Operational Guidelines for Addition Methods of Polydextrose in Applications

1 General Provisions

1.1 Purpose

To standardize the addition methods, operating procedures, dosage control and quality assurance of polydextrose in various application fields, ensure that products meet process requirements, nutritional claims and relevant regulatory standards, improve production efficiency, reduce production risks, and guarantee stable product quality.

1.2 Scope of Application

This guide applies to all production links using polydextrose as a raw material in food, health food, feed and pet food, covering a full range of applications including beverages, dairy products, baked goods, meat products, confectionery, frozen food, condiments, health food, feed/pet food, etc. It is intended for use by production operators, technicians, quality inspectors and relevant training personnel.

1.3 Reference Standards

Formulated in accordance with the *National Food Safety Standard Standard for the Use of Food Additives* (GB 2760-2024), the *National Food Safety Standard Dietary Fiber* (GB 28050) and production process specifications for related products, combined with the product characteristics of polydextrose.

2 Basic Characteristics of Polydextrose

The core prerequisite for guiding polydextrose addition is to master its inherent properties, which determine the addition process, timing and dosage, as detailed below:

2.1 Physicochemical Properties

- **Solubility and dispersibility**: Freely soluble in water; can be added directly as dry powder or dissolved in warm water. It has good dispersibility, is not prone to caking, and is shear-resistant, making it suitable for various food processing techniques such as homogenization and emulsification.
- **Thermal and acid stability**: Heat-resistant, compatible with baking, sugar cooking, extrusion, high-temperature sterilization and other processes; highly acid-resistant, with good stability in systems with pH ≥ 2.5, suitable for acidic products such as beverages, yogurt and fruit puree.
- **Basic parameters**: Average degree of polymerization 10–200, dietary fiber content ≥ 90%, caloric value approximately 1 kcal/g (1/4 of sucrose, 1/9 of fat), sweetness 0.1 times that of sucrose, low hygroscopicity, pH of 10% aqueous solution 2.5–7.0, and refined-grade product pH near neutral.

2.2 Core Functional Characteristics

- **Dietary fiber fortification**: Serves as a high-quality source of water-soluble dietary fiber, supporting nutritional claims such as “contains dietary fiber” and “high in fiber”.
- **Texture modification functions**: Provides thickening, stabilization, moisture retention, anti-aging and ice crystal growth inhibition effects, improving product taste and texture and extending shelf life.
- **Health functions**: Low in calories; can replace part of sugar, fat and starch to achieve low-sugar, low-fat and low-calorie product positioning. It also acts as a prebiotic, regulating intestinal flora balance and supporting intestinal health, making it suitable for functional product development.
- **Process compatibility**: Highly compatible; can be compounded with sugar alcohols, sugar substitutes, colloids, starches and other raw materials, adapting to production processes for various foods, health foods and feeds.

2.3 Safety and Compliance Requirements

Polydextrose is a nationally permitted food additive complying with GB 2760-2024. It is used in appropriate amounts as required for production with no general limit. It may be used in infant food, health food, regular food and feed/pet food, provided that the compliance standards of the corresponding products are met, and the nutritional labeling of the finished product is consistent with the actual addition amount.

3 General Specifications for Addition Process

Polydextrose addition in all application fields shall follow the general specifications below to ensure uniform addition, full dissolution and no adverse impact on product quality.

3.1 Pretreatment and Dissolution Methods

- **Direct dry powder addition**: Suitable for solid mixed products (e.g., baking flour, solid beverages, compressed tablets, pet pellet feed). Operating points: Pre-mix polydextrose evenly with other dry powder raw materials (flour, maltodextrin, sugar substitutes, etc.) to ensure uniform dispersion and avoid local agglomeration before proceeding to subsequent processing steps.
- **Aqueous solution preparation**: Suitable for liquid and emulsified products (e.g., beverages, dairy products, sauces, ice cream). Operating points: Dissolve polydextrose in warm water at 45–50°C at a ratio of 1:2.8–3.5, stir for 20–30 minutes until the solution is completely clear, then filter through an 80–120 mesh sieve

before use to remove undissolved particles and impurities that may affect taste and appearance.

- **Compounding principles**: Prioritize compounding with sugar alcohols, sugar substitutes and colloids (e.g., sodium carboxymethyl cellulose, xanthan gum) to enhance functional effects. Avoid direct contact with strong oxidizing agents. In strongly acidic systems with pH < 3.5, verify polydextrose stability in advance; adjust pH or select refined-grade products if necessary.

