Operation Guidelines for Sorbitol Addition Methods in Application Scenarios

Preface

This guideline aims to provide standardized and professional operational instructions for the application and processing of **sorbitol** to technical staff, R&D engineers and production managers of downstream enterprises in food, pharmaceutical, feed, daily chemical and other industries. As a widely used polyol ingredient, **sorbitol** features multiple functions including sweetness regulation, moisture retention, texture improvement, chelation stabilization and low-temperature anti-crystallization. With high safety and excellent compatibility, it is highly adaptable to industrial production of various product categories. A correct understanding of the physicochemical properties, compliance standards and process adaptation logic of **sorbitol** serves as the core prerequisite for stabilizing product quality, optimizing production costs, avoiding operational risks and realizing formula innovation.

This guideline systematically sorts out the full-process application specifications of **sorbitol** from five core dimensions: global regulatory compliance, category-based physical property selection, full-scenario process SOP, compound synergistic strategy and quality risk control. It can be directly used as a standard technical manual for enterprise production, new product development and quality control review.

Chapter 1 Cornerstone of Global Regulatory Compliance

The food safety of **sorbitol** has been officially certified by JECFA with established safe intake standards. It is recognized as a compliant universal ingredient in most countries and regions worldwide and can be applied in accordance with Good Manufacturing Practice (GMP). Regional regulations differ in scope of use, dosage limits and labeling requirements. Industrial production must strictly comply with the compliance rules of target markets.

1.1 China (GB Standard System)

- Legal Basis: Implemented in accordance with **National Food Safety Standard – Food Additives – Sorbitol and Sorbitol Solution** (GB 1886.187-2016).
- Scope of Application: Per **GB 2760 Standards for the Use of Food Additives**, **sorbitol** can be used as a sweetener, humectant, stabilizer, chelating agent and anti-caking agent. It is allowed for use in most food categories in accordance with GMP (as required by production) without mandatory dosage limits. It is also applicable to pharmaceutical excipients, feed additives and daily chemical humectants.
- Label Warning: In compliance with **GB 7718**, a single adult intake of over 20g of **sorbitol** may cause gastrointestinal discomfort. Products with high single consumption such as candies, chewing gums and beverages must be labeled with the warning: *Excessive consumption may cause bloating and diarrhea*.

1.2 Codex Alimentarius Commission (CAC / Codex Alimentarius)

- Legal Basis: Assigned INS No. 420; JECFA stipulates its ADI value as *not limited*, and it is included in the FNP series of food additive specification standards.
- Scope of Application: Listed in Table 3 of GSFA as a universal additive, allowed for GMP-based addition in confectionery, bakery products, frozen desserts, beverages, aquatic processed products and other categories.
- Core Reminder: CAC standards serve as the benchmark for global food trade. For exports to Southeast Asia, Africa, South America and other regions adopting Codex standards, ingredient addition and compliance review shall be implemented uniformly under this framework.

1.3 European Union (EU Regulation)

- Legal Basis: EU fundamental food additive regulation (EC) No 1333/2008, additive code E420.
- Scope of Application: Applicable to all food categories permitted for polyol sweeteners, following the *quantum satis* principle with no fixed upper dosage limit.
- Special Provisions: The EU restricts the maximum daily adult intake of **sorbitol** to no more than 25g in dietary supplements and sugar-free meal replacement foods. Compliant functional claims such as *helping maintain normal intestinal metabolism* and *improving product texture stability* are permitted.

1.4 United States (FDA)

- Legal Basis: Classified as a GRAS (Generally Recognized As Safe) substance, included in 21 CFR 172.802.
- Scope of Application: Allowed for on-demand addition in foods, dietary supplements and food auxiliary materials under strict GMP regulations.
- Label Warning: Per FDA labeling rules, products with a conventional single serving containing more than 50g of **sorbitol** must be marked with the warning: *Excess consumption may cause gastrointestinal distress*.

Compliance Red Lines

Export products are prohibited from adopting the unlimited domestic GMP addition standard. Enterprises shall accurately match the food classification criteria, dosage limits and label warning requirements of target countries, complete compliance verification in advance, and avoid trade compliance risks.

