Operating Guidelines for the Application of Erythritol in Various Fields

I. General Provisions

1.1 Basic Information

Erythritol (CNS: 19.018, INS: 968, CAS: 149-32-6) is a four-carbon sugar alcohol that naturally exists widely in grapes, pears, mushrooms, fermented foods and human body fluids.

- Sweetness: Approximately 60%~70% that of sucrose
- Energy coefficient: 0kJ/g (zero-calorie)
- Solubility: Highly soluble in water (solubility at 25℃≈37g/100mL), aqueous solution is clear without precipitation
- Core characteristics: Zero-calorie, no blood glucose elevation, no involvement in insulin metabolism, high stability, no Maillard reaction, low hygroscopicity, anti-caries

1.2 Authoritative Compliance Basis

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

- Approved as a sweetener that can be used appropriately in various foods according to production needs, with no daily intake limit.
- Food safety standard: GB 26404-2011 *National Food Safety Standard Food Additive Erythritol*.

★ International Authoritative Recognition

- US FDA: Granted GRAS certification in 1997 (GRN 000012), allowing use in all food categories.
- EU EFSA: Established an ADI value with no limitation in 1999, and re-evaluated and confirmed safety in 2023.
- Widely approved and listed in food additive standards by JECFA, Australia & New Zealand, Japan, South Korea, Canada and other countries/regions.

★ Population Applicability

- No clearly contraindicated population; safe for normal consumption by infants, pregnant women, lactating women and people with diabetes.

1.3 Operating Principles

1. **Compliance Priority**: Strictly follow GB 26404 and GB 2760 standards, and add appropriately according to production needs.
2. **Characteristic Adaptation**: Match production processes based on zero-calorie, high stability, low hygroscopicity and non-browning characteristics.
3. **Gradient Testing**: Start with **10%~50%** sucrose substitution, and verify through laboratory testing → pilot testing → mass production.
4. **Tolerance Control**: Single adult intake ≤**0.8g/kg bw** to avoid gastrointestinal discomfort caused by excessive consumption.
5. **Labeling Specification**: Clearly mark erythritol in the ingredient list; "zero-calorie", "anti-caries" and "no blood glucose elevation" can be labeled.

II. Physicochemical Properties and Basic Addition Parameters

2.1 Key Physicochemical Parameters

- Sweetness equivalent: 1.0g erythritol ≈ 0.6~0.7g sucrose; formula substitution shall be converted at a ratio of 1:1.4~1:1.6.
- Thermal stability: Completely stable below 180℃, no decomposition, discoloration or peculiar smell during high-temperature baking.
- Maillard reaction: No Maillard or browning reaction, ensuring stable product color and resistance to yellowing.
- Freezing point adjustment: Freezing point depression effect is 70% that of sucrose; inhibits large ice crystals and delivers a dense texture in ice cream applications.
- Hygroscopicity: Extremely low hygroscopicity in crystalline form (moisture absorption rate <2% at 25℃/75% RH), resistant to caking and moisture absorption.
- pH stability: Stable within pH 2~10, suitable for beverage, baking and dairy product systems.

2.2 Basic Addition Methods

1. **Direct dry powder addition**: Suitable for baking, tableting and solid beverages; sieve through 80~100 mesh and premix evenly with powder raw materials.
2. **Aqueous solution addition**: Stir to dissolve at room temperature ~50℃ (30%~50% syrup), used in beverages, dairy products and sauces.
3. **Compound addition**: Compound with allulose, steviol glycosides, mogrosides, sucralose to optimize taste and supplement sweetness.
4. **Stepwise addition**: Add in batches during baking / confectionery production to improve mixing uniformity and product texture.

III. Addition Methods in Various Food Fields

3.1 Beverages (Carbonated / Fruit Juice / Protein / Functional Drinks)

3.1.1 Scope of Application

Carbonated drinks, fruit juices, tea drinks, coffee, protein drinks, sports drinks, flavored water

3.1.2 Addition Amount and Method

- Addition range: 3%~10% (w/w), replacing **20%~100%** of sucrose.
- Operating process: Stir and dissolve erythritol in purified water at room temperature ~50℃ → filter through 10μm → mix with other raw materials → sterilize (stable at ≤121℃).
- Process key points: Rapid dissolution, no decomposition during high-temperature sterilization, refreshing sweetness, no precipitation, stable flavor.
- Compound optimization: Compound with steviol glycosides (0.01%~0.05%) to supplement sweetness and simulate sucrose taste.

