the sweetness of Mogroside V is about 300 times of sucrose

- Sweetness Quality: Pure sweetness close to sucrose, no after-bitterness, no metallic taste, no peculiar odor, long-lasting sweet sensation and mellow taste
- Cool Sensation: Slight cool and sweet aftertaste on entry, no strong irritating cool feeling, soft and natural flavor
- Solubility: Easily soluble in water (good solubility at 25℃) , hot water and dilute ethanol; slightly soluble in methanol; insoluble in ether, chloroform and acetone
- Melting Point: 197–201℃ (decomposition, high-purity Mogroside V)
- Calorie Value: ≈0 kcal/g (nearly zero), only 0–2% of sucrose in calories
- Density: Relative density of approximately 1.51 (20℃)
- Hygroscopicity: Low hygroscopicity, not easy to absorb moisture and agglomerate under conventional humidity with excellent storage stability

3. Stability

- Thermal Stability: Ultra-high temperature stability (no decomposition under long-term heating ≤120℃); no deterioration after heating neutral aqueous solution at 100℃ for 25h, suitable for high-temperature sterilization, spray drying, baking and sugar boiling
- pH Stability: Broad-spectrum stable at pH 2.0–10.0, resistant to strong acid and strong alkali, compatible with various acidic beverages, neutral food and alkaline systems
- Maillard Reaction: Free of reducing aldehyde groups, completely free from Maillard browning, maintaining the original color and clarity of products
- Caramelization: No caramelization or coloration at high temperature, meeting the appearance requirements of white confectionery, transparent beverages and high-end food
- Hygroscopicity: Low moisture absorption, anti-caking and anti-adhesion, keeping powder loose and fluid stable during long-term storage
- Crystallinity: High-purity products feature good crystallinity, high purity and superior fluidity, suitable for solid beverages, tablet candies and powdered food
- Antioxidation: Strong antioxidant capacity, not easily oxidized by air, light-resistant and microbial fermentation-resistant with an extremely long shelf life
- Compatibility Stability: No incompatibility with acids, alkalis, salts, flavors, pigments, proteins, vitamins and pharmaceuticals, compatible with all types of food formulations

II. Functional Characteristics

1. Metabolic Properties:

Zero Calorie, Zero Glycemic Rise, Non-insulin Dependent, Not Absorbed by the Body

- GI Value = 0: Zero glycemic effect, does not cause blood sugar fluctuations or stimulate insulin secretion, an ideal sugar substitute for diabetics, sugar-controlled population and ketogenic dieters
- Zero Calorie: Barely absorbed by the human small intestine, directly excreted through the intestines without generating calories or converting into fat, the optimal choice for weight control and fat loss
- Non-fermentable: Not fermented by harmful bacteria in the intestines, causing no flatulence or diarrhea, with better gastrointestinal tolerance than most sugar alcohols

- Medicinal and Edible Homology: Possesses traditional effects of moistening the lung to relieve cough and promoting fluid production to soothe the throat, complying with China's medicinal and edible homology standards with high health added value

2. Flavor Properties:

Pure Sweet Sensation, Flavor Modification, No Unpleasant Aftertaste

- Pure Sucrose Taste: Sweetness curve close to sucrose with no astringency, after-bitterness or metallic taste, extremely high consumer acceptance
- Flavor Optimization: Covers astringency, bitterness and sourness, enhances the mellow sense of sweetness and improves the overall flavor coordination of food
- No Odor Interference: Does not change the original flavor of food, adapting to the flavor demands of beverages, baked goods, confectionery, dairy products and other full categories
- Compound Advantages: Compound with erythritol, steviol glycoside and xylitol to complement flavors, cover aftertaste and optimize sweet sensation, realizing high-end sugar-free formulations

3. Processing Properties:

High Stability, Low Dosage, Full Process Adaptability, Anti-caries

- Ultra-high Sweetness: A minimal dosage (0.01–0.1%) can achieve the required sweetness, greatly reducing costs and addition amount
- Full-process Adaptability: Suitable for high-temperature baking, boiling and sugar boiling, acidic beverages, frozen food, solid tableting, spray drying and all other processing scenarios
- Anti-caries: Cannot be utilized by oral cariogenic bacteria or produce acidic substances, protecting enamel and preferred for children's food and oral care
- Preservation Stability: Inhibits microbial reproduction, delays food deterioration and extends product shelf life

4. Safety Properties:

Non-toxic Grade, No Accumulation, Liver and Kidney Friendly, Non-teratogenic and Non-carcinogenic

- Toxicological Safety: LD_{50} > 10g/kg bw (oral administration in rats), practically non-toxic grade and safe for long-term consumption
- No Accumulation: Not absorbed, metabolized or accumulated in the body, excreted in prototype form without metabolic residue
- Liver and Kidney Safety: Does not increase metabolic burden on the liver and kidneys, safe for patients with kidney and liver diseases
- Genetic Safety: No risk of carcinogenicity, teratogenicity or mutagenicity, passing multiple rounds of global toxicological safety assessments
- Wide Population Adaptability: Safe for infants, pregnant women, lactating women and middle-aged and elderly people with an extremely wide scope of application

