

Catalase Technical Sheet

High activity enzyme for digesting peroxides



HIGH ACTIVITY DIGESTS PEROXIDES FOOD PROCESSING PACKAGING AID BULK OPTION

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1. Product Overview

Food-grade high-activity catalase enzyme is a powerful biocatalyst widely used across food and beverage industries for its ability to rapidly decompose hydrogen peroxide (H₂O₂) into water and oxygen. This reaction is crucial for removing residual peroxide used in sterilisation, bleaching, or disinfection processes, ensuring product safety and compliance with food-grade standards. The enzyme exhibits high catalytic efficiency, broad pH stability (typically pH 5–10), and thermal resilience, allowing it to perform effectively under diverse industrial conditions. Key benefits include improved process efficiency, shorter reaction times, and enhanced product quality by preventing oxidative damage to flavours, colours, and nutrients. Catalase is also eco-friendly and non-toxic, offering a sustainable alternative to chemical neutralisers in applications such as dairy processing, beverage clarification, egg product treatment, and textile bleaching.

2. Product Characteristics

Parameter	Specification
Enzyme Class	Oxireductase (EC 1.11.1.6)
Source	<i>Aspergillus niger</i> (non-GM strain)
Appearance	Brown liquid
Activity	400,000 U / g
Units	Where 1 U is the amount of enzyme required to release 1 µg of water per minute from hydrogen peroxide
Total Protein	10-14 % w/v
Density	1.10-1.20 g per mL
Temperature Range	15–60 °C
Optimal Temperature	45–55 °C
pH Range	5.0–10.0
Optimal pH	6.0–8.0
Shelf Life	24 months (sealed and kept under recommended storage conditions)

3. Enzymatic Properties

3.1 Mechanism of Action:

Catalase is a haem-containing oxidoreductase enzyme that protects cells by rapidly decomposing hydrogen peroxide (H₂O₂), a reactive oxygen species that can damage proteins, lipids, and DNA. Its mechanism of action is based on a two-step catalytic cycle involving the haem iron at the enzyme's active site. First, catalase reacts with hydrogen peroxide to form Compound I, an oxyferryl complex

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where the haem iron is oxidised. Second, a second molecule of hydrogen peroxide reduces Compound I back to its resting state, releasing water and molecular oxygen. Through this highly efficient cycle—capable of breaking down millions of hydrogen peroxide molecules per second—catalase prevents oxidative stress, maintains cellular redox balance, and supports organismal survival in oxygen-rich environments.



3.2 Kinetics:

Catalase exhibits exceptionally fast reaction kinetics, making it one of the most efficient enzymes known. Its catalytic activity follows typical Michaelis–Menten behaviour, but with unusually high turnover rates due to its rapid two-step catalytic cycle involving the formation and reduction of Compound I. Catalase has a very high turnover number (k_{at}), often exceeding 10^6 reactions per second, meaning each enzyme molecule can convert millions of hydrogen peroxide molecules to water and oxygen every second. The enzyme operates efficiently even at relatively high substrate concentrations because hydrogen peroxide serves as both the electron donor and acceptor in the reaction. Its K_m values for H_2O_2 are typically low to moderate (on the order of 10^{-1} to 10^{-3} M), reflecting strong affinity but also a design optimized for handling toxic spikes in peroxide levels. Unlike many enzymes, catalase reaction rates do not increase linearly at extremely high substrate levels; instead, excessive H_2O_2 can lead to transient inhibition or inactivation due to over-oxidation of Compound I. Overall, catalase's kinetic profile is defined by high catalytic efficiency, strong substrate affinity, and rapid turnover, enabling organisms to detoxify hydrogen peroxide almost instantaneously.

3.3 Inhibitors:

- Heavy metals (Hg^{2+} , Cu^{2+})
- Urea, Guanidine hydrochloride, SDS
- Extreme low or high pH
- High temperatures above 65 deg. C
- High chelator concentrations (EDTA)

4. Applications

4.1 Removal of Hydrogen Peroxide:

Catalase rapidly breaks down hydrogen peroxide into water and oxygen, common applications include:

- Neutralising residual hydrogen peroxide after sterilisation (e.g., aseptic packaging, equipment sanitation).
- Removing peroxide used in food surface treatments, such as cheese or egg products.

4.2 Dairy Industry:

- Milk and cheese processing: removes residual peroxide after cold pasteurisation or sterilisation treatments.
- Whey processing: decomposes peroxide used for microbial control.
- Improves safety without heating steps that may affect nutrients or flavour.

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4.3 Egg Product Processing:

- Defoaming and oxidation control in liquid egg processing.
- Removes hydrogen peroxide used to reduce microbial load.
- Ensures eggs are safe for use in bakery and ready-to-eat applications.

4.4 Beverage Industry:

- Juices and soft drinks: Neutralizes peroxide after aseptic packaging sterilisation.
- Helps maintain colour, flavour, and nutritional integrity since no heat is required.

4.5 Baking Industry:

Used with glucose oxidase systems:

- Glucose oxidase generates peroxide to strengthen dough.
- Catalase removes excess peroxide to avoid over-oxidation and off-flavours.
- Ensures optimal dough texture, crumb structure, and shelf life.

4.6 Processing of Fish & Seafood:

- Neutralizes residual peroxide used during bleaching or microbial control.
- Prevents rancidity and off-flavours.

4.7 Cosmetics & Food-Adjacent Products:

Although still “food-grade” quality, catalase is used in:

- Mouthwashes and oral care (to break down peroxide)
- Processing of food-contact materials where peroxide sterilization is involved

4.8 Environmental & Safety Applications in Food Plants:

- Detoxifying peroxide before wastewater discharge.
- Reducing chemical hazards for workers.

4.9 Bio-processing and Fermentation:

- Removes inhibitory peroxide generated by microorganisms.
- Protects sensitive enzymes and cultures.

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

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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)	1.15–1.20 g / mL
Moisture (powder)	≤ 8%
Microbial load	Total plate count ≤ 50,000 CFU / g
Pathogens	<i>Salmonella</i> negative, <i>E. coli</i> negative

9. Shelf Life

Liquid: 12 months, store 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.

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