Chapter 2 Scientific Selection: Properties and Application Orientation of Different Sorbitol Forms

Commercially available **sorbitol** is mainly divided into three types: crystalline solid sorbitol, liquid sorbitol and ultrafine powder sorbitol. Significant differences exist in hygroscopicity, solubility, thermal stability and fluidity among the three forms. Accurate process selection is the key to ensuring finished product quality and reducing

production loss.

1. Crystalline Solid Sorbitol

● Physical Properties: White crystalline particles, purity ≥99%, melting point 90-101℃, moderate hygroscopicity, excellent fluidity, obvious endothermic dissolution leading to a cooling taste, stable chemical properties, non-decomposable and free of Maillard browning reaction.

● Core Application Scenarios: Suitable for dry production processes such as compressed candies, solid health products, chewing gums, powdered food ingredients and oral solid preparations, ideal for products requiring good powder fluidity and specific taste.

2. Liquid Sorbitol (70% Concentration)

● Physical Properties: Colorless, transparent and viscous liquid, 70% solid content and 30% moisture content, good fluidity at room temperature, fast dissolution rate, strong moisturizing performance, moderate viscosity and excellent compatibility with water-based systems.

● Core Application Scenarios: Widely used in high-moisture products including bakery goods, gummy candies, beverages, dairy products, jams, preserved fruits, aquatic fresh-keeping and daily chemical products, focusing on moisturizing, anti-drying, bacteriostasis and fresh-keeping.

3. Ultrafine Powder Sorbitol

● Physical Properties: Fine powder (D50: 40-80μm), high purity, low dust generation, excellent solubility in water and weak alcohol systems, better compressibility and dispersibility than ordinary crystalline particles.

● Core Application Scenarios: Direct pharmaceutical tableting, high-end solid beverages, instant powders and refined compound ingredients, adapted to high-precision and high-uniformity powder production processes.

4. Selection Decision Tree

● Is the product based on dry powder or compression molding process?

○ Yes → Priority: Ultrafine powder sorbitol / Crystalline solid sorbitol

○ No → Proceed to the next step

● Is the product a high-moisture system requiring strong moisturizing, anti-aging and anti-cracking effects?

○ Yes → Priority: 70% liquid sorbitol

○ No → Proceed to the next step

● Does the product require a cooling taste and stable texture?

○ Yes → Priority: Crystalline solid sorbitol

○ No → All three forms are optional, selected based on production cost and process equipment conditions

Chapter 3 Scenario-Based Application Processes and SOP Key Points

3.1 Sugar-Free Candies and Chocolate Products

3.1.1 Hard Candy

(1) Functions and Dosage:

Sucrose substitute sweetener, anti-crystallizing agent and shaping agent; inhibits sucrose recrystallization, improves candy transparency and brittleness. Recommended dosage: **20%-40% of total dry base**.

(2) Addition Process

(2.1) Addition Timing:

Added into the sugar melting tank together with liquid raw materials such as syrup, purified water and compound sweeteners at the initial stage of sugar melting.

(2.2) Operational Key Points

- Dissolution: Turn on constant-speed stirring, heat up to 80-90℃, feed materials slowly to avoid agglomeration and dust, and ensure complete dissolution with clear and impurity-free solution. Liquid sorbitol can be added directly without pre-dissolution to shorten processing time.
- Boiling: Filter materials and transfer to a vacuum boiling pot; control the final temperature at 150-165℃. The anti-crystallization property of sorbitol effectively prevents hard candy from sanding and whitening during storage, enhancing glossiness and crisp texture.
- Cooling and Forming: Cool rapidly to 110-120℃ after boiling, followed by slitting, shaping and air cooling to stabilize the internal crystal structure of candies.

(2.3) Notes:

Strictly control vacuum degree and boiling temperature to avoid abnormal material viscosity caused by prolonged high-temperature heating. Sorbitol does not trigger Maillard reaction for a bright product color; compliant food colorants can be added in the late boiling stage if coloring is needed.

