Operation Guide for Addition Methods of Maltitol in Application Fields

I. General Provisions

1.1 Basic Information

Maltitol (CNS: 19.005, INS: 965, CAS: 585-88-6) is a dihydric sugar alcohol produced by hydrogenation of maltose. It naturally exists in some fermented foods and is an indirectly related substance to human carbohydrate metabolism.

- Sweetness: Approximately **85%~95%** of sucrose, with a fresh, mild taste and no obvious bitter aftertaste.
- Energy Coefficient: About **2.1kJ/g** (50% of sucrose).
- Solubility: Freely soluble in water (solubility at 25℃ ≈150g/100mL), no obvious heat absorption during dissolution, and higher viscosity of aqueous solution than sucrose.
- Core Characteristics: **low glycemic (GI≈35)**, insulin-independent metabolism, anti-caries, high stability, excellent moisture retention, starch retrogradation inhibition and non-fermentability.

1.2 Authoritative Compliance Basis

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

- Approved as a sweetener for moderate use in all types of foods according to production requirements; the maximum dosage in chewing gum and bubble gum is **50g/kg**.
- Food Safety Standard: GB 28307-2012 *National Food Safety Standard – Food Additives: Maltitol and Maltitol Liquid*.

★ International Authoritative Certification

- U.S. FDA: Granted GRAS certification and approved for use in all food categories.
- EU EFSA: Established no limited ADI value and confirmed its safety.
- 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 specific contraindicated groups; safe for normal consumption by infants, pregnant women, lactating women and diabetic populations; the recommended daily intake for adults is **≤50g** to prevent gastrointestinal discomfort caused by excessive intake.

1.3 Operation Principles

- Compliance Priority: Strictly abide by GB 28307 and GB 2760 standards, and add moderately in accordance with production demands.
- Characteristic Adaptation: Match production processes based on its properties of low glycemic, anti-caries, moisture retention and high stability.
- Gradient Test: Start with **40%~80%** sucrose substitution, and verify through lab trial → pilot test → mass production.
- Tolerance Control: Single intake for adults ≤**0.8g/kg·bw** to avoid abdominal distension and diarrhea caused by overconsumption.
- Label Specification: Clearly mark **maltitol** in the ingredient list; permissible claims include "low calorie", "moisturizing & fresh-keeping" and "suitable for diabetic populations".

II. Physicochemical Properties & Basic Addition Parameters

2.1 Key Physicochemical Parameters

- Sweetness Equivalent: **1.0g Maltitol ≈0.85~0.95g Sucrose**, calculated at a ratio of **1:0.9** for formula substitution.
- Thermal Stability: Stable below **150℃**, resistant to decomposition, discoloration and peculiar odor during high-temperature baking and sugar boiling.
- Maillard Reaction: Hardly triggers Maillard reaction, presenting light color in baked goods and assisting in controlling browning degree.
- Freezing Point Regulation: Freezing point reduction effect reaches **70%** of sucrose, refining ice crystals and delivering dense texture in ice cream.
- Hygroscopicity: Low hygroscopicity in crystalline form (moisture absorption rate ≈2% at 25℃/75% RH), and no caking under sealed storage.
- pH Stability: Stable within the pH range of **3~11**, applicable to beverages, baked goods and dairy products.

2.2 Basic Addition Methods

- Direct Powder Addition: Suitable for baked goods, tablets and solid beverages; sieve through **80~100 mesh** and pre-mix evenly with powder raw materials.
- Aqueous Solution Addition: Stir and dissolve at normal temperature to 80℃ to prepare **50%~70% syrup**, applied in beverages, dairy products and sauces.
- Compound Addition: Compounded with erythritol, xylitol, steviol glycosides and sucralose to optimize taste and regulate texture.
- Stepwise Addition: Added in batches during baking/confectionery production to improve mixing uniformity and product stability.