3.2 General Key Points for Addition Procedures

- **Addition timing**: Select an appropriate addition point based on product process characteristics, with the core principle of "ensuring full dissolution/dispersion and avoiding functional loss due to prolonged high-temperature heating".
- **Stirring requirements**: Stir thoroughly after addition. For liquid systems, control stirring speed at 1000–1500 r/min; for solid systems, stir until no obvious caking and uniform mixing are achieved.
- **Metering requirements**: Use precision metering equipment (electronic scales, metering pumps, etc.) to strictly control the addition amount per formula, preventing metering deviations that cause abnormal product quality or inconsistent nutritional claims.

3.3 General Quality Control Standards

- **Solubility**: Dissolved solution is clear and transparent, free of sediment or visible particles; no polydextrose agglomeration or caking in solid products.
- **Sensory requirements**: No impact on the original flavor and color of the product, no off-odors or abnormal color changes.
- **Nutritional control**: Dietary fiber content in finished products meets formula requirements and nutritional labeling regulations, ensuring claims such as "high in fiber" and "contains dietary fiber" are truthful and valid.

4 Field-Specific Process Guidance for Addition

Based on product characteristics and production processes in each application field, the addition amount, procedures, operating points and functional objectives of polydextrose are specified to ensure direct implementability.

4.1 Beverages (Liquid Beverages, Solid Beverages)

4.1.1 Applicable Products

Fruit juice drinks, carbonated drinks, sports drinks, functional drinks, solid beverages, meal replacement powders, etc.

4.1.2 Addition Amount

Liquid beverages: 0.5%–3%; solid beverages: 5%–20% (based on total formula mass).

4.1.3 Addition Procedures and Operating Points

- **Liquid beverages**: Add during batching. Dissolve polydextrose in warm water at 45–50°C at 1:2.8–3.5, filter, add to the batching tank, mix evenly with sweeteners, stabilizers, flavors and other raw materials, homogenize at 20–30 MPa, then proceed to sterilization (pasteurization or UHT sterilization), avoiding prolonged high-temperature heating.
- **Solid beverages**: Add during dry mixing. Pre-mix polydextrose evenly with dry powder raw materials such as maltodextrin, sugar substitutes, vitamins and minerals, then perform granulation, drying, tableting and other subsequent steps to ensure good solubility and no caking.

4.1.4 Functional Objectives and Notes

Functional objectives: Fortify dietary fiber content, improve beverage taste, enhance system stability, reduce product calories, and support "sugar-free/low-sugar" positioning.

Notes: Complete polydextrose dissolution before carbonation in carbonated drinks to avoid affecting aeration. Use refined-grade polydextrose in acidic beverages (pH < 3.5) to prevent sour taste.

4.2 Dairy Products (Liquid Milk, Yogurt, Milk Powder, Soy Milk)

4.2.1 Applicable Products

Pure milk, flavored milk, fermented yogurt, yogurt drinks, infant milk powder, middle-aged and elderly milk powder, soy milk, etc.

4.2.2 Addition Amount

0.5%–5% (based on total formula mass).

4.2.3 Addition Procedures and Operating Points

- **Liquid milk/soy milk**: Add during batching. Dissolve polydextrose, add to the batching tank, mix evenly with milk/soy milk, stabilizers and sweeteners, homogenize at 25–35 MPa, sterilize, then fill.
- **Yogurt/fermented milk**: Can be added before or after fermentation.
    - Before fermentation: Mix polydextrose evenly with milk, starter cultures and sweeteners, inoculate and ferment without affecting probiotic activity, improving consistency and stability of the fermentation system.

  - After fermentation: Mix dissolved polydextrose with yogurt evenly after fermentation, homogenize and fill to avoid damaging probiotics.
- **Milk powder**: Add during dry mixing. Pre-mix polydextrose evenly with milk powder, maltodextrin, nutritional fortifiers and other dry powders, then package after spray drying or blending to ensure mixing uniformity.

4.2.4 Functional Objectives and Notes

Functional objectives: Synergize with probiotics to regulate intestinal health, fortify dietary fiber content, enhance nutritional labeling value, and improve dairy taste and stability.