3.1.2 Gummy Candy / Gel Candy

(1) Functions and Dosage:

Humectant, flavor regulator and gel stabilizer; prevents dehydration, cracking and hardening of gummies and extends shelf life. Recommended dosage: **15%-35%**.

(2) Addition Process

(2.1) Addition Timing:

Added during the mixing stage with the syrup system after complete hydration and dissolution of colloids such as pectin, gelatin and carrageenan.

(2.2) Operational Key Points

- Dissolution and Mixing: Preheat the jacketed pot to 70-80℃, add sorbitol and auxiliary materials for stirring and dissolution, slowly pour homogenized feed liquid into the colloid solution, and stir at low speed for 10-15 minutes to ensure uniform mixing.
- Boiling: Control the final atmospheric boiling temperature at 100-110℃. Relying on excellent moisturizing capacity, sorbitol locks gel moisture and maintains the chewy and soft texture of gummies.
- Pouring and Drying: Dry in a low-temperature and low-humidity environment after pouring, cooling and gelling to stabilize dehydration rate and prevent cracking and shrinkage.

(2.3) Notes:

Simultaneous feeding with high-concentration strong acid colloids is prohibited to avoid damage to the gel network. Control production environment humidity steadily at RH 40%-55% to prevent moisture absorption and adhesion of finished products.

3.1.3 Compressed Candy

(1) Functions and Dosage:

Filler, binder and flavor corrector; improves powder fluidity and compressibility and masks bitter taste of raw materials. Recommended dosage: **30%-85%**.

(2) Addition Process

(2.1) Addition Timing:

Added together with all dry raw materials including acidulants, flavors, lubricants and functional powders in the total mixing process.

(2.2) Operational Key Points

- Direct Tableting: Prefer ultrafine powder sorbitol (D50: 80-120μm). Mix in a V-type mixer or three-dimensional mixer for 20-25 minutes to achieve a powder repose angle ≤35° with outstanding fluidity, compatible with high-speed tableting equipment.
- Wet Granulation: For functional raw materials with poor fluidity, pre-mix sorbitol with main materials, prepare wet mass with purified water, granulate through 20-40 mesh sieve, dry at 60-70℃ at low temperature, size and add lubricants for total mixing and tableting.

(2.3) Notes: Control workshop humidity below RH < 45% to prevent powder agglomeration due to moisture absorption. Detect powder moisture content and compressibility before tableting, and fine-tune equipment pressure to avoid tablet cracking and loosening.

3.1.4 Chocolate

(1) Functions and Dosage:

Sucrose substitution, anti-blooming moisturization, texture refinement and sweetness adjustment. Recommended dosage: **25%-45% (proportion of non-fat cocoa solids)**.

(2) Addition Process

(2.1) Addition Timing:

Added into refining equipment together with dry raw materials such as cocoa butter, cocoa powder and milk powder at the initial refining stage.

(2.2) Operational Key Points

- Temperature Control: Maintain a constant refining temperature of 65-75℃. Crystalline sorbitol features high thermal stability without water precipitation, stabilizing material viscosity and avoiding abnormal consistency of chocolate slurry.
- Refining and Homogenization: Conduct continuous refining for 24-48 hours to control material particle size below 20μm. The fine dispersibility of sorbitol delivers a silky taste and inhibits fat precipitation and surface blooming during storage.
- Tempering and Forming: Adopt standard cocoa butter tempering curves. Sorbitol does not change fat crystallization characteristics; mass production is allowed after parameter verification in pilot tests.

(2.3) Notes: Due to the low sweetness of sorbitol, uniform pre-mixing with high-intensity sweeteners such as sucralose is required. Strictly control refining temperature to prevent material oxidation and flavor deterioration under high heat.

3.2 Baked Foods

3.2.1 Biscuits

(1) Functions and Dosage:

Texture improvement, crispness retention, staling retardation and sweetness adjustment with partial sucrose replacement. Recommended dosage: **3%-10% (based on flour weight)**.

