Lactase Technical Sheet

High activity lactase for digesting lactose

Scientific & Technical™

Lactase Technical Datasheet

1. Product Overview

Food grade lactase (β-galactosidase) is an enzyme that hydrolyses lactose, the sugar found in milk and dairy products, into its simpler, more digestible components: glucose and galactose. Its key applications include the production of lactose-free or low-lactose dairy products, such as milk, yogurt, cheese, and ice cream, making them suitable for lactose-intolerant consumers. Lactase also improves sweetness and solubility in dairy formulations, as the resulting monosaccharides are sweeter than lactose and dissolve more easily. Additionally, it enhances fermentation efficiency in dairy-based beverages and can prevent lactose crystallization in products like condensed milk and ice cream, improving texture and shelf life. The enzyme is food grade, safe for consumption, and contributes to broader consumer accessibility, improved product quality, and extended shelf life in the dairy industry.

2. Product Characteristics

Parameter	Specification
Enzyme Class	β-galactosidase (EC 3.2.1.23)
Source	*Aspergillus oryzae* (non-GM strain)
Appearance	Yellow liquid
Activity	20,000 ALU / g
Units	Where 1 acid lactase unit (ALU) is the amount of enzyme required to digest 1 µg of lactose per min
Density	1.1-1.2 g per mL
Total Protein	10-15 % w/v
Temperature Range	15–65 °C (operational)
Optimal Temperature	37–50 °C
pH Range	3.0–8.0
Optimal pH	4.0–6.0
Shelf Life	24 months (sealed and kept under recommended storage conditions)

3. Enzymatic Properties

3.1 Mechanism of Action:

Lactase (β-galactosidase) functions by catalysing the hydrolysis of lactose into glucose and galactose through a two-step double-displacement mechanism. First, lactose binds to the enzyme's active site, where two key glutamate residues act as a proton donor and a nucleophile. One glutamate protonates the glycosidic bond between the glucose and galactose units, weakening it, while the other attacks the anomeric carbon of galactose to form a temporary covalent galactosyl–enzyme

intermediate. This step releases the glucose molecule. Next, a water molecule is activated by the catalytic residue and attacks the intermediate, breaking the covalent linkage and releasing galactose. The enzyme is then regenerated to its original state, ready to catalyse another reaction. Through this mechanism, lactase efficiently cleaves dietary lactose into its absorbable monosaccharide components.

3.2 Kinetics:

Lactase follows classic Michaelis–Menten reaction kinetics, in which the rate of lactose hydrolysis depends on both substrate concentration and the enzyme's catalytic parameters. At low lactose concentrations, the reaction rate increases proportionally as more substrate is available to form enzyme–substrate complexes. As lactose concentration continues to rise, the active sites of lactase molecules become increasingly occupied, causing the reaction rate to approach a maximum velocity (V_{max}), where further increases in substrate no longer increase turnover. The K_m value of lactase reflects its affinity for lactose, with lower K_m indicating stronger binding and more efficient catalysis at physiological concentrations. Factors such as pH, temperature, and the presence of inhibitors or competing β-galactosides can significantly modify these kinetic parameters. Overall, the enzyme exhibits saturation kinetics typical of glycoside hydrolases, with catalytic efficiency determined by the interplay of V_{max}, K_m, and environmental conditions.

- K_m = 20-50 mM
- V_{max} = 400 µmol min^{-1} mg^{-1}
- K_{cat} = 100 s^{-1}

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. Applications

4.1 Production of Lactose-Free and Low-Lactose Dairy Products:

Lactase hydrolyses lactose into glucose and galactose, making dairy products digestible for lactose-intolerant consumers. Used in:

- Milk (UHT, pasteurized, ESL)
- Yogurt
- Ice cream
- Cheese milk
- Infant formula

4.2 Sweetness Enhancement Without Added Sugar:

- Glucose and galactose are sweeter than lactose, so lactose hydrolysis naturally increases sweetness by ~20–30%. Allows reduction of added sucrose in flavoured dairy. Improves flavour in chocolate milk and ice cream. Enhances sweetness in whey-based beverages

4.3 Brewing & Distillation:

- Used to produce fermentable sugars from lactose for brewing and distillation products

4.4 Waste Processing:

- Digest lactose into non-toxic

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

- 0.1 L, 1 L, 10 L, 25 L

7. Quality Control Specifications

Test	Specification
Activity assay	≥ labelled activity
Moisture (powder)	≤ 8%

Test	Specification
Microbial load	Total plate count ≤ 50,000 CFU / g
Pathogens	*Salmonella* negative, *E. coli* negative

9. Shelf Life

- **Liquid:** 24 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