Notes: Limit polydextrose addition to ≤5% when adding before fermentation to avoid affecting fermentation efficiency. Test mixing uniformity after pre-blending in milk powder production to meet standards.

4.3 Baked Goods (Bread, Pastries, Biscuits, Dried Noodles)

4.3.1 Applicable Products

Toast bread, cakes, biscuits, mooncakes, dried noodles, steamed buns, etc.

4.3.2 Addition Amount

0.5%–10% (based on flour mass), replacing 5%–20% of flour or sugar.

4.3.3 Addition Procedures and Operating Points

- **Bread/cake**: Add during flour mixing. Dry-blend polydextrose evenly with flour, yeast, sugar, fat and other raw materials, then add water, egg liquid and knead dough. Control dough temperature at 28–32°C, adjust fermentation time per original process, bake at 180–220°C, and adjust baking time based on product size.
- **Biscuits**: Add during dry mixing. Pre-mix polydextrose evenly with flour, butter, sugar, leavening agents, etc., add a small amount of water to form dough, rest, sheet and mold, bake at 160–180°C to ensure crispness.
- **Dried noodles**: Pre-mix evenly with flour and starch, add appropriate water to form dough, roll, cut, dry and package, improving toughness and reducing breakage and pasting during cooking.

4.3.4 Functional Objectives and Notes

Functional objectives: Improve dough water retention, soften finished products, delay staling, extend shelf life; reduce calories, fortify dietary fiber, and enhance taste and texture.

Notes: Adjust water volume and kneading time appropriately when addition exceeds 10% to avoid overly dry or sticky dough. Compounding with colloids improves crispness in biscuit production.

4.4 Meat Products (Ham, Sausages, Canned Meat, Fillings)

4.4.1 Applicable Products

Low-temperature ham, high-temperature sausages, canned meat, meatballs, dumpling fillings, bun fillings, etc.

4.4.2 Addition Amount

2.5%–20% (based on meat paste mass); dosage may be increased appropriately when used as a fat substitute.

4.4.3 Addition Procedures and Operating Points

- **Ham/sausages**: Add during chopping/emulsification. Place meat paste in a chopper, chop at medium-high speed until viscous, add dissolved polydextrose solution, continue chopping for 5–10 minutes for full emulsification, add other accessories (salt, soy sauce, spices, etc.), mix evenly, then casing and sterilize.
- **Canned meat/meatballs**: Add during emulsification. Blend meat paste, polydextrose, starch, salt and other ingredients, emulsify, mold, cook and sterilize to reduce water loss during steaming.
- **Fillings**: Mix evenly with meat, vegetables, starch and other raw materials, add appropriate water and stir until viscous, improving water retention and formability to prevent water release during cooking.

4.4.4 Functional Objectives and Notes

Functional objectives: Act as a water-retaining agent and fat substitute to reduce water and fat loss during steaming and freezing, improve tenderness and yield, achieve low-fat positioning, and fortify dietary fiber.

Notes: Control temperature ≤10°C during chopping to prevent meat spoilage. Adjust dosage based on meat fat content; increase appropriately with lower fat ratio.

4.5 Confectionery/Chocolate (Hard Candy, Soft Candy, Gum Base Candy, Chocolate)

4.5.1 Applicable Products

Hard candy, soft candy, nougat, gum base candy, chocolate, jelly, etc.

4.5.2 Addition Amount

Hard/soft candy: 2%–10%; gum base candy/jelly: 8%–9%; chocolate: 5%–10% (based on total formula mass).

4.5.3 Addition Procedures and Operating Points

- **Hard/soft candy**: Add during sugar cooking. Heat sugar and water to boiling, add polydextrose and sugar alcohols (sorbitol, maltitol, etc.), continue cooking to specified temperature (hard candy 150–160°C, soft candy 110–120°C), stir evenly, cool and mold to inhibit sugar crystallization.
- **Gum base candy**: Add after gum base softening. Heat and soften gum base, add polydextrose, sweeteners, flavors, etc., mix evenly, then sheet and mold to improve chewiness and taste.
- **Chocolate**: Add after cocoa butter melting. Melt and blend cocoa butter, cocoa powder and sugar, add polydextrose, stir evenly, homogenize, temper, mold and cool, replacing part of cocoa butter and sugar to reduce calories.

4.5.4 Functional Objectives and Notes

Functional objectives: Inhibit sugar crystallization, improve taste (chewiness, fineness), reduce sweetness and calories, fortify dietary fiber, and support “sugar-free/low-sugar” confectionery positioning.

