Mannanase Technical Sheet

High activity enzyme for digesting mannan

Scientific & Technical™

Mannanase Technical Datasheet

1. Product Overview

Our food-grade mannanase is an enzyme derived from safe microbial sources that specifically hydrolyses mannans and galactomannans, which are complex polysaccharides found in plant cell walls. Key properties of food-grade mannanase include high substrate specificity, stability under moderate temperatures and pH levels suitable for food processing, and absence of toxic or allergenic contaminants, making it safe for human consumption. Its primary applications in the food industry include improving the viscosity and clarity of fruit juices, enhancing extraction of oils and bioactive compounds, reducing anti-nutritional effects of mannans in legume-based foods, aiding in coffee and tea processing, and improving texture and digestibility in baked goods and plant-based products. By breaking down mannans efficiently, food-grade mannanase helps increase yield, optimize product quality, and enhance nutritional availability in a variety of plant-derived foods.

2. Product Characteristics

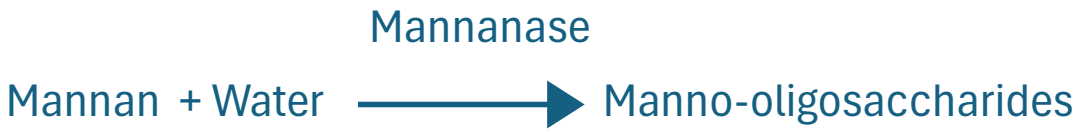
Parameter	Specification
Enzyme Class	Hydrolase (EC 3.2.1.25)
Source	*Bacillus lentus* (non-GM strain)
Appearance	Light brown liquid
Activity	50,000 U / mL
Units	Where 1 U is the amount of enzyme required to release 1 µmol of manno-oligosaccharides per minute under standard conditions
Temperature Range	15–55 °C (operational)
Optimal Temperature	30–50 °C
pH Range	6.0–10.5
Optimal pH	7.0–8.0
Shelf Life	12 months (sealed and kept under recommended storage conditions)

3. Enzymatic Properties

3.1 Mechanism of Action:

Mannanase (typically endo-β-1,4-mannanase) catalyses the hydrolysis of β-1,4-mannosidic bonds within mannan-based polysaccharides such as galactomannan and glucomannan, breaking long chains into shorter manno-oligosaccharides and mannose-rich fragments. The enzyme binds the mannan chain in a groove-shaped active site and positions a specific β-1,4 linkage for cleavage; most industrial mannanases are glycoside hydrolases that operate via a double-displacement (retaining) mechanism, using two key catalytic residues (commonly glutamate/aspartate) where one acts as a general acid/base and the other as a nucleophile. First, the nucleophile attacks the anomeric carbon

to form a transient glycosyl–enzyme intermediate while the acid catalyst protonates the leaving group; in the second step, water (activated by the base form of the catalyst) hydrolyses the intermediate to release the shortened carbohydrate and regenerate the active site. By depolymerizing mannans, mannanase reduces viscosity, disrupts cell wall structure, and improves the release and digestibility of nutrients or the processability of mannan-rich materials.



3.2 Kinetics:

Mannanase (typically endo-β-1,4-mannanase) generally exhibits Michaelis–Menten reaction kinetics, where the initial hydrolysis rate increases with mannan concentration until the enzyme becomes saturated and reaches a maximum rate (Vmax); the substrate concentration giving half-maximal velocity is the Km, which reflects the apparent affinity of the enzyme for mannan substrates such as galactomannan or glucomannan. Because mannans are high-molecular-weight, heterogeneous polymers, observed kinetics are often "apparent" and influenced by substrate accessibility (degree of branching, crystallinity, and particle size), meaning rates can be limited not only by catalytic turnover (kcat) but also by diffusion and chain binding. Mannanase activity is strongly dependent on pH and temperature, showing a bell-shaped pH profile around its optimum (often acidic for fungal enzymes and nearer neutral/alkaline for many bacterial enzymes) and increasing with temperature up to an optimum before declining due to thermal denaturation. At higher substrate loadings, some mannanases can display substrate inhibition or reduced efficiency due to viscosity effects and non-productive binding, while accumulated soluble products (manno-oligosaccharides, mannobiose, and occasionally mannose) may cause product inhibition by competing for binding subsites in the active-site cleft. In industrial processing, the practical reaction rate therefore reflects both intrinsic enzyme kinetics (Km, Vmax, kcat) and process-dependent factors such as substrate solubility, mixing, and the evolving molecular weight distribution as hydrolysis proceeds.

