THERAPEUTIC POTENTIAL OF CHITOSAN AS A PHARMACEUTICAL EXCIPIENT

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Abstract— **Chitosan is the most abundant polysaccharide next to cellulose; it is obtained by alkaline N-deacetylation of chitin. The major raw material for chitosan production is shrimp heads and shells. Shells of other crustaceans such as crabs, lobster, squilla and cuttle fish bones also could be profitably utilized. Chitosan has been widely investigated as a drug carrier for many possible routes of administration because chitosan has favourable biological properties, such as non-toxicity, biocompatibility, biodegradability and antibacterial characteristics. The physical and chemical properties of chitosan such as inter and intramolecular hydrogen bonding and the cationic charge in acidic medium, makes this polymer more attractive for the development of conventional and novel pharmaceutical product. Chitosan can serve a number of purposes, including a coating agent, gel former, controlled-release matrix etc. in addition to desirable properties, such as muco-adhesion and permeation enhancement to improve oral bioavailability of drug. The microbial floras that are present in the colon degrade chitosan; as a result chitosan is a good candidate for site-specific drug delivery. Chitosan has been found to be of use in many clinical situations for ameliorating variety of human ailments, ranging from wound healing, glomerulonephritis up to substitute of artificial red blood cells. These multiform aspects of chitosan parallel to those as a drug carrier make it a unique polymer in pharmaceutical field.**

Index Terms— Chitosan, chitin, pharmaceutical etc.

I. INTRODUCTION

Chitin is a naturally occurring cellulose-like biopolymer found mainly in the exoskeleton of marine animals such as shrimps, crabs or lobsters. Chitin can also be found in mushrooms and yeasts. It is the second most important natural polymer in the world. Chitosan is a chemically processed form of chitin. Prawn shell waste and shell byproducts of squid processing, are a renewable and inexpensive source of chitosan. It is the deacetylated derivative of chitin and the second most commonly occurring organic compound next to cellulose. Even though it is found in plankton and mushrooms, commercial applications will most likely come from shellfish wastes. The international shrimp industry from harvest through various processing operations produces a vast amount of potentially recoverable proteinaceous by-products in the form of shrimp heads and shells which is one of the raw materials for chitosan production.

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The chitosan has bioadhesive as well as antibacterial activity. It is soluble at acidic pH, forming gel; therefore it is mainly used for a drug delivery. Due to all these physical and chemical properties of chitosan it has become more attractive for the development of conventional and novel pharmaceutical product. Chitosan is a natural, cationic, hydrophilic, non-toxic, biocompatible and biodegradable polysaccharide suitable for application in pharmaceutical technology. In pharmaceutical manufacturing, chitosan is used as a filler in tablets; as a carrier in controlled-release drugs; to improve the way certain drugs dissolve; and to mask bitter tastes in solutions taken by mouth.

In India it is estimated that more than one lakh tonne of shrimp processing waste is being wasted annually which could be gainfully utilized for manufacturing chitosan, a high value industrial product. Another raw material for chitin is squilla. It is estimated that a potential of around 50,000 tonne of squilla is available of which nearly 5,000 tonne is being thrown back into the sea. This is an important trawl by catch especially in Mangalore and could be used for chitin/chitosan production. Crab shells and Lobster shells are also raw materials for chitosan production. The estimated availability of crab shells is 30 - 40,000 tonne in the Indian water.

The Ratnagiri is a coastal area bounded by Arabian Sea and famous for prawn and crab fishery. Fishing is the most important economic activity for people in this area. There are many fish processing industries generating crustacean wastes which can be used for the production of chitosan. Value addition industries for manufacturing of chitin and chitosan from shrimp, prawn and crab waste will generate socio economic benefits to local fishermen communities. By keeping this in mind, the present project was undertaken to isolate the chitosan from different crustaceans and to provide an insight into the many potential applications of chitosan as a pharmaceutical excipient.

II. MATERIALS AND METHODS

Dried Shells of prawn ***Peaneus indicus*** and crab ***Scylla serrata*** were collected from the local fish market of Ratnagiri, Maharshtra, India. All the shells were thoroughly cleaned to make them free from sand and extraneous matter and then they were weighed and packed into airtight containers.

Deprotenization

Then sample was then boiled with 3% sodium hydroxide for 30 minutes in a steel vessel to remove protein stuck to head and shell. The boiled raw material was allowed to cool and it was washed with water to remove all the traces of alkali. The NaOh was exchanged intermittently and the sample washed

with distilled water every time before adding fresh NaOH. After 24 hour the sample was filtered. The sample filterate was washed as before and dried. The weight was noted.

Demineralization

The deproteinised shells were transferred to a steel vessel and were treated with 3% hydrochloric acid. This was kept for 30 minutes with occasional stirring till the reaction was complete. The excess acid was decanted and the residue was washed till the pH becomes normal. Excess water was removed till the moisture was below 60%. The product thus obtained was called chitin. Chitin isolation was done according to the standard procedure described by Hackman (1954). After that the deacetylation of chitin was carried out.

Deacetylation of Chitin :

Chitin was heated at 90-95^0 C for about one and a half hour with 40% caustic soda in a steel vessel. Excess alkali was drained off and the mixture was washed with water several times till it was free from alkali.

Thus, Chitosan was obtained from the raw shells of both the crustaceans.

III. RESULTS AND DISCUSSION

Chitin and chitosan naturally abundant polysaccharide found particulary in the shell od crustaceans. It is white, hard; in elastic nitrogenous polysaccharide forms the major source of surface pollution in coastal areas. It is specially biopolymer having specific properties including biodegradability, biocompatibility and bioactivity. It is interesting not only as an abundant resource but also a novel type of functional material(Kobayashi *et al.,* 1990)

Yield has been calculated for shrimp and crab waste, chtin and chitosan. The yield of chitosan from prawn *Peaneus indicus* was **75%.** The yield of chitosan from crab *Scylla serrata* was **71%.** Different workers have reported that chitin and chitosan yields differ between species. Brzeski (1982) and Anderson *et al.,* (1978) reported yields of 70% and 90% respectively from Krill. Anderson *et al*.,(1978) reported 60% yield from crab chitin and Aluminiar and Zainuddin (1992) have reported 80% yield from prawn shells. In this study, the yields range from 75% for prawn and 71% for crab.This appears to be within the range earlier reported. In this study it has been observed that prawn *Peaneus indicus* contains more chitosan than the crab *Scylla serrata.*

Chitosan has been developed for a variety of biomedical applications including wound dressings and drug delivery systems. Chitin supports the growth of beneficial microorganisms in the animals' digestive tract for the digestion of high-lactose whey. It has ability to reduce 20-30% cholesterol from the human body. **Dietary Supplements:** Chitosan has properties similar to plant fiber and can significantly bind fat, acting like a sponge in the digestive tract. It is not digestible itself and the bound fat leaves via the body without ever entering the bloodstream. Recently applied in Artificial skin, surgical sutures and corneal contact lenses. Biodegradable and non-toxic products from 'natural' sources such as chitin and chitosan are going to be more and more appealing for the replacement of synthetic compounds. Applications of chitosan are growing rapidly. Not only due to its multitude of applications but due to increasing environmental awareness of the population.

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