III. Unique Performance

1. Taste: Ultra-high Sweetness, Pure Sucrose Flavor, Zero After-bitterness, Natural Mellow Taste

- King of Sweetness: Top-tier sweetness among natural sweeteners (300 times of sucrose), extremely low dosage with strong sweet sensation and reduced addition cost
- Pure and Impurity-free: The only natural high-potency sweetener close to sucrose in taste, free from stevia after-bitterness and sugar alcohol cooling irritation with optimal flavor
- Long-lasting Sweetness: Gentle sweet release and lingering aftertaste, improving the taste hierarchy and palatability of food
- Universal Flavor Adaptation: Compatible with sweet-sour, salty-sweet, pure sweet and other flavor systems without flavor conflict or cross-taste, optimizing overall taste

2. Processing:

Ultra-stable Temperature Resistance, Broad-spectrum Acid-base Resistance, Zero Browning, Low Moisture Absorption, Full Compatibility

- Extreme Stability: Stable under high temperature ≤120℃ and pH 2–10 acid-base environment, fully adaptable to all food processing technologies
- Zero Browning & Zero Coloration: Free from Maillard reaction and caramelization, permanently maintaining the original color/transparency of products, the first choice for high-end food appearance
- Low Moisture Absorption & Anti-caking: Superior to most sugar alcohols and natural sweeteners, ensuring more stable storage of powder products, solid beverages and tablet candies
- Extremely Low Dosage: Due to high-potency sweetness, the addition amount is only 1/300 of sucrose, greatly reducing formula volume without affecting product texture
- Full Formula Compatibility: Perfectly compatible with various food raw materials, additives and nutrient fortifiers with no incompatibility

3. Health:

Zero Calorie, Zero Glycemic Rise, Anti-caries, Antioxidation, Medicinal and Edible Homology, Dual Value

- Zero Calorie for Weight Control: Genuine zero calorie, the core choice for sugar control, weight management, fat loss and fitness groups with no metabolic burden
- Zero GI Safety: Completely safe for diabetics, hyperglycemic patients and insulin resistance groups with zero blood sugar fluctuation
- Triple Health Value: Zero glycemic rise + zero calorie + strong anti-caries performance, delivering triple benefits of children's caries prevention, sugar-controlled tooth protection and healthy diet
- Natural Antioxidation: Scavenges free radicals, delays aging and protects cells, possessing dual functions of sweetening and nutritional health care
- Medicinal and Edible Homology: A traditional Chinese medicinal and edible substance with dual attributes of sweetening and health care, its health added value far exceeds ordinary sweeteners

4. Regulation & Safety (Global Authoritative Recognition)

- China:

  Approved by GB 2760-2024, CNS 19.015, allowed for appropriate use according to production needs with no maximum limit; quality standard specified in GB 1886.77-2016; included in the medicinal and edible homology catalog in 2002

- United States:

  FDA GRAS certification (2016), permitted for use in all types of food, beverages and infant food with no intake limit

- European Union:

  Passed EFSA safety assessment, approved as a food sweetener and widely allowed for application in the food industry

- JECFA:

  No specified ADI value, the highest safety grade with no daily intake restriction

- Global Recognition:

  Approved by more than 40 countries and regions, with a century-old edible history, sufficient toxicological data and undisputed safety, setting a benchmark for high-end natural sugar substitutes

IV. Summary

Mogrosides is a high-end natural multi-functional sweetener native to China, derived from natural plants and featured with medicinal and edible homology, ultra-high sweetness, zero calorie, zero glycemic rise, zero browning, thermal and acid-base stability, pure flavor, anti-caries and antioxidation.

With the combined advantages of **300 times ultra-high sweetness + 0 kcal zero calorie + GI=0 zero glycemic rise + 120℃ ultra-high temperature stability + pH 2–10 broad-spectrum acid resistance + zero browning + low moisture absorption + pure sucrose taste + anti-caries + antioxidation + medicinal and edible homology**, it has become an irreplaceable core raw material in the fields of sugar-free beverages, high-end confectionery, baked goods, infant complementary food, middle-aged and elderly health products, sugar-controlled food and oral care.

It integrates multiple functions of high-potency sweetener, flavor improver, anti-caries agent, antioxidant and health care additive. Among natural sweeteners, it is the only one that owns four core strengths: pure sucrose taste, full-process processing stability, safe applicability for all crowds and medicinal and edible health value. It acts as a key core raw material for the high-end, healthy, natural and functional development of the global food industry. Its industrial value and application barriers are significantly higher than artificial sweeteners and ordinary sugar alcohols, representing the mainstream development direction of healthy sweeteners in the future.