Glucoamylase

High activity glucoamylase for digesting oligosaccharides

Glucoamylase Technical Datasheet

1. Product Overview

Food-grade glucoamylase catalyses the hydrolysis of α-1,4 and, to a lesser extent, α-1,6 glycosidic bonds in starch, converting it into glucose. Its key benefits include high efficiency in producing fermentable sugars, improved sweetness, and enhanced digestibility of starch-containing foods. In the food and beverage industry, glucoamylase is widely used for starch saccharification in the production of glucose syrups, high-fructose syrups, and brewing, where it increases fermentable sugar availability for yeast. It also improves the texture, shelf-life, and clarity of fruit juices and purees by reducing viscosity. Additionally, glucoamylase plays a role in producing digestible starch-based ingredients for confectionery, baking, and dairy applications. Its specificity and high activity make glucoamylase a versatile enzyme for enhancing efficiency, quality, and functionality in a variety of starch-based processes.

2. Product Characteristics

Parameter	Specification
Enzyme Class	Hydrolase – Glucoamylase (EC 3.2.1.3)
Source	*Aspergillus niger* (non-GM strain)
Appearance	Brown liquid
Activity	300,000 U / g
Temperature Range	15–55 °C (operational)
Optimal Temperature	50–55 °C
pH Range	3.4 – 8.0
Optimal pH	4.5 – 5.5
Shelf Life	12–24 months (sealed, recommended storage conditions)

3. Enzymatic Properties

3.1 Mechanism of Action:

Glucoamylase (amyloglucosidase) catalyses the complete hydrolysis of starch by progressively cleaving glucose units from the non-reducing ends of polysaccharide chains such as amylose and amylopectin. The enzyme specifically targets α-1,4 glycosidic bonds, using an acid–base catalytic mechanism in which a key glutamic acid residue protonates the glycosidic oxygen, enabling water to attack and break the bond. Each cleavage releases a molecule of β-D-glucose, which can freely mutarotate to the α-anomer in solution. Although its primary activity is against α-1,4 linkages, glucoamylase can also slowly hydrolyse α-1,6 branch points, allowing it to degrade branched starch structures completely. Through this stepwise, processive action, glucoamylase efficiently converts complex carbohydrates into individual glucose monomers.

3.2 Kinetics:

Glucoamylase follows typical Michaelis–Menten reaction kinetics, in which its catalytic rate depends on the concentration of available starch or dextrin substrates. The enzyme shows a high affinity for the non-reducing ends of polysaccharide chains, and its reaction rate increases as more chain ends become exposed through prior gelatinisation or α-amylase pretreatment. Glucoamylase activity is strongly influenced by temperature and pH, typically exhibiting optimal performance near pH 4.0–5.0 and at elevated temperatures (50–60°C), where substrate accessibility and enzyme flexibility are maximised. At saturating substrate concentrations, the reaction reaches Vmax, reflecting the maximum turnover rate determined by the enzyme's catalytic constant (k_{cat}). Because glucoamylase acts processivity, continuously removing glucose units from each chain, the kinetics reflect both the enzyme's binding affinity (K_m) and its ability to remain attached to the substrate. The presence of α-1,6 branch points slows the overall reaction due to reduced cleavage rate at these linkages, creating plateaus in kinetic curves as the enzyme transitions between linear and branched regions.

- K_m = 0.1-5 mg per mL
- V_{max} = 1000 U / mg
- K_{cat} = 400 s^{-1}

3.3 Inhibitors:

- Heavy metals (Hg^{2+}, Cu^{2+})
- Urea, Guanidine hydrochloride, SDS
- Extreme low or high pH
- High temperatures above 60 deg. C
- High chelator concentrations (EDTA)

4. Applications

4.1 Starch Conversion & Sweetener Production:

- Glucose syrup production – Converts liquefied starch into high-glucose syrups.
- High-maltose / maltodextrin processing – Enhances glucose yield or tailors sugar profiles.
- High-fructose syrup precursor – Produces the glucose required for fructose isomerization.

4.2 Brewing Industry:

- High attenuation beers – Breaks down dextrins into fermentable sugars.
- Low-carb beer production – Full dextrin hydrolysis results in nearly complete fermentation.
- High-gravity brewing – Increases fermentable sugars in concentrated mashes.
- Adjunct brewing – Helps process non-malted grains like rice, corn, sorghum.

4.3 Distilled Spirits / Ethanol Production:

- Fuel ethanol fermentation – Converts residual starch into fermentable glucose.
- Potable alcohol – Used in whiskey, vodka, rum, and neutral spirit fermentation.
- Improved fermentation efficiency – Maximizes alcohol yield from starch-rich raw materials.

4.4 Baking Applications:

- Dough fermentation enhancement – Produces extra glucose for yeast fermentation.
- Crumb softening – Glucose changes moisture retention and reduces staling.
- Flavour & browning improvement – Increases reducing sugars for Maillard reaction.

4.5 Fruit Processing & Juice Industry:

- De-starching fruit purees
- Clarification of juices (e.g., apple, pear) — Prevents cloudiness from starch.
- Improves filtration efficiency and juice stability.

4.6 Plant-Based & Fermentation-Based Foods:

- Production of fermented plant beverages – barley, oats, rice, sorghum.
- Sugar release for kombucha, kefir, and other fermentations when made from grain bases.

4.7 Food Ingredient Manufacturing / Production of Glucose Powders / Syrups Used in:

- candy and confectionery
- ice cream stabilization
- energy gels and sports drinks
- baked goods
- sauces and jams

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 (1000 kg totes available upon request)

7. Quality Control Specifications

Test	Specification
Activity assay	≥ labelled activity
Density (liquid)	1.1–1.2 g / mL
Moisture (powder)	≤ 8%
Microbial load	Total plate count ≤ 50,000 CFU / g
Pathogens	*Salmonella* negative, *E. coli* negative

9. Shelf Life

- **Liquid:** 12 months
- **Powder:** 24 months
  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.