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

3.2.1 Scope of Application

Biscuits, cookies, bread, cakes, mooncakes, Chinese pastries, shortbreads

3.2.2 Addition Amount and Method

- Addition range: 5%~12% (based on flour / formula), replacing **30%~100%** of sucrose.
- Operating process: Premix dry powder evenly with flour and fat → normal dough mixing → baking (temperature 160~180℃, time unchanged or extended by 5%~10%).
- Process key points: Non-browning, white / light yellow color, crisp texture, extended shelf life.
- Color optimization: If golden color is required, compound with 5%~15% allulose or add a small amount of food coloring.

3.3 Dairy Products and Frozen Foods (Yogurt / Ice Cream / Cheese)

3.3.1 Scope of Application

Sugar-free yogurt, fermented milk, ice cream, sorbet, smoothies, low-fat cheese, flavored milk

3.3.2 Addition Amount and Method

- **Yogurt / Fermented milk**: Addition amount 3%~7%, can be added before or after fermentation; does not affect probiotic activity, balances acidity and delivers a smooth taste.
- **Ice cream / Sorbet**: Addition amount 5%~10%, lowers freezing point, inhibits large ice crystals, provides a dense texture without ice crystals, and has strong freezing stability.
- **Cheese / Cream**: Addition amount 2%~6%, softens flavor, improves texture, and controls sugar and calories.

3.4 Confectionery and Preserved Fruits (Tableted Candies / Hard Candies / Chocolate / Preserved Fruits)

3.4.1 Scope of Application

Sugar-free hard candies, tableted candies, chewing gum, chocolate, throat lozenges, low-sugar preserved fruits, jelly

3.4.2 Addition Amount and Method

- **Tableted candies / Hard candies**: Addition amount 80%~95%, low hygroscopicity, good formability, non-sticky, long shelf life, cool taste.
- **Chocolate / Filled candies**: Addition amount 4%~10%, enhances sweetness, does not affect fat crystallization, smooth taste and no bloom.
- **Preserved fruits / Candied fruits**: Addition amount 3%~6%, reduces total sugar, retains moisture and color, reduces excessive sweetness, and extends shelf life.

3.5 Condiments and Sauces (Jam / Salad Dressing / Ketchup)

3.5.1 Scope of Application

Sugar-free jam, salad dressing, ketchup, seasoning sauce, barbecue sauce, compound sauces

3.5.2 Addition Amount and Method

- Addition range: 2%~7% (w/w).
- Operating process: Prepare 40%~50% syrup and add → cooking temperature ≤**110℃**, stable at pH 3.5~5.0.
- Product advantages: Balances sweet and sour taste, inhibits browning, resists moisture absorption, high stability, extended shelf life.

3.6 Other Foods and Non-Food Fields

3.6.1 Solid Beverages / Instant Foods

- Addition amount 5%~12%, good fluidity, low moisture absorption, fast reconstitution and dissolution, natural sweetness.

3.6.2 Functional Foods / Health Products

● Addition amount 3%~10%, controls sugar and calories, improves taste, masks raw material peculiar smell; suitable for diabetes-specific foods, meal replacement powders and protein bars.

3.6.3 Oral Care Products / Pet Foods

● **Toothpaste / Mouthwash**: Addition amount 1%~5%, anti-caries, fresh breath, assists oral cleaning.

● **Pet food**: Addition amount 2%~5%, improves palatability, protects pet teeth, and does not cause obesity or abnormal blood glucose.

IV. Compound Technology Specification

4.1 Common Compound Systems (Optimizing Sweetness / Taste / Cost)

● **Erythritol + Allulose (ratio 3:1~5:1)**

Advantages: Complementary color and texture, simulating sucrose characteristics; suitable for baking, ice cream and confectionery.

