



ensymm  
project consulting for life science

## CHITOSAN PRODUCTION LINE OFFER





## CHITOSAN PRODUCTION - INTRODUCTION

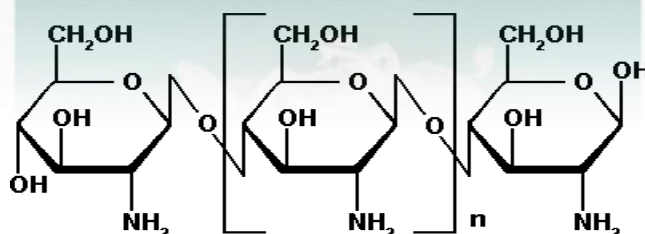
Chitosan is a deacetylated derivative of chitin. It is polysaccharide found in nature with an amino group, contained in the shells of Crustacea such as crab, shrimp, etc. Chitosan is a white to light-red solid powder, insoluble in water, soluble in organic acid, but indigestible by human digestive enzymes. Therefore, it is used as one of the so-called dietary fibers

Chitin is one of the three most abundant polysaccharides in nature, in addition to cellulose and starch. It ranks second to cellulose as the most plentiful organic compound on earth. Chitin and its derivatives have many properties that make them attractive for a wide variety of applications, from food, nutrition and cosmetics to biomedicine, agriculture and the environment.

Their antibacterial, anti-fungal and anti-viral properties make them particularly useful for biomedical applications, such as wound dressings, surgical sutures and as aids in cataract surgery and periodontal disease treatment.



Chitin/Chitosan is the most important additive and product from marine bio sources beside Calcium, Astaxanthin, Glucosamine. The middle extraction value of chitosan is 5%. It is strongly depend on process and know how which kind of extraction grade the production will reach.





## CHITOSAN APPLICATION

### Application

#### Nutritional Uses:

- Dietary Fibre

#### Biomedicine:

- Wound Healing
- Contact lenses
- Sutures

#### Skin and Hair Care:

- Moisturizing Creams and Lotions
- Hair care products

#### Environment and Agriculture:

- Water Treatment
- Seed Treatment

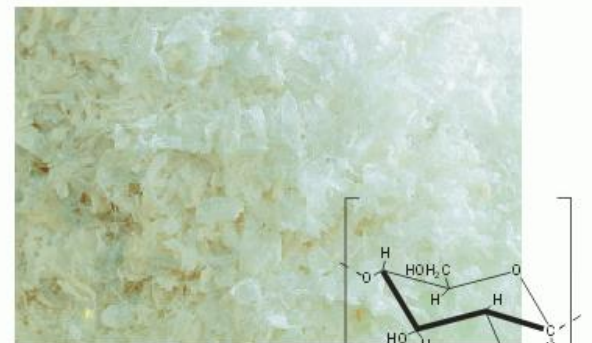
#### Other:

- Undergarments
- Paper
- Textiles
- Feed Additive

Commercial chitosan is usually offered as flakes or powder. The products of various companies differ in purity, granulation, colour, DD, average molecular weight, and solubility.

#### CHITOSAN:

- It is a nitrogen-containing cationic polysaccharide found in nature, and is one of the water-soluble dietary fibres.
- Its physiological functions include decrease of cholesterol, inhibition of fat absorption, prevention of increases in blood pressure, and improvement of intestinal environment are expected.
- Its safety in humans, animals and microbes has been confirmed by experiments. Also, it has long been taken as a food.



Chitosan

#### High Value



#### Low Value

- Biomedical and Pharmaceuticals
- Chemical and Industrial
- Cosmetics
- Food Industry
- Nutraceutical
- Water Purification
- Agricultural
- Fiber & Textiles
- Paper Technology



## MEDICAL GRADE INFORMATION

It is in medicine that the bacteriostatic, immunologic, antitumoral, cicatrizant, hemostatic and anticoagulant properties of chitin and its derivatives have been of the greatest use.



