

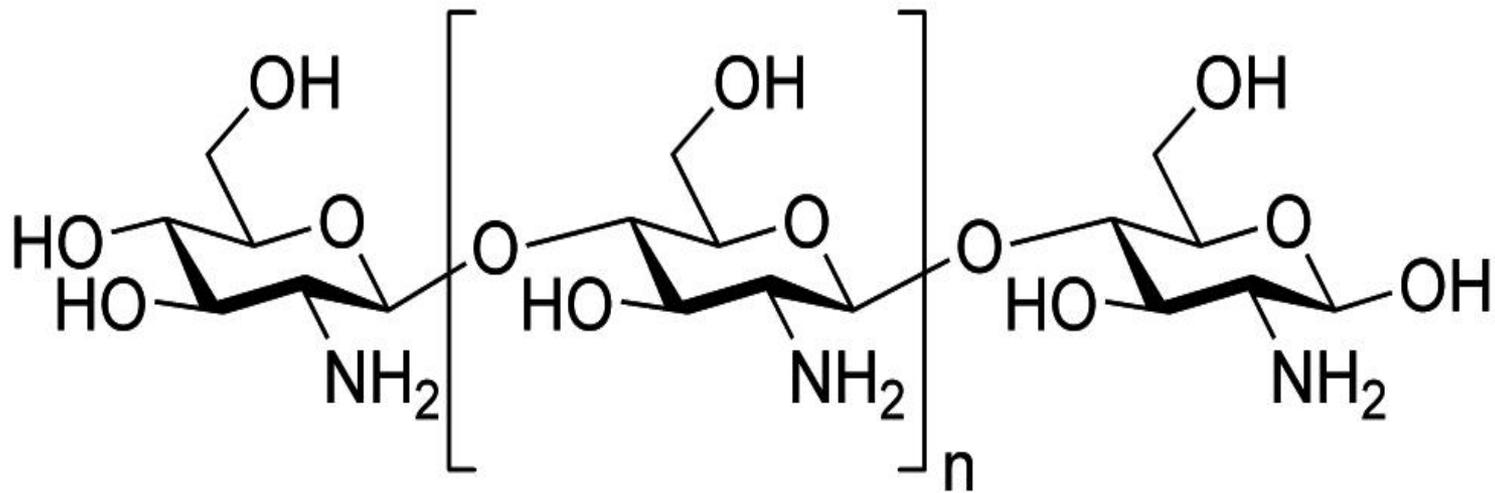
# Chitosan & Usage



# What is Chitosan?

- ▶ Chitosan is a linear polysaccharide composed of randomly distributed  $\beta$ -(1-4)-linked D-glucosamine (deacetylated unit) and N-acetyl-D-glucosamine (acetylated unit).
- ▶ Chitosan is produced commercially by deacetylation of chitin, which is the structural element in the exoskeleton of crustaceans (crabs, shrimp, etc.) and cell walls of fungi.
- ▶ A common method for the synthesis of chitosan is the deacetylation of chitin using sodium hydroxide in excess as a reagent and water as a solvent.

# Molecular structure of Chitosan



# Properties

- ▶ The amino group in chitosan has a pKa value of  $\sim 6.5$ , which leads to a protonation in acidic to neutral solution with a charge density dependent on pH.
- ▶ This makes chitosan water soluble and a bioadhesive which readily binds to negatively charged surfaces such as mucosal membranes.
- ▶ Chitosan enhances the transport of polar drugs across epithelial surfaces, and is biocompatible and biodegradable.

# Contd.

- ▶ Chitosan and its derivatives such as trimethylchitosan (where the amino group has been trimethylated) have been used in non-viral gene delivery.
- ▶ Trimethylchitosan, or quaternised chitosan, has been shown to transfect breast cancer cells; with increased degree of trimethylation increasing the cytotoxicity and at approximately 50% trimethylation the derivative is the most efficient at gene delivery.

# Usage

- ▶ Chitosan's properties allow it to rapidly clot blood, and has recently gained approval in the USA for use in bandages and other hemostatic agents.
- ▶ In agriculture, chitosan is used primarily as a plant growth enhancer, and as a substance that boosts the ability of plants to defend against fungal infections.
- ▶ Chitosan can also be used in water processing engineering as a part of a filtration process. Chitosan causes the fine sediment particles to bind together and is subsequently removed with the sediment during sand filtration. Chitosan also removes phosphorus, heavy minerals, and oils from the water

# Contd.

- ▶ Chitosan is an important additive in the filtration process. Sand filtration apparently can remove up to 50% of the turbidity alone while the chitosan with sand filtration removes up to 99% turbidity.
  - ▶ Chitosan is frequently sold in tablet form at health stores as a 'fat attractor': It is supposed to have the capability of attracting fat from the digestive system and expelling it from the body so that users can, it is claimed, lose weight without eating less.
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