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Extraction and Characterization of Chitosan Isolated from Shrimp (*Trachysalambia aspera*) Shell Waste

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Abstract: The world's oceans covering more than 70% of the surface represents by marine organisms. By-products are used in very large quantity and variety of food production occur having important health benefits. The FT-IR shows the following characteristic peaks of alginate appeared at 3429, 1620 and 1421 cm⁻¹ corresponding to hydroxyl (OH), carbonyl (C=O) and carboxyl (COOH), respectively. The IR spectrum of F-C-SA shows characteristics peaks of fibrin