III. Addition Methods for Various Food Categories

3.1 Beverages (Carbonated Drinks / Fruit Juices / Plant-Based Beverages / Solid Beverages)

- Dosage: **2%~8%** for liquid beverages, **5%~15%** for solid beverages (calculated by finished product mass).
- Addition Method: Prepare **60% maltitol syrup** in advance, filter and add during blending at **40~60℃** to prevent flavor damage by high temperature.
- Process Key Points: When compounded with citric acid and flavors, dissolve maltitol first, then adjust acidity and add flavors to avoid precipitation; control pressure for carbonated drinks to prevent bubble loss.
- Application Advantages: Improve taste, enhance viscosity, stabilize flavor and reduce glycemic response, suitable for sugar-free/low-sugar beverage formulas.

3.2 Baked Foods (Bread / Cakes / Biscuits / Mooncakes)

- Dosage: **3%~15%** based on flour mass, replacing **50%~100%** of sucrose.
- Addition Method: Sieve powder and pre-mix with flour, yeast and other dry raw materials, or prepare **50% syrup** and add during dough kneading with uniform stirring.
- Process Key Points: Control baking temperature ≤**180℃** and extend baking time by **5~10min** to avoid surface scorching; compound maltitol with malt syrup at a ratio of **7:3** in mooncake production to improve oil return performance.
- Application Advantages: Delay starch retrogradation, extend shelf life, maintain moist texture, present light color and reduce calorie content.

3.3 Confectionery & Chocolate (Hard Candy / Gummy Candy / Chewing Gum / Sugar-Free Chocolate)

- Hard Candy: Dosage of **10%~20%**, sugar boiling temperature at **130~140℃**, forming after cooling to 80℃ to inhibit crystallization and deliver crisp texture.
- Gummy Candy: Dosage of **15%~30%**, compounded with gelatin and pectin to adjust elasticity and chewiness, and maintain moisture to prevent dry cracking.
- Chewing Gum: Dosage of **10%~40%**, compounded with sorbitol at **1:1**, added to gum base in three batches at temperature ≤**60℃** to reduce stickiness.
- Sugar-Free Chocolate: Dosage of **15%~30%**, tempering temperature ≤**31℃**, inhibiting cocoa butter blooming and ensuring delicate taste.

3.4 Dairy Products & Frozen Desserts (Yogurt / Ice Cream / Ice Lolly / Condensed Milk)

- Yogurt: Dosage of **1%~5%**, added before fermentation to improve taste, reduce acidity and prolong shelf life.
- Ice Cream: Dosage of **2%~10%**, added during batching to lower freezing point, refine ice crystals and enhance melting resistance.

- Condensed Milk: Dosage of **3%~8%**, added during concentration to improve viscosity, prevent crystallization and enhance stability.
- Process Key Points: Aging time of ice cream ≥**6h** for fine ice crystals; yogurt fermentation temperature controlled at 42℃ to protect lactic acid bacteria activity.

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

- Dosage: **3%~15%** (calculated by finished product mass).
- Addition Method: Heat to **60~80℃** for dissolution, mix evenly with fruit materials and sauces, and concentrate to the specified solid content.
- Process Key Points: Replace **50%~100%** sucrose in jam production to enhance moisture retention, prevent water precipitation and extend shelf life.
- Application Advantages: Optimize texture, stabilize flavor, lower calorie and inhibit microbial growth.

IV. Compound Addition Schemes & Principles

4.1 Classic Compound Schemes

- **Maltitol + Erythritol (Ratio: 7:3~8:2)**

  Advantages: Reduce calorie, deliver refreshing taste and inhibit crystallization; applicable to beverages, ice cream and sugar-free confectionery.
- **Maltitol + Xylitol (Ratio: 6:4~7:3)**

  Advantages: Strengthen anti-caries effect, optimize taste and improve moisture retention; applicable to chewing gum and baked foods.
- **Maltitol + Steviol Glycosides / Mogroside (Ratio: 99:1~99.5:0.5)**

  Advantages: Low calorie, sucrose-like sweetness and elimination of bitter aftertaste; applicable to beverages, solid beverages and sugar-free foods.
- **Maltitol + Polydextrose / Soluble Fiber (Ratio: 3:1~5:1)**

  Advantages: Supplement dietary fiber, improve texture and reduce calorie; applicable to yogurt, baked goods and health products.

