

ENZYMES: THE INVISIBLE INTELLIGENCE BEHIND LIFE & HEALTH

Enzymes are not just chemical substances — they are the biological intelligence that drives life itself.

From the moment a cell breathes, divides, heals, or produces energy, enzymes are silently working in the background, directing every biochemical reaction with precision and speed.

In nature, enzymes act as biological catalysts, accelerating essential reactions without being consumed. In the human body, they govern digestion, metabolism, immunity, detoxification, cellular repair, and energy production. Without enzymes, life as we know it would slow down to a standstill.

Modern science has taken inspiration from this natural intelligence. Today, enzymes are harnessed to support health, enhance nutrition, improve bioavailability, and enable sustainable industrial processes across pharmaceuticals, nutraceuticals, food, feed, fermentation, and biotechnology. They help convert complex molecules into absorbable nutrients, reduce metabolic stress on the body, and promote efficient physiological balance.

At the intersection of science and health, enzymes represent a powerful tool — natural, efficient, and precise. They do not replace the body's systems; instead, they support and optimize them, making enzymes a cornerstone of preventive healthcare and advanced biological innovation.

In a world moving toward cleaner labels, sustainable solutions, and science-backed wellness, enzymes stand as nature's most refined technology for better health and better living.



BROMELAIN: NATURE'S PROTEOLYTIC POWER FROM PINEAPPLE

Bromelain is a naturally derived proteolytic enzyme complex obtained from the stem of *Ananas comosus* (pineapple). Known for its powerful protein-digesting capability, Bromelain has been used for decades in healthcare, nutrition, and pharmaceutical applications due to its broad biological activity and excellent safety profile.

At a molecular level, Bromelain works by breaking complex protein structures into easily absorbable peptides and amino acids, thereby supporting efficient digestion and nutrient utilization. Beyond digestion, scientific studies have demonstrated Bromelain's role in supporting inflammation management, tissue recovery, circulation, and immune balance, making it a valuable enzyme in modern health formulations.

In therapeutic and nutraceutical applications, Bromelain is widely valued for its anti-inflammatory, anti-edematous, and fibrinolytic properties. It is commonly used in joint health, sports nutrition, post-surgical recovery, and respiratory support formulations. Its stability and activity across a broad pH range further enhance its suitability for oral dosage forms and functional food applications.

Industrially, Bromelain functions as a clean-label, plant-based enzymatic solution for food processing, meat tenderization, brewing, protein hydrolysates, and cosmetic formulations. As demand grows for science-backed, plant-origin bioactives, Bromelain continues to bridge natural enzymatic wisdom with modern biochemical innovation—delivering sustainable, efficient, and measurable benefits across health, nutrition, and industry.

WHY BROMELAIN?

A Smart Enzyme Choice Backed by Nature & Science

Bromelain stands out among proteolytic enzymes because it offers multi-functional benefits in a single, plant-based solution. Its growing demand across healthcare, nutraceutical, and food industries is driven by the following key reasons:

Key Benefits:



Superior Protein Digestion

Breaks complex proteins into absorbable peptides & amino acids, improving bioavailability and reducing digestive burden.



Natural Anti-Inflammatory Support

Supports the body's natural inflammatory response, helping reduce edema and promote tissue recovery.



Joint, Muscle & Recovery Health

Widely used in joint care, sports nutrition, and post-surgical recovery formulations.



Immune & Circulatory Balance

Exhibits fibrinolytic activity, supporting healthy circulation, immune modulation, and respiratory wellness.



Plant-Based • Clean-Label • Safe

- Derived from pineapple stem
- Non-animal origin
- Vegetarian-friendly
- Well-tolerated with long-standing safe use



Wide Functional Versatility

- Remains active across a broad pH & temperature range, enabling use in:
- Capsules & tablets
 - Functional foods & beverages
 - Food processing
 - Cosmetics & personal care

MECHANISM OF ACTION

Bromelain is a complex of proteolytic enzymes derived from *Ananas comosus* (pineapple) that hydrolyzes peptide bonds in proteins, breaking them down into smaller peptides and amino acids. Its enzymatic activity is primarily attributed to thiol endopeptidases, which function optimally across a broad pH range (5.5–8.0), making bromelain suitable for diverse industrial applications.

In industrial processes, bromelain acts by:

PROTEIN DEGRADATION

1

Efficiently cleaves internal peptide bonds in both soluble and insoluble proteins, facilitating meat tenderization, dough conditioning, and beverage clarification.

In industrial processes, bromelain acts by:

SELECTIVE HYDROLYSIS

1

Exhibits high substrate specificity, enabling targeted breakdown of proteins without damaging essential structures in food, textiles, or biological systems.

In industrial processes, bromelain acts by:

THERMOSTABLE ACTIVITY

1

Maintains functional integrity under moderate thermal conditions, enhancing its utility in processing environments.

These properties make bromelain a versatile biocatalyst in food technology, pharmaceuticals, cosmetics, and textile processing, offering a natural, sustainable alternative to synthetic enzymes.



MORE APPLICATIONS, MORE BENEFITS

1

PHARMACEUTICAL INDUSTRY

- **Anti-inflammatory Agent:** Used in formulations for arthritis, sinusitis, and post-operative recovery.
- **Digestive Aid:** Included in enzyme supplements to support protein digestion.
- **Wound Healing:** Promotes tissue regeneration and reduces swelling.
- **Antithrombotic:** Helps prevent blood clots by inhibiting platelet aggregation.

2

FOOD & BEVERAGE INDUSTRY

- **Meat Tenderizer:** Breaks down tough meat proteins, improving texture and palatability.
- **Protein Hydrolysates:** Used in producing hypoallergenic food and nutritional supplements.
- **Baking:** Enhances dough elasticity and reduces mixing time.
- **Beverage Clarification:** Removes haze-forming proteins in beer and fruit juices.

3

COSMETICS & PERSONAL CARE

- **Exfoliation:** Gently removes dead skin cells in facial masks and scrubs.
- **Acne Treatment:** Helps reduce swelling and redness.

4

ANIMAL FEED INDUSTRY

- **Feed Additive:** Enhances protein digestibility and nutrient absorption in livestock and poultry.

5

BIOTECHNOLOGY & RESEARCH

- Cell Culture, Protein Extraction

TECHNICAL SPECIFICATIONS:

PRODUCT NAME	BROMELAIN
Source of Organism	Pineapple stem
Exp.Date	Depends on Grades
Carrier Material	Maltodextrin

TEST	LIMITS
Description	Off white to Yellow coloured powder
Moisture	NMT 7 %
pH	3.5-5.8
Odor	Typical, Natural odor
Heavy Metal	NMT 30 ppm
Arsenic	NMT 5 ppm
Lead	NMT 5 ppm
Activity Bromelain	NLT 150 / 200 / 600 / 1200 /2000/2400 GDU /g
Microbial Limit – Total Viable Count Yeast & Mold Count E. coli Salmonella Staphylococcus aureus	NMT 10000 cfu/g NMT 100 cfu/g Should be Absent Should be Absent Should be Absent

*Note: Technical Parameters may vary depending on the grade

Quality, Safety & Compliance

Manufactured under controlled GMP conditions with strict quality monitoring. Each batch is tested for enzyme activity, microbial limits, and heavy metal compliance to ensure consistent performance and safety.

Handling, Storage & Packaging

Store in a cool, dry place away from direct sunlight and moisture. Avoid inhalation of enzyme dust and use appropriate protective equipment during handling.

Standard Packaging: 25 kg drum
 Custom packaging available upon request.

Why Choose Enzyme Bioscience?

Enzyme Bioscience combines strong R&D capabilities, robust quality systems, and industry-focused expertise to deliver reliable enzyme solutions. Our commitment to consistency, documentation, and customer support makes us a trusted partner for enzyme-based applications.

Regulatory Disclaimer

This product is intended for B2B use only. Final application suitability, formulation claims, and regulatory compliance are the responsibility of the customer as per local regulations.

**PARTNER WITH US TO POWER INNOVATION
THROUGH NATURE'S MOST EFFICIENT CATALYSTS.
TOGETHER, LET'S BUILD A HEALTHIER,
MORE SUSTAINABLE WORLD.**