● **Erythritol + Steviol glycosides / Mogrosides (ratio 99:1~99.8:0.2)**

Advantages: Zero-calorie, sweetness close to sucrose, eliminates aftertaste bitterness; suitable for beverages, solid beverages and sugar-free foods.

● **Erythritol + Sucralose (ratio 99.5:0.5~99.9:0.1)**

Advantages: High stability, acid and alkali resistance, pure taste, cost optimization; suitable for beverages, baking and condiments.

● **Erythritol + Polydextrose / Soluble Fiber (ratio 4:1~6:1)**

Advantages: Improves texture, enhances dietary fiber, low calorie; suitable for yogurt, baking and health products.

4.2 Compound Addition Principles

● **Addition sequence**: Dissolve erythritol first → add high-intensity sweeteners → finally add stabilizers and flavor substances.

● **High-intensity sweetener control**: High-intensity sweeteners account for **≤5%** of total sweetness to avoid bitterness, metallic taste and abnormal aftertaste.

● **Gradient verification**: Conduct substitution at gradients of 10%/30%/50%; mass production shall be carried out only after passing sensory, physicochemical and stability tests.

V. Quality Control and Safety Specification

5.1 Raw Material Quality Standard (GB 26404-2011)

- Erythritol content ≥**98.0g/100g**; loss on drying ≤**1.0%**; residue on ignition ≤0.1%.
- Heavy metals: Pb≤1mg/kg, As≤0.3mg/kg; microorganisms: total plate count ≤**100CFU/g**, coliform negative.
- Appearance: White crystals or powder, no peculiar smell, no impurities, no caking.

5.2 Production Process Control

- **Ingredient proportioning**: Accurate measurement by electronic scale, error ≤±**0.5%**; dry powder sieved through 80~100 mesh, liquid filtered to remove impurities.
- **Mixing**: Ensure no caking or segregation, uniformity RSD ≤**3%**.
- **Heating**: Real-time temperature monitoring; baking ≤180℃, sugar cooking ≤120℃; over-temperature is strictly prohibited.
- **Cooling**: Rapid cooling (≤30min) to prevent crystallization, discoloration and flavor attenuation.

5.3 Finished Product Inspection and Storage

- **Finished product inspection**: Content, moisture, pH, color, flavor, microorganisms, gastrointestinal tolerance evaluation.
- **Storage conditions**: Sealed, cool and dry, temperature ≤25℃, humidity ≤65%, shelf life 18~24 months.
- **Transportation**: Sun protection, moisture protection, rain protection; mixed transportation with toxic and harmful substances is strictly prohibited.

VI. Common Problems and Solutions

Problem	Cause	Solution
Excessively white baked products without caramel aroma	No Maillard reaction	Compound with 5%~15% allulose, or extend baking time and lower temperature
Ice crystals and rough texture in ice cream	Weak freezing point depression effect	Compound with 3%~5% allulose / maltitol, aging time ≥6h
Weak and insufficient sweetness of beverages	Only 60%~70% sweetness of sucrose	Convert substitution at 1:1.4~1:1.6, compound with a small amount of high-intensity sweeteners
Sticky and hygroscopic tableted candies	Excessively high environmental humidity	Control production humidity ≤**50%**, add 1%~3% magnesium stearate, sealed packaging
Bloating, diarrhea and borborygmus after consumption	Excessive single intake (>1.0g/kg bw)	Strictly control single dosage ≤**0.8g/kg bw**, eat in fractions and adapt gradually
Caking and poor fluidity of solid beverages	Moisture absorption or uneven mixing	Dry raw materials (moisture ≤0.5%), fully sieve, add 0.5%~1% silicon dioxide

VII. Labeling Specification (Mandatory Requirements)

1. Clearly mark "Erythritol" (CNS 19.018/INS 968) in the ingredient list.
2. Compliant labeling allowed: "Zero-calorie", "No blood glucose elevation", "Anti-caries", "Suitable for people with diabetes".
3. Nutrition information table: Energy labeled as 0kJ/g.
4. No need to label unsuitable populations or consumption limits (not required by authoritative standards).