4.2 Compound Addition Principles

- Addition Sequence: Dissolve maltitol first → add high-intensity sweeteners subsequently → finally incorporate stabilizers and flavor substances.
- High-Intensity Sweetener Control: The sweetness contribution of high-intensity sweeteners shall not exceed **3%** of total sweetness to avoid bitter taste, metallic taste and abnormal aftertaste.

- Gradient Verification: Conduct mass production only after passing sensory, physicochemical and stability tests with sucrose substitution gradients of **30%/50%/70%**.

V. Quality Control & Safety Specifications

5.1 Raw Material Quality Standards (GB 28307-2012)

- **Maltitol content (dry basis) ≥98.0%**; drying loss ≤**1.0%**; ignition residue ≤**0.10%**.
- Heavy Metals: Pb≤**0.5mg/kg**, Ni≤**2.0mg/kg**; Microorganisms: total bacterial count ≤**100CFU/g**, coliform negative.
- Appearance: White crystal or powder, odorless, impurity-free, non-caking and low hygroscopicity.

5.2 Production Process Control

- Batching: Accurate metering by electronic scale with error ≤**±0.5%**; sieve powder through 80~100 mesh and filter liquid materials to remove impurities.
- Mixing: Ensure no caking and segregation with uniformity RSD ≤**3%**.
- Heating: Real-time temperature monitoring; baking temperature ≤180℃, sugar boiling temperature ≤140℃, over-temperature is strictly prohibited.
- Cooling: Rapid cooling (≤**30min**) to prevent moisture absorption, crystallization and flavor attenuation.

5.3 Finished Product Inspection & Storage

- Finished Product Inspection: Test items include content, moisture, pH, color, flavor, microorganisms and gastrointestinal tolerance assessment.
- Storage Conditions: Sealed, cool and dry environment with temperature ≤**25℃** and humidity ≤**60%**; shelf life: **18~24 months**.
- Transportation: Protect from sunlight, moisture and rain; prohibited to transport with toxic and harmful substances, and avoid extrusion damage.

VI. Common Problems & Solutions

Problem	Cause	Solution
Dry, hard and dull texture of baked goods	Insufficient moisture retention and weak Maillard reaction	Compound with **5%~10%** xylitol or malt syrup and extend baking time
Coarse texture with ice crystals in ice cream	Insufficient freezing point reduction and inadequate aging	Compound with **3%~5%** erythritol and extend aging time to ≥6h
Weak and insufficient sweetness in beverages	Sweetness only reaches 85%~95% of sucrose	Substitute at a ratio of 1:0.9 and add a small amount of high-intensity sweeteners (≤0.5%)
Easy crystallization and coarse texture of confectionery	Strong crystallinity and improper sugar boiling temperature	Control sugar boiling temperature at 130~140℃ and compound with **10%~20%** xylitol
Abdominal distension, diarrhea and borborygmus after consumption	Excessive single intake (> 0.8g/kg·bw)	Strictly control single intake ≤0.8g/kg·bw, take in separate portions and adapt gradually
Caking and poor fluidity of solid beverages	Moisture absorption or uneven mixing	Dry raw materials (moisture ≤1.0%), fully sieve and add **0.5%~1%** silica
Blooming and coarse texture of chocolate	Unstable cocoa butter crystallization and improper tempering	Control tempering temperature ≤31℃, compound with **5%~10%** erythritol and stabilize storage temperature

VII. Labeling Specifications

1. Clearly mark **“Maltitol”** (CNS 19.005/INS 965) in the ingredient list.
2. Compliant permissible claims: "Low Calorie", "Anti-Caries", "Moisturizing & Fresh-Keeping", "Suitable for Diabetic Populations".
3. Nutrition Facts Panel: Mark energy at **2.1kJ/g**, and clearly indicate carbohydrate and sugar content.
4. No mandatory labeling of unsuitable groups and consumption limits (no compulsory requirements in authoritative standards); the claim of "Recommended daily intake for adults ≤50g" is optional.