(2) Addition Process

(2.1) Addition Timing:

Added into the dough mixer together with dry raw materials such as flour, leavening agents and edible salt at the initial dough mixing stage.

(2.2) Operational Key Points:

Pre-mix dry raw materials for 1-2 minutes to ensure uniform dispersion of sorbitol, then add wet raw materials including oil, egg liquid and purified water for kneading. Sorbitol balances dough moisture to prevent biscuits from softening due to moisture reabsorption after baking and maintain crispness during long-term storage. Liquid sorbitol can be directly added to wet material systems for higher dispersion efficiency.

(2.3) Notes: As a non-reducing sugar alcohol, sorbitol does not cause Maillard browning, resulting in a light baked color. Product color can be optimized by fine-tuning baking temperature, adding a small amount of malt syrup or appropriately increasing baking soda dosage.

3.2.2 Cakes / Bread

(1) Functions and Dosage:

Powerful moisturizing, gluten softening, starch aging inhibition and shelf life extension. Recommended dosage: **2%-8% (based on flour weight)**.

(2) Addition Process

(2.1) Addition Timing:

Added at the initial stirring stage of batter and dough together with dry raw materials such as flour, yeast and improvers.

(2.2) Operational Key Points:

In cake production, sorbitol can be whipped with sucrose and oil to enhance batter fluffiness and stability. In bread production, mix dry powders evenly before adding water for kneading to lock dough moisture, reduce hardening rate and keep internal texture soft and delicate.

(2.3) Notes: High-intensity sweeteners shall be compounded to supplement sweetness when sucrose is completely replaced. Compliant colorants or adjusted baking parameters can be adopted to solve insufficient browning of baked goods.

3.3 Beverages, Dairy Products and Frozen Desserts

3.3.1 Flavored Beverages / Yogurt

(1) Functions and Dosage:

Sweetness adjustment, flavor buffering, system stabilization, precipitation inhibition and taste roundness improvement. Recommended dosage: **0.8%-6%**.

(2) Addition Process

(2.1) Addition Timing

- Neutral / Weakly Acidic Beverages (pH > 3.5): Added synchronously during the initial sugar blending stage.
- Strongly Acidic Beverages (pH < 3.5): Added in the blending stage after sterilization and cooling to avoid slight degradation under high-temperature acidic conditions.

(2.2) Operational Key Points:

Preheat purified water to 55-65℃, add sorbitol slowly under stirring, add stabilizers, sweeteners, flavors and other auxiliary materials in sequence after complete dissolution, mix with main liquid after filtration and homogenization to ensure system uniformity and stability.

(2.3) Notes: Avoid prolonged high-temperature boiling. Ensure equipment sterility for post-addition in acidic drinks, and conduct short-term pasteurization if necessary to prevent microbial contamination.

3.3.2 Ice Cream

(1) Functions and Dosage:

Freezing point reduction, ice crystal inhibition, texture refinement and smoothness improvement. Recommended dosage: **2%-9% of total mixture**.

(2) Addition Process

(2.1) Addition Timing:

Dissolved together with milk solids, stabilizers and sweeteners during raw material mixing.

(2.2) Operational Key Points:

Pre-mix sorbitol with powder auxiliary materials and add into liquid raw materials such as milk and cream under low-temperature stirring at 40-50℃ for full hydration. Heat up to 68-72℃ for pasteurization, homogenize and cool rapidly to 4℃ for low-temperature aging.

(2.3) Notes: Combined use with special ice cream stabilizers maximizes ice crystal refinement and prevents freezing agglomeration and rough texture. Compound with other sugar alcohols to enhance cooling taste.

3.4 Pharmaceutical and Feed Industry

3.4.1 Oral Tablets / Granules

(1) Functions and Dosage:

Pharmaceutical filler, flavor corrector, flow aid and stabilizer; masks peculiar odors of active pharmaceutical ingredients and improves tablet formability. Dosage range: **5%-95%**.

(2) Addition Process

(2.1) Addition Timing:

Added together with active pharmaceutical ingredients, disintegrants, lubricants and other excipients in the powder total mixing process.

