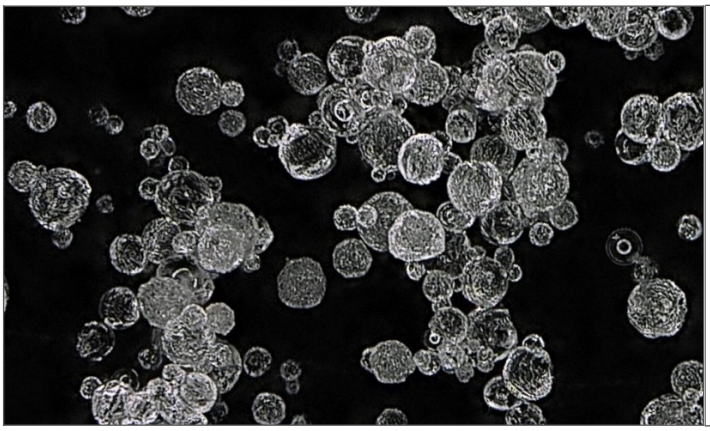
Prebiotics – Spray-Dried Oligosaccharides

Case Study
PTC Japan



Spray drying is a proven method for producing stable, free-flowing **prebiotic powders such as oligosaccharides and dietary fibers.** By carefully controlling temperature, moisture, and particle design, spray drying preserves functionality, solubility, and taste while preventing adhesion and caking. **The result is high-quality powders** with consistent bulk density and flowability, ready for use in infant formula, functional foods, nutraceuticals, and pet nutrition—meeting growing global demand for prebiotics.

Background

Prebiotics such as oligosaccharides and dietary fibers are essential for maintaining gut health by nourishing beneficial bacteria like bifidobacteria. Widely used in functional foods, infant formula, dairy products, beverages, pharmaceuticals, and pet foods, they support mineral absorption, immunity, and allergy suppression. With the global oligosaccharide market forecast to reach US$2.5 billion by 2029, efficient powder production is critical.

Applications of Oligosaccharides

- Human nutrition: infant formula, bakery, dairy, functional beverages
- Healthcare: intestinal health, immune support, allergy reduction
- Pet foods: MOS and FOS for gut health in animals
- Emerging area: Human Milk Oligosaccharides (HMOs) for infant formula, immune, and cognitive development

Spray Drying Challenges

- High hygroscopicity and adhesiveness → risk of sticking inside dryer, yield loss
- Heat sensitivity → risk of discoloration and loss of functional properties
- Powder instability → agglomeration, moisture re-absorption, or uneven bulk density
- Volatile loss during drying → reduced flavor and functionality

Solutions

- Low-temperature spray drying to minimize thermal damage.
- Controlled process gas (dehumidified or inert air) to reduce adhesion and oxidation.
- Use of carriers/additives: maltodextrin, trehalose, cyclodextrin for flavor retention and stability
- Optimization of powder recovery line conditions for consistent moisture, density, and powder quality.

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Key Quality Parameters

- Particle Size Distribution – flowability and filling stability.
- Bulk Density – consistent dosing and packaging efficiency.
- Moisture Content – balanced for shelf life without caking.
- Surface Properties – solubility, wettability, color, and taste.

Results

Spray drying enables the production of stable, free-flowing oligosaccharide powders with excellent solubility and long shelf life. By optimizing process conditions and formulations, producers achieve:

- High product recovery and yield
- Stable powders resistant to caking and discoloration
- Preserved prebiotic functionality for food and health applications
- Scalability from R&D to commercial production

POWDER TECHNICAL CENTER

With extensive experience in prebiotic materials spray drying, we provide:

- Tailored process design for each raw material and application.
- Three Powder Technical Centers (Japan & ASEAN) for R&D and scale-up.
- PTC2 (2023) – Japan's largest analytical and measurement facility.
- Cutting-edge Freeze Granulation Technology – overcoming the limitations of spray- and freeze-dried powders.
- One-stop services – raw material preparation, powder processing, testing, and evaluation.

Conclusion

Spray drying transforms prebiotics and oligosaccharides into high-quality powders that are stable, soluble, and commercially viable. By leveraging advanced process design and technical expertise, we support manufacturers in meeting the growing demand for prebiotics across global food, health, and pharmaceutical markets.

PRECI **Technology by PRECI Co., Ltd., Japan**

Specialist in spray drying, spray cooling and freeze granulation, with Powder Technical Centers in Japan. T.S.K. Engineering is PRECI's exclusive partner in Thailand, and PTC ASEAN in Chonburi runs trials with PRECI know-how.