Operation Guidelines for Stevia Addition Methods in Application Fields

I. General Provisions

1.1 Basic Information

Stevia（Steviol Glycosides, CNS:19.008, INS:960, CAS:57817-89-7）is a natural high-potency sweetener extracted and refined from the leaves of *Stevia rebaudiana Bertoni*, a plant of the Asteraceae family, approved by the National Health Commission of the People's Republic of China.

- **Sweetness**: Approximately 200~300 times that of sucrose. mainstream products (such as Rebaudioside A) present a fresh and sweet taste with a slight lingering astringency.
- **Energy Coefficient**: ≈ 0 kJ/g (nearly calorie-free).
- **Solubility**: Freely soluble in water (solubility > 40g/100mL at 25℃) with rapid dissolution rate and low viscosity of aqueous solution.
- **Core Characteristics**: **zero glycemic index (GI≈0)**, no impact on blood sugar fluctuation, anti-caries, high thermal stability, non-fermentable and natural source.

1.2 Authoritative Compliance Basis

★ China (National Health Commission / GB 2760-2024)

- Approved as a natural sweetener that can be added in appropriate amounts according to production requirements in all types of food. Specific limits (calculated as steviol equivalents): 0.2g/kg for beverages, 3.5g/kg for confectionery, 0.33g/kg for baked goods, 0.2g/kg for flavored fermented milk.
- Food Safety Standard: GB 1886.355-2022 *National Food Safety Standard – Food Additive: Steviol Glycosides*.

★ International Authoritative Certification

- U.S. FDA: Granted GRAS certification for use in all food categories.
- EU EFSA: Approved as a safe food additive (E960) with a specified ADI value of 4mg/kg·bw (calculated as steviol).
- JECFA, Australia & New Zealand, Japan, South Korea, Canada and other authorities have approved its widespread application and included it in food additive standards.

★ Population Applicability

- No contraindicated groups; safe for normal consumption by infants, pregnant women, lactating women and diabetic populations.
- Recommended daily intake for adults ≤4mg/kg·bw (calculated as steviol); conventional use of high-purity products poses no risk of gastrointestinal discomfort.

1.3 Operation Principles

- **Compliance Priority**: Strictly abide by GB 1886.355 and GB 2760 standards, and add in appropriate amounts as required by production.
- **Characteristic Adaptation**: Match production processes based on its properties of zero calorie, zero glycemic index, high stability and anti-caries.
- **Gradient Test**: Start with 50%~90% sucrose replacement, and conduct verification through lab trial → pilot test → mass production.
- **Tolerance Control**: Convert the single addition amount strictly in accordance with steviol equivalents to avoid lingering astringency.
- **Label Specification**: Clearly mark **steviol glycosides (stevia)** in the ingredient list; qualified to claim "zero calorie", "sugar-free", "suitable for diabetic populations" and "anti-caries".

II. Physicochemical Properties & Basic Addition Parameters

2.1 Key Physicochemical Parameters

- **Sweetness Equivalent**: 1.0g steviol glycosides ≈200~300g sucrose, with a conversion ratio of 1:250 for formula replacement.
- **Thermal Stability**: Stable below 200℃; no decomposition, discoloration or peculiar odor during high-temperature baking and sugar boiling (≤180℃).
- **Maillard Reaction**: Does not participate in the Maillard reaction, resulting in light-colored baked products and assisting in controlling browning degree.
- **Freezing Point Regulation**: Weaker freezing point reduction effect than sucrose; polyols compounding is required to refine ice crystals in ice cream.
- **Hygroscopicity**: Powdered stevia is prone to moisture absorption (moisture absorption rate≈8% at 25℃/75% RH), and sealed storage is required to prevent caking.
- **pH Stability**: Stable within the pH range of 3~9, compatible with beverages, baked goods and dairy products; prone to decomposition under long-term heating at pH < 3 or pH > 9.