Notes: Control temperature and time during sugar cooking to avoid polydextrose charring. Ensure full dissolution of polydextrose in chocolate production to avoid affecting gloss and taste.

4.6 Frozen Food (Ice Cream, Sorbet, Frozen Dough)

4.6.1 Applicable Products

Ice cream, sorbet, frozen glutinous rice balls, frozen dumplings, frozen bread dough, etc.

4.6.2 Addition Amount

0.5%–5% (based on total formula mass).

4.6.3 Addition Procedures and Operating Points

- **Ice cream/sorbet**: Add during batching. Dissolve polydextrose, add to batching tank, mix evenly with milk, cream, sugar, stabilizers, etc., homogenize at 20–30 MPa, sterilize, cool, age (4–6°C for 4–8 hours), freeze, then fill and store frozen to inhibit ice crystal growth.
- **Frozen dough**: Add during dry mixing. Pre-mix polydextrose evenly with flour, yeast, sugar, fat, etc., add water and knead dough, mold and quick-freeze to improve water retention, inhibit ice crystal formation during freezing, and ensure stable quality after thawing.

4.6.4 Functional Objectives and Notes

Functional objectives: Inhibit ice crystal growth, improve fineness and taste, reduce quality loss during freezing/thawing, extend shelf life, reduce fat usage and achieve low-fat positioning.

Notes: Ensure sufficient aging time for ice cream to allow full integration of polydextrose with other ingredients. Control frozen dough temperature ≤ -18°C and avoid repeated thawing.

4.7 Condiments (Sauces, Hot Pot Base, Soup Mixes, Soy Sauce)

4.7.1 Applicable Products

Tomato sauce, salad dressing, hot pot base, soup packets, soy sauce, oyster sauce, etc.

4.7.2 Addition Amount

5%–15% (based on total formula mass).

4.7.3 Addition Procedures and Operating Points

- **Sauces/hot pot base**: Add during emulsification. Place oil, water and sauce base in emulsifier, emulsify at medium-high speed, add dissolved polydextrose solution, continue emulsifying for 10–15 minutes, add spices, salt and other accessories, stir evenly, sterilize and fill.
- **Soup mixes/soy sauce**: Add during batching. Dissolve polydextrose, add to soup or soy sauce fermentation tank, mix evenly with other raw materials, cook, filter, sterilize and package to enhance flavor fullness and fiber content.

4.7.4 Functional Objectives and Notes

Functional objectives: Thicken and stabilize the system, improve water retention and clinginess, enhance taste, fortify dietary fiber, and boost health attributes.

Notes: Control emulsification temperature and speed in sauce production to prevent phase separation. Add in later fermentation stage for fermented products such as soy sauce to avoid affecting fermentation.

4.8 Health Food (Capsules, Tablets, Granules, Oral Liquids)

4.8.1 Applicable Products

Dietary fiber capsules, dietary fiber tablets, meal replacement granules, intestinal health oral liquids, etc.

4.8.2 Addition Amount

0.5%–50% (based on total formula mass); daily intake controlled at 5–15 g.

4.8.3 Addition Procedures and Operating Points

- **Capsules/tablets**: Add during dry mixing. Pre-mix polydextrose evenly with other excipients (microcrystalline cellulose, magnesium stearate, etc.), granulate, dry, then tablet or encapsulate to ensure good formability and compliance with disintegration time limits.
- **Granules/oral liquids**: Process granules per solid beverage procedures by pre-mixing with other dry powders; process oral liquids per liquid procedures by dissolving and filtering polydextrose, adding to batching tank, mixing evenly with other functional ingredients, homogenizing, sterilizing and filling.

4.8.4 Functional Objectives and Notes

Functional objectives: Supplement dietary fiber, exert prebiotic effects, regulate intestinal health, assist in sugar and lipid control, and support dietary fiber supplement health food positioning.

Notes: Strictly control addition amount to ensure daily intake complies with health food regulations. Adjust polydextrose dosage in tablet production to meet hardness and disintegration requirements.

4.9 Feed/Pet Food (Pellet Feed, Dry Pet Food, Wet Pet Food)

4.9.1 Applicable Products

Livestock and poultry pellet feed, aquatic feed, dry pet food, wet pet food, pet snacks, etc.

