



BUTTERFLIES

Project Bio-Polymers & Additive Manufacturing

Newsletter I

Chitin – Nature’s Most Underrated Supermaterial

Why we will use it in medical technology, too



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Chitin – Nature’s Most Underrated Supermaterial

Why we will use it in medical technology, too

If nature had a “hidden champion,” chitin would be a top contender. Few materials are as widespread, as robust, and as versatile. And yet, many people barely know it—unless they’ve peeled shrimp in the kitchen.

Where Chitin Shows Up – Far Beyond Crab Shells

Chitin is a natural biopolymer—a kind of biological plastic fiber—and appears in some surprising places:

- **Insects:** From dragonflies to houseflies, their protective exoskeletons rely heavily on chitin.
- **Crustaceans:** Shrimp, crabs, and lobsters use it to build their sturdy shells.
- **Fungi:** Even mushrooms contain chitin in their cell walls—the structural framework of your everyday champignon.
- **Cephalopods:** Squid and octopuses incorporate chitin into their hooks and beak-like structures.

In short: wherever nature needs strength, lightness, and flexibility, chitin is the go-to material.

What is chitin made of?

Chitin is a polysaccharide composed of acetylglucosamine units. These acetylglucosamine units are linked by β -1,4-glycosidic bonds—the same type of linkage that connects glucose molecules in cellulose. Chitin can therefore be viewed as a modified form of cellulose in which the hydroxyl groups at the C-2 position of the monomer units are replaced by acetamido groups. This substitution enables stronger hydrogen bonding between adjacent polymer chains, making chitin harder and more stable than cellulose. However, natural chitin is usually not a uniform polymer; instead, it consists of a statistical copolymer of D-glucosamine (GlcN) and N-acetyl-D-glucosamine (GlcNAc), meaning that not every amino group is acetylated.

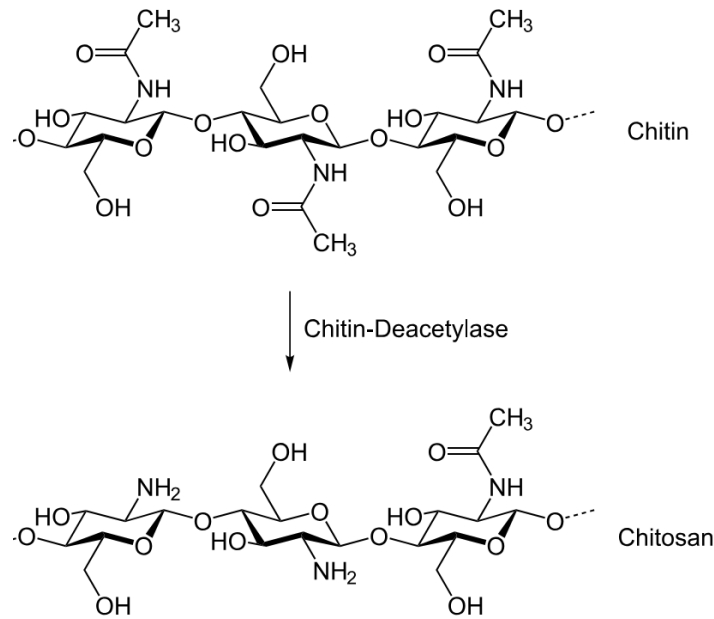


Figure 1: Molecular structure of chitin and its deacetylated form chitosan. (source: Wikipedia, NEUROtiker)

How Chitin Is Obtained – From Ocean Waste to White Gold

Most industrial chitin production begins in the sea. Common raw materials include:

- Shrimp and crab shells
- Lobster shells
- Processing waste from the seafood industry

These leftovers—otherwise simple waste—are cleaned, deproteinized, and decalcified. What remains is a fine, white, fibrous substance: pure chitin. With an additional treatment step, it can be converted into **chitosan**, a deacetylated form that is more water-soluble and offers even broader application potential.

There are many indications that insect harvesting will increase significantly in the future, simply because the biotechnological use of insect larvae for vitamin and protein production and waste recycling is rapidly gaining ground.

A Natural Multi-Talent: Antibacterial, Antiviral, Antifungal

Chitin and chitosan are not only strong and lightweight—they also have remarkable biological properties:

- **Antibacterial:** Chitosan can inhibit bacteria by disrupting their cell membranes. This makes it valuable in wound dressings, medical gels, and even food preservation.
- **Antiviral:** Studies show that chitosan can affect viral activity—an exciting field for applications ranging from medicine to filtration technologies.
- **Antifungal:** No wonder plant research and agriculture are enthusiastic about it—chitosan helps plants defend themselves against fungal attacks.

Nature didn't just design chitin as a building material, but also as a protective shield.

Why Chitin Stands Out

- It is **sustainable**, sourced largely from unavoidable waste streams.
- It is **biodegradable**.
- It is **biocompatible**, making it safe for use with living tissue.
- It can be processed into **films, gels, fibers, powders, or coatings**.

In short: chitin is an impressive all-rounder—and a shining example of the untapped potential hidden in natural materials

It's time to mine the “treasure”

It is incomprehensible that, despite all the interesting properties of this biopolymer, it has found almost no technical application to date. Butterflies is attempting to make the material available in two additive processes: 2-photon polymerization for the production of organoids and the binder jet application process for printing medical devices like orthoses and prostheses.