(2.2) Operational Key Points

- Direct Tableting: Adopt pharmaceutical-grade ultrafine powder sorbitol with excellent powder uniformity. Pre-mix with raw drugs for direct tableting, compatible with high-speed pharmaceutical equipment to achieve uniform tablet hardness and stable disintegration performance.
- Wet Granulation: For poorly formable raw drugs with strong peculiar odors, take sorbitol as the carrier, prepare wet mass with purified water, dry and granulate at low temperature (≤75℃), size and mix integrally for tableting to effectively mask odors and improve finished product stability.

(2.3) Notes: Strictly control pharmaceutical workshop humidity below RH < 45%. Verify the compatibility stability of sorbitol with raw drugs and alkaline excipients in advance to prevent physicochemical reactions during long-term storage.

3.4.2 Functional Feed

(1) Functions and Dosage:

Feed attraction and flavor enhancement, palatability improvement, powder structure protection and oxidation retardation. Recommended dosage: **1%-4%**.

(2) Addition Process

(2.1) Addition Timing:

Pre-mix with trace auxiliary materials such as vitamins and amino acids in the feed pre-blending stage, then add into main raw materials for mixing.

(2.2) Operational Key Points:

Strictly follow the equal incremental pre-mixing method. Mix with carriers such as corn flour and bran in a small proportion to prepare premixes first, then add into main mixing equipment for uniform stirring to avoid uneven distribution of trace ingredients.

(2.3) Notes: Prohibit long-term direct mixing with high-activity heavy metal trace elements. Staged feeding or coated trace elements are recommended to prevent auxiliary material failure and feed discoloration and deterioration.

Chapter 4 Compound Synergy Solutions and Troubleshooting

4.1 Sweetness Synergy and Flavor Improvement

Sorbitol delivers approximately **50%-60% of sucrose sweetness** with a mild taste and no after-bitterness. Its insufficient single-use sweetness can be optimized by scientific compounding with high-intensity sweeteners to simulate sucrose flavor perfectly, suitable for sugar-free and low-calorie formulas. The optimal compound ratios are as follows:

- **Sorbitol + Sucralose**

10% Sorbitol + 0.012% Sucralose, equivalent to 10% sucrose in overall sweetness with pure and odorless flavor.

- **Sorbitol + Aspartame**

10% Sorbitol + 0.025% Aspartame, full-bodied sweetness adapted to bakery and confectionery products.

- **Sorbitol + Stevioside**

10% Sorbitol + 0.018% Stevioside (Reb A), neutralizes the after-bitterness of stevia for a mild and natural taste.

Operational Suggestion: High-intensity sweeteners shall be pre-mixed with a small amount of sorbitol powder evenly following the equal incremental principle, then mixed in batches to completely solve uneven sweetness distribution, local oversweetness or insufficient sweetness.

4.2 Texture and Functional Synergy

- Compound with Dietary Fiber:

  Combined with water-soluble dietary fibers such as resistant dextrin and inulin to jointly enhance product moisturizing capacity and intestinal regulation functions, supporting nutritional claims of low calorie, high fiber and prebiotic properties for healthy sugar-free foods.

- Compound with Polyols:

  Blended with maltitol and erythritol to balance system hygroscopicity and sweetness, accurately adjust product hardness and softness, and eliminate defects of single sugar alcohols such as moisture absorption and sugar recrystallization, widely applied in pastries, gummies and meal replacement products.

- Compound with Hydrophilic Colloids:

  Combined with pectin, gelatin and sodium carboxymethyl cellulose to stabilize gel systems, improve colloid elasticity and toughness, reduce gel water separation and collapse, and optimize the quality of gummies, puddings and jams.

Chapter 5 Quality and Risk Control Red Lines

1. Excessive Intake Risk Control

- **Risk Description:**

  Sorbitol has low intestinal absorption in the human body. A single adult intake over 30g and a single child intake over 10g will cause intestinal osmotic pressure effects, leading to bloating, borborygmus, diarrhea and other gastrointestinal discomfort. Infants and young children have the lowest tolerance.