4.9.2 Addition Amount

1%–10% (based on total formula mass).

4.9.3 Addition Procedures and Operating Points

- **Pellet feed**: Add during dry mixing. Pre-mix polydextrose evenly with corn flour, soybean meal, fish meal and other raw materials, extrude, expand and dry to form pellets, acting as a binder and carrier to improve pellet formability and moisture resistance.
- **Dry/wet pet food**: Process dry food per pellet feed procedures; add wet food during batching by dissolving polydextrose, adding to batching tank, mixing evenly with meat, vegetables and other nutrients, sterilizing and filling.

4.9.4 Functional Objectives and Notes

Functional objectives: Supplement dietary fiber, improve intestinal health and digestibility of livestock, poultry and pets; act as a binder to enhance pellet formability and moisture resistance, extending storage life.

Notes: Ensure thorough pre-mixing with other raw materials in feed production for uniform distribution. Control polydextrose dosage in wet pet food to avoid affecting palatability.

5 Common Problems and Solutions (Production Operation Support)

For common production issues during polydextrose addition, causes and solutions are specified to ensure smooth production and product quality.

Common Problems	Causes	Solutions
Incomplete dissolution, sediment/particles in solution	Low water temperature, insufficient stirring time, direct addition without pre-mixing, raw material impurities	Raise water temperature to 45–50°C, extend stirring time to 20–30 minutes; pre-mix solid products with other dry powders first; filter liquid products through 80–120 mesh after dissolution to remove impurities and undissolved particles
Sour taste and off-odors in product	Use of regular-grade polydextrose, excessively low pH in acidic system, excessive addition amount	Use refined-grade polydextrose; adjust system pH to 5.5–7.0; compound with sweeteners (maltitol, steviol glycosides, etc.) to mask off-odors; reduce addition amount appropriately
Abnormal product texture (too hard, too soft, sticky)	Unreasonable addition amount, no compounding with colloids/starch, improper process parameters (temperature, time, shear speed)	Adjust polydextrose addition to reasonable range; compound with colloids (xanthan gum, CMC) and starch to optimize texture; adjust process parameters (dough kneading time, sugar cooking temperature, emulsification speed)
Inconsistent finished product nutritional labeling and claims	Metering deviation, insufficient addition, finished product testing errors	Use precision metering equipment, strictly control addition per formula; test dietary fiber content before finished product release to meet “contains dietary fiber”/“high in fiber” claims; calibrate metering equipment regularly
Phase separation and water exudation during shelf life	Uneven polydextrose dispersion, insufficient or inadequate homogenization, insufficient stabilizer addition	Ensure full dissolution and dispersion of polydextrose; optimize homogenization process (pressure, time); increase stabilizer dosage appropriately and compound with polydextrose to enhance stability

6 Storage and Transportation Requirements

6.1 Storage Requirements

- Polydextrose raw materials shall be stored sealed in a cool, dry and ventilated warehouse at temperature ≤25°C and relative humidity ≤65%, away from moisture, direct sunlight and high temperature.
- Store separately from toxic, harmful and odorous items to avoid contamination; avoid excessive stacking height to prevent compression caking.
- Raw material shelf life is 12–24 months; expired materials are strictly prohibited. Use promptly after opening; seal unused portions to prevent moisture absorption and caking.

6.2 Transportation Requirements

Avoid direct sunlight, rain and moisture during transportation to prevent package damage leading to raw material contamination or caking.

- Transport vehicles shall be clean, dry and odor-free, and transported separately from toxic and harmful items to ensure raw material safety.
- Handle with care during loading and unloading to avoid package damage; strictly prohibit compression and impact.

7 Operational Safety Requirements

- Operators shall wear proper personal protective equipment (masks, gloves, work clothes, caps) before starting work to avoid inhalation of polydextrose dust and direct skin contact.
- Maintain good ventilation in the operation area during dissolution and stirring to prevent dust dispersion. Take anti-scald measures when operating high-temperature equipment (sugar cookers, sterilizers, etc.).
- Polydextrose dust is prone to static electricity; implement anti-static measures during operation to avoid safety hazards from static accumulation.
- Classify and dispose of production waste (undissolved particles, packaging waste) per environmental protection requirements to prevent pollution.
- Operators shall be familiar with equipment operating specifications and strictly prohibit illegal operation. Stop the machine immediately and report to responsible personnel if equipment failure or raw material abnormality is found.