3.3 Inhibitors:

- Heavy metals (Hg^{2+}, Cu^{2+})
- Urea, Guanidine hydrochloride, SDS
- Extreme low or high pH
- High temperatures above 70 deg. C
- High chelator concentrations (EDTA)

4. Key Applications

4.1 Coffee processing (instant coffee & extraction):

- Reduces galactomannan-driven viscosity in coffee extracts
- Improves extraction yield, filtration, and spray-drying efficiency

- Helps reduce fouling and improves process throughput

2) Plant-based beverages (oat, soy, almond, coconut, legume drinks):

- Breaks down mannans → lowers viscosity and improves mouthfeel
- Reduces sedimentation and improves stability during storage
- Improves homogenisation efficiency and processing consistency

3) Baking & dough handling (bread, pastries, gluten-free baking):

- Modifies hemicellulose (mannans) in flour → improves dough machinability
- Helps with water distribution, softness, and texture
- Can improve loaf volume and crumb structure, especially in mixed grains

4) Fruit & vegetable processing (purees, sauces, pulps):

- Degrades mannan-containing polysaccharides → reduces thickness / gel formation
- Improves pressing, clarification, and filtration
- Supports better yield and smoother textures in processing lines

5) Protein & plant ingredient processing (soy, guar, locust bean gum, legumes):

- Used to partially hydrolyse galactomannans (guar/LBG) → control viscosity
- Improves handling of plant protein slurries by reducing thickening
- Supports production of functional oligosaccharides (MOS) when desired

6) Hydrocolloid modification (guar gum / locust bean gum tailoring):

- Controlled hydrolysis for:
- viscosity reduction (“low-viscosity guar”)
- improved solubility and faster hydration
- improved functionality in food formulations
- Enables tuning of rheology for sauces, dairy alternatives, and beverages

7) Clarification and filtration aid in food processing:

- Acts as a processing aid to reduce membrane fouling and improve filtration flux
- Useful where mannans contribute to high viscosity or filter blockage
- Applied in plant extracts, beverage bases, syrups, and specialty liquids

8) Production of prebiotic manno-oligosaccharides (MOS):

- Hydrolyses mannans to generate MOS, used as:
- prebiotic ingredients in food
- gut health-supporting functional ingredients
- Especially relevant for controlled enzymatic production from guar/LBG or other mannan-rich substrates

5. Handling & Storage

5.1 Storage Conditions:

- Store at 4–25 °C in sealed containers
- Avoid direct sunlight and freezing
- Keep away from acids, oxidizing agents, and heavy metals

5.2 Stability on Storage:

- Activity loss ~1–5% per month at room temperature
- Refrigeration improves stability

5.3 Safety Information:

- Non-toxic and biodegradable
- May cause allergic reactions via inhalation or skin contact
- Use protective clothing, gloves, goggles
- Avoid aerosol formation

Refer to product MSDS for complete safety details.

6. Packaging Options

- 100 mL, 1 L, 10 L, 25 L.

7. Quality Control Specifications

Test	Specification
Activity assay	≥ labelled activity
Moisture (powder)	≤ 8%
Microbial load	Total plate count ≤ 50,000 CFU / g
Pathogens	*Salmonella* negative, *E. coli* negative

9. Shelf Life

- **Liquid:** 12 months when stored in original container, sealed, in cool conditions.

10. Disclaimer

This technical data sheet provides general information. Application testing is recommended to determine optimal use conditions.

NOTE: THIS DOCUMENT CANCELS AND SUPERSEEDS ALL OTHER EDITIONS