- Operational Guidelines:

  High-consumption products such as candies, chewing gums, beverages and snacks must be labeled with gastrointestinal warning statements in accordance with national standards. Strictly control the dosage in infant complementary foods and children’s snacks to reduce consumption risks.

2. Key Process and Storage Prohibitions

- Maillard Reaction Property:

  As a non-reducing sugar alcohol, sorbitol does not trigger Maillard browning, making it suitable for light-colored and color-protected product production. Reducing sugars, leavening agents or compliant colorants shall be compounded for baked goods requiring browning.

- Storage Conditions:

  Store solid sorbitol in a cool, dry and ventilated warehouse with sealed packaging for moisture resistance to avoid agglomeration under high temperature and humidity. Liquid sorbitol requires constant-temperature storage in winter to prevent low-temperature crystallization and stratification; use up quickly after opening to avoid microbial contamination.

3. Compatibility Stability Precautions

Prolonged high-temperature boiling in a strongly acidic environment with pH < 2 is prohibited, as it may cause slight degradation of sorbitol and damage product flavor and stability. For feed and pharmaceutical formulas, small-scale stability tests must be conducted before adding new auxiliary materials to screen risks such as discoloration, agglomeration and potency attenuation.

Appendix 1: Quick Comparison Table of Functional Properties between Sorbitol and Sucrose

Property	Sucrose	Sorbitol
Relative Sweetness	1.0	0.5-0.6
Calorie (kcal/g)	4.0	2.6
Glycemic Index (GI)	65	≤9
Hygroscopicity	Moderate	Relatively high (extremely high for liquid, moderate for solid)
Maillard Reaction	Yes	No
Solubility (20℃)	Soluble	Highly soluble
Prebiotic / Anti-Caries Effect	None	Available (caries prevention & intestinal regulation)

Appendix 2: Quick Troubleshooting Table for Common Problems

1. Phenomenon: Candy sanding, whitening and rough texture

○ Possible Causes: 1. Insufficient sorbitol dosage leading to poor anti-crystallization effect; 2. Substandard boiling temperature and vacuum degree with excessive residual moisture.

○ Solutions: Adjust sorbitol addition ratio, optimize boiling process parameters and strictly control finished product moisture content.

2. Phenomenon: Light color and dull appearance of baked goods

○ Possible Cause: Sorbitol is non-browning and unable to produce typical baked color.

○ Solutions: Add an appropriate amount of malt syrup or glucose syrup, adjust baking temperature and duration, or adopt compliant food colorants.

3. Phenomenon: Loose, cracked and low-hardness compressed candies

○ Possible Causes: (1) Ordinary crystalline sorbitol with poor powder fluidity and compressibility is selected; (2) Excessively high workshop humidity causing powder moisture absorption.

○ Solutions: Replace with ultrafine powder sorbitol, control workshop humidity below RH < 45% and optimize tableting machine pressure parameters.

4. **Phenomenon: Low overall sweetness and thin taste of finished products**

○ Possible Causes: Low inherent sweetness of sorbitol, unscientific compounding with high-intensity sweeteners or uneven mixing.

○ Solutions: Adopt high-intensity sweeteners per the optimal compound ratios in Chapter 4 and implement standardized pre-mixing processes to ensure uniform ingredient dispersion.

Conclusion

As a highly versatile and safe polyol ingredient, **sorbitol** features multiple advantages including moisturizing, texture stabilization, flavor correction, anti-crystallization and low glycemic response, supporting extensive production and application in food, pharmaceutical, feed and other industries. The realization of its product value relies on accurate raw material selection, standardized addition processes, scientific formula compounding and strict production risk management. All regulatory standards, process parameters and formulation schemes in this guideline are formulated based on national standards, international authoritative specifications and mature industrial production experience. Enterprises must complete pilot and pilot-scale tests combined with their own equipment conditions and product formulas before mass production, fine-tune process parameters to ensure stable quality and full compliance. It is hoped that this guideline can provide professional and practical technical support for enterprises in new product R&D, process optimization, quality control and compliant production.