2.2 Basic Addition Methods

- **Direct Powder Addition**: Applicable to baked goods, tablets and solid beverages; sieve through 100~120 mesh and pre-mix evenly with powder raw materials.
- **Aqueous Solution Addition**: Stir and dissolve at normal temperature to 60℃ (10%~20% syrup), suitable for beverages, dairy products and sauces.
- **Compound Addition**: Compound with erythritol, xylitol, maltitol and mogroside to eliminate lingering astringency, optimize taste and adjust texture.
- **Stepwise Addition**: Dissolve stevia first then add other ingredients for liquid products; add during dough mixing for baked goods to improve uniformity.

III. Addition Methods & Dosage in Various Food Fields

3.1 Beverages (Carbonated Drinks / Fruit Juices / Tea Drinks / Plant Protein Beverages)

- **Dosage**: 0.01%~0.05% (based on finished products, steviol glycosides content ≥95%).
- **Addition Methods**:
  1. Stir and dissolve in water at normal temperature to 40℃ (concentration≤20%);
  2. Add other ingredients (acidulants, flavors, pigments);
  3. Constant volume, homogenization, sterilization and filling.
- **Key Points**: Compound with citric acid to improve lingering astringency; optimal stability with pH controlled at 3.5~5.5.

3.2 Baked Goods (Bread / Cakes / Biscuits / Pastries)

- **Dosage**: 0.02%~0.08% (based on flour mass).
- **Addition Methods**:
  1. Sieve through 100 mesh and pre-mix evenly with flour, leavening agents and other powder raw materials;
  2. Add oil, egg liquid, water and other materials for dough mixing and shaping;
  3. Fermentation (bread) and baking (temperature≤180℃).
- **Key Points**: No adverse impact on dough fermentation; compound with 5%~10% erythritol to improve taste and moisture retention.

3.3 Dairy & Frozen Foods (Yogurt / Milk Beverages / Ice Cream / Ice Lollies)

- **Dosage**:

• Yogurt / Milk Beverages: 0.005%~0.03%;

• Ice Cream / Ice Lollies: 0.015%~0.06%.

- **Addition Methods**:
  1. Dissolve in a small amount of milk / water and add to raw milk;
  2. Conduct homogenization, sterilization, fermentation (yogurt) or freezing (ice cream).

- **Key Points**: Does not inhibit lactic acid bacteria fermentation; compound with 3%~5% maltitol to enhance the fineness of ice cream.

3.4 Confectionery & Preserves (Hard Candy / Soft Candy / Chewing Gum / Dried Fruits)

- **Dosage**: 0.02%~0.07% (based on finished products).
- **Addition Methods**:
  1. Mix with sugar alcohols (maltitol / erythritol) and add water for sugar boiling (temperature≤140℃);
  2. Add flavors and pigments, then cool and shape (hard candy / soft candy);
  3. For chewing gum: mix with gum base and sugar alcohols for tableting.
- **Key Points**: High temperature resistance and non-coking; compound with menthol to enhance cooling sensation and mask lingering astringency.

3.5 Condiments & Sauces (Jam / Salad Dressing / Seasoning Sauce)

- **Dosage**: 0.02%~0.09% (based on finished products).
- **Addition Methods**:
  1. Dissolve in water first and add to the sauce system;
  2. Stir evenly and heat for concentration (temperature≤95℃);
  3. Cool, fill and sterilize.
- **Key Points**: Acid and alkali resistance with stable properties; replace sucrose to reduce calories without affecting sauce viscosity.

IV. Compound Application Solutions & Principles

4.1 Classic Compound Formulas

- **Stevia + Erythritol (Ratio: 1:99~0.5:99.5)**

  Advantages: Sucrose-like taste, zero calorie, elimination of lingering astringency and anti-caries; suitable for beverages, baked goods and sugar-free foods.
- **Stevia + Maltitol / Xylitol (Ratio: 1:99~0.5:99.5)**

  Advantages: Improved moisture retention and texture, calorie reduction and anti-caries; suitable for chewing gum and baked goods.

- **Stevia + Mogroside (Ratio: 1:1~3:1)**

  Advantages: natural compound sweet taste, pure flavor, no bitter aftertaste and zero glycemic index; suitable for high-end beverages and health products.

4.2 Compound Addition Principles

- **Adding Sequence**: Dissolve stevia first → add sugar alcohols / other sweeteners → finally add stabilizers and flavor substances.
- **High-potency Sweetness Control**: The sweetness contributed by stevia accounts for ≤5% of total sweetness to avoid lingering astringency and metallic taste.
- **Gradient Verification**: Conduct mass production only after passing sensory, physicochemical and stability tests with sucrose replacement gradients of 30%/60%/90%.

V. Quality Control & Safety Specifications

5.1 Raw Material Quality Standards (GB 1886.355-2022)

- Total steviol glycosides content (dry basis) ≥95.0%; loss on drying ≤6.0%; ash content ≤0.4%.
- Heavy Metals: Pb≤1.0mg/kg, As≤0.5mg/kg; Microorganisms: total bacterial count≤100CFU/g, coliform negative.
- Appearance: White or off-white crystalline powder with no peculiar smell, impurities or caking.

5.2 Production Process Control

- **Batching**: Accurate measurement by electronic scale with error ≤±0.3%; sieve powder materials through 100~120 mesh and filter liquid materials to remove impurities.
- **Mixing**: Ensure no caking or segregation with uniformity RSD≤2%.
- **Heating**: Real-time temperature monitoring; strictly control **baking ≤180℃, sugar boiling ≤140℃, sterilization ≤95℃**, and overheating is strictly prohibited.
- **Storage**: Store raw materials in sealed, cool and dry conditions with **temperature ≤25℃ and humidity ≤60%**; shelf life: 24 months.

5.3 Finished Product Inspection & Storage

- **Finished Product Inspection**: Test indicators include content, moisture, pH, color, flavor, microorganisms and sensory evaluation (focus on lingering astringency).
- **Storage Conditions**: Sealed, cool and dry environment with **temperature ≤25℃ and humidity ≤60%**; shelf life: 12~18 months.
- **Transportation**: Avoid sunlight, moisture and rain; mixed transportation with toxic and harmful substances is prohibited, and prevent extrusion damage.

VI. Common Problems & Solutions

Problems	Causes	Solutions
Lingering astringency / metallic taste in products	Insufficient stevia purity, excessive dosage and no compounding	Adopt **high-purity products ≥95%**; reduce addition dosage; compound with erythritol / mogroside
Impure sweet taste and thin mouthfeel of beverages	Single use of stevia and insufficient mellow sense	Compound with 1%~3% maltitol / erythritol to enhance taste fullness
Insufficient coloring and light color of baked goods	No participation in Maillard reaction and sucrose reduction due to high sweetness	Compound with 5%~10% fructose / glucose; extend baking time by 5~10min
Caking and poor fluidity of solid beverages	Raw material moisture absorption and uneven mixing	Dry raw materials (moisture≤5.0%), fully sieve and add 0.5%~1% silica
Rough ice crystals and poor taste of ice cream	Weak freezing point reduction and insufficient moisture retention	Compound with 3%~5% maltitol; extend aging time ≥8h
Turbidity and precipitation of liquid products after long-term storage	Incomplete dissolution, improper pH and impurities	Fully dissolve at temperature≥40℃; control pH at 3.5~5.5; filter to remove impurities

VII. Labeling Specifications

1. Clearly mark **steviol glycosides (stevia)** (CNS 19.008/INS 960) in the ingredient list.
2. Compliance claims are allowed: "Zero Calorie", "Sugar-Free", "Low Glycemic Index", "Anti-Caries" and "Suitable for Diabetic Populations".
3. Nutrition Facts Panel: mark energy as 0 kJ/g, and clearly indicate carbohydrate and sugar content (0g/100g).
4. No need to label unsuitable groups; allowed to mark **"Recommended daily intake for adults ≤4mg/kg·bw (calculated as steviol)"**.