### Analyze Report of Chitosan (Medical Grade)

TEST	SPECIFICATION	RESULT	REMARK
<b>Appearance:</b>	Yellow and light Brown, Free flowing powder	Pass	Gardner No. Max.2
<b>Density</b>	Pass 25 -200 Mesh	100 Mesh	Sieve No.25-100 pass ration (Fisher)
<b>Moisture content</b>	Less than 10%	5.0 %	Dry 3hr at 105deg.C
<b>Oligo content</b>	65%	85%	-
<b>Residue on ignition</b>	Less than 0.5%	0.06 %	Ashing method
<b>Protein content</b>	Less than 0.3%	0.19%	Kjeldal method
<b>Degree of Deacetylation</b>	70 - 100 %	95 %	Colloidal method
<b>Viscosity</b>	5 CPS and less	N/A	-
<b>Molecular weight</b>	Less than 4,000	1,800	Average
<b>Insoluble</b>	Less than 1% insolubility	<0.2%	Dissolved 10g of chitosan in 50ml of 1% distilled water solution. Chitosan solution to which added 200 ml distilled water was stirred 1hr. Filtration with a GF/C and washed with 20ml acetone. Dry residue at 105deg.C
<b>Heavy Metals(As)</b>	Less than 10 ppm	Non	ICP Analysis
<b>Heavy Metals(Pb)</b>	Less than 10 ppm	Non	ICP Analysis
<b>pH</b>	5 - 7	5.8	Dispersed 1g of chitosan in 99ml of distilled water after stirred 15 min.
<b>Toxicity</b>	Non-toxic	Non-toxic	ID 50 16g/kg body weight in mice
	10kgs/20kgs net each	-	Corrugated carton box with PE liner



## CHITOSAN MARKET OVERVIEW

### Prices for Chitin and Chitosan:

Chitin price is about 3-6 USD/kg. The price of Chitosan with standard quality for various applications ranges between 15-20 USD/kg.

### High Demand:

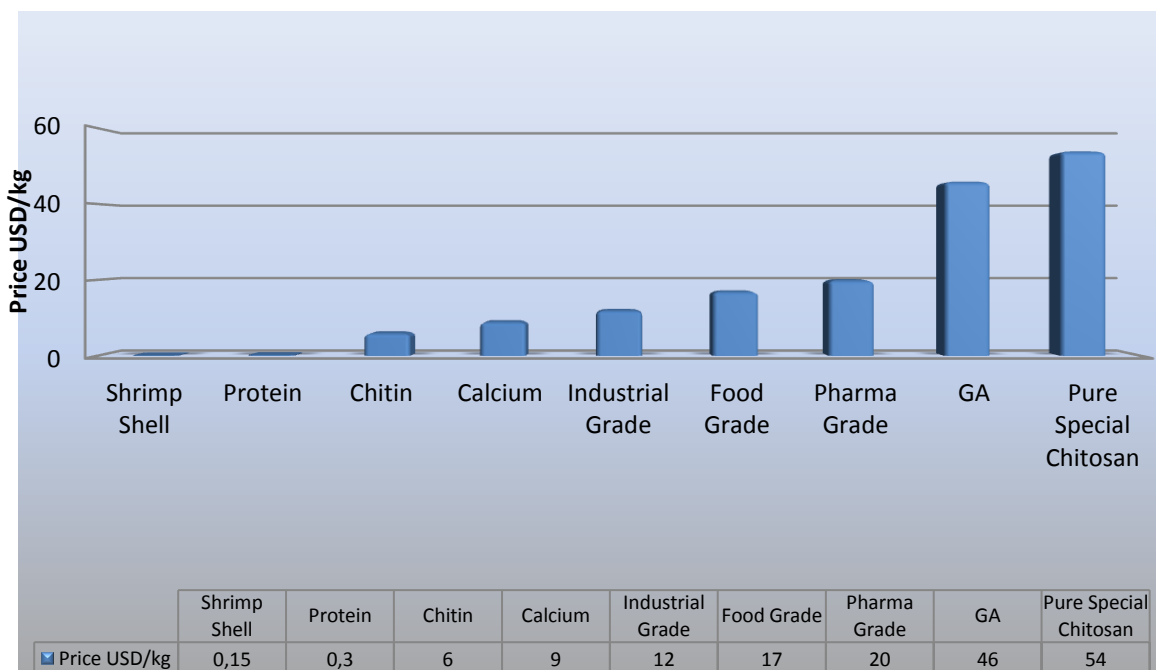
The chitin derivatives market is rapidly growing with an average of about 25% per year!

The natural polymer, chitin, and the increasing number of useful products derived from chitin such as chitosan, their derivatives, oligosaccharides and monosaccharides (e.g., glucosamine) continue to attract commercial development. Prices for chitin and chitosan range from \$10 to \$1,000 per kilogram depending on product quality.

The table below shows the average price of chitosan for different qualities and application application in comparison to other by-products from shrimp shell waste in USD/kg.

2001 the market volume of chitosan was 1400 MT increasing 2003 to 2800 MT.

The US chitin derivatives market is also expected to record a CAGR of nearly 22% over the period 2001-2010. Among Chitin derivatives, Chitosan is projected to offer the highest growth potential. The Chitosan market in Asia-Pacific is projected to grow at a compounded annual rate of approximately 24.5% over the period 2001-2010.





## CHITOSAN PRODUCTION - PROCESS

Shellfish processing results in large quantities of waste materials which can be processed into chitin, or its more valuable derivative, chitosan. The amount of chitin present in the shell may be affected by a number of factors, such as type of shell (e.g. shrimp, lobster, crab), Shell freshness, and portion of the shell used. Typically shell portions with high calcium concentrations are low in chitin. Shrimp shells generally have a higher content of chitin than crab offal.

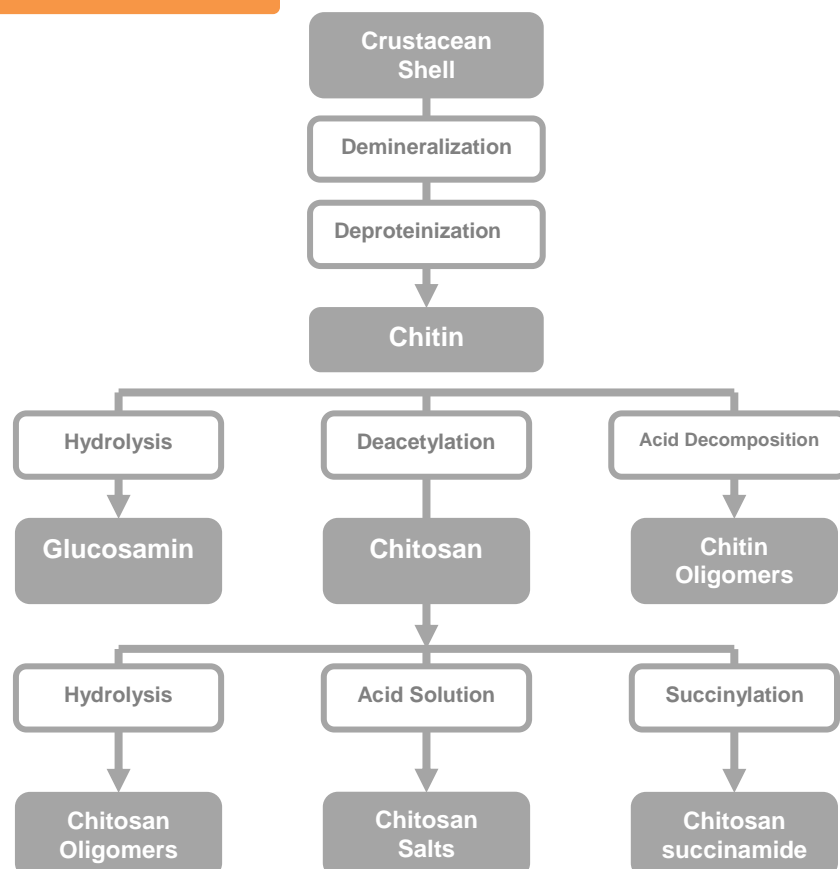
The chitin/chitosan process involves the crushing and drying of crab shell or other suitable species of crustaceans such as shrimp shell waste. The product is processed with acid and alkaline in order to remove protein and calcium. The product is then further dried, grinded, and packaged as a finished or semi-finished product.

A plant set-up would involve a number of pieces of equipment for grinding or particulation, drying, acid and alkaline treatment, packaging and effluent treatment.

### Shrimp Shell Waste Composition

- 5% Chitin
- 9% Protein
- 14% Ash
- 72% Water

### Production Flow Chart





## CHITOSAN PRODUCTION - PRODUCTS

Shrimp waste can be processed into five different products and by-products

### Products



Raw Material:  
Shrimp Head and Shell



Protein



Chitin



Pigment



Glucosamine



Chitosan



Activated Chitosan



## CHITOSAN PRODUCTION – PROCESS OPTIONS

There are two different technologies and processes to produce Chitin, Chitosan and Glucosamine:

- The Chemical Process that is the regular way and process worldwide.
- The Fermentation Process that is a new technology. For the production of Chitin it is already at industrial scale but for Chitosan it is first in the pilot phase.
- Also a combination of chemical (for production of Chitosan & Glucosamine) and fermentation process (for production of Chitin) is feasible. Details will be shared with you at a personal meeting.



The whole project study will contain:

1. Product description
2. Biochemical Introduction
3. Marketing and Feasibility study
4. Industrial use
5. Process Technology
6. Production line
7. Technology Transfer
8. Environmental aspects