



**Get more value
from your collagen
and gelatin**

The global collagen market size was valued at **\$ 3.5 billion** in 2018, and is projected to reach a value of nearly USD 4.6 billion by 2023, at a CAGR of **5.2%**.

The gelatin market size is projected to grow from **\$ 2.6 billion** in 2018, to USD 3.6 billion by 2023, with CAGR of **6.6%**.

– Markets and Markets



Meeting customer demands

The major driving factors for the **collagen** market demand is attributed to convenience food and increasing awareness of collagen in the medical and healthcare industries.

The increasing demand for **gelatin** is expected to come from the nutraceutical, medical and biomedical industries.

– Markets and Markets

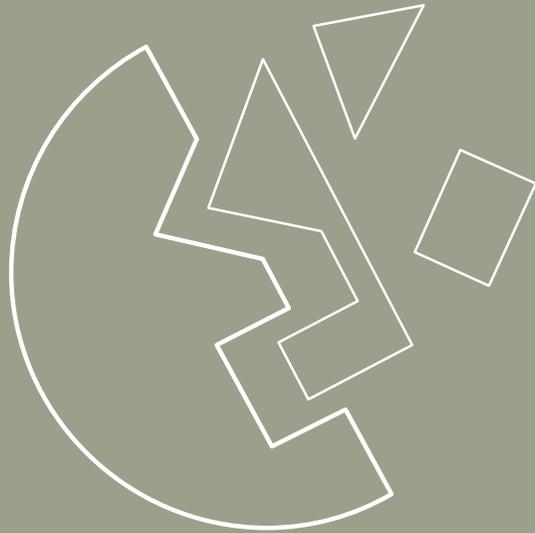
Gelatin and hydrolyzed collagen



Chemical-based gelatin and collagen production is expensive, slow and impactful for the environment

- When using bones as the raw material, the traditional liming process takes 3–12 weeks
- The chemical process is not only polluting, it is also slow, costly and difficult to control, resulting in products of low quality with limited uses
- Consumers are growing increasingly aware of the link between diet and sustainability — and expect processors to choose the most environmentally friendly production methods





**Derive value from
co-products with
Novozymes' microbial
enzymes to produce high-
value collagen and gelatin**

- **Maximize the quality of your products**
 - Produce high and low degree collagen hydrolysates, with a consistent clean taste, and without producing harmful compounds (e.g. 3-MCPD)
- **Reduce time and costs, increase capacity**
 - By using enzymes, you can significantly reduce soaking and liming times for gelatin extraction, thereby increasing production capacity
- **Improved quality of raw material**
 - Enzymes offer superior bone-cleaning, improving the quality of raw materials
- **Natural processing aid**
- **Sustainable processing**
 - Enzymes are a more environmentally friendly compared to chemical agents

Products

The following enzymes are suitable for the production of gelatin and collagen:

Novozymes product	Description
Alcalase® Pure	Broad-spectrum endoprotease, liquid
Alcalase® 2.4 L FG	Broad-spectrum endoprotease, liquid
Neutrase® 0.8 L	Broad-spectrum endoprotease, liquid
Novo-Pro® D	Very broad-spectrum endoprotease, liquid, for pet and animal feed only
Flavourzyme® 1000 L	Flavor-modifying exopeptidase, liquid

Raw material preparation



Soaking



Liming



Extraction



Downstream processing

Usage: gelatin and collagen extraction

- Raw material can be varied depending on each geographical origin (most commercial extraction from hides, skins, and in some cases, bones from pigs and cattle)
- Hydrolysis during liming step:
 - Alcalase® 2.4 L FG or Neutrase® 0.8 L: Low degree of hydrolysis — neutral pH, 0.5–1.0 h
 - Alcalase® 2.4 L FG/Neutrase® 0.8 L + Flavourzyme® 1000 L: High degree of hydrolysis — neutral pH, longer time
- Heat extraction over time can yield different bloom strength gelatins or hydrolyzed collagen
- Examples of different products generated:
 - Low-DH gelatin: processed meats, nail strengthening, shampoos, conditioners, etc.
 - High-DH gelatin: ready-to-eat meals
 - Hydrolyzed collagen: protein supplementation

Usage of microbial enzymes

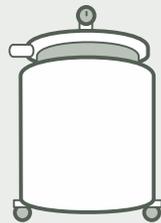
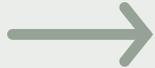
Gelatin and collagen extraction



Step **1**

Raw material treatment

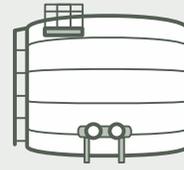
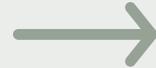
- Cleaned and washed raw materials e.g. hides



Step **2**

Soaking

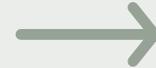
- Hydration and softening of material
- Can be shortened with enzymes



Step **3**

Liming

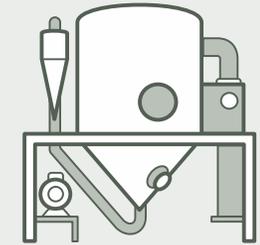
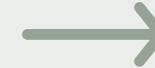
- Can be shortened and enhance yields with enzymes



Step **4**

Extraction

- Sequential extractions and additional hydrolysis yields decreasing bloom strength gelatin or hydrolyzed collagen



Step **5**

Drying

Partner to expand your gelatin and collagen production capabilities



Differentiate

Understanding market demands

Animal-derived co-products are rich in functional properties that are in high demand in several industries globally.

By working with Novozymes' experts, you can unlock the value within these process streams and win in the marketplace.

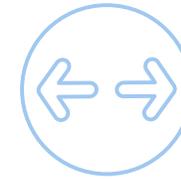


Optimize

Optimizing your product with enzymes

Enzyme technology has unique and versatile functional benefits. Through experimentation, we select the optimal balance and dosage of enzymes for your gelatin production.

The enzymes that can boost your processing performance are Alcalase[®], Flavourzyme[®], Neutrase[®] and Novo-Pro[®] D.



Expand

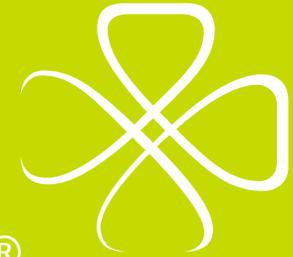
Winning customers and sales

Novozymes helps you meet your production and launch goals with a partnership mentality.

You have access to a wealth of expertise, from labeling and regulatory to technical services, supply chain and commercial account management. Together we ensure that your gelatin and hydrolyzed collagen products are a commercial success.

Go to <https://new.novozymes.com/food-beverages/animal-protein>
and click on contact us to get in touch with our experts

novozymes[®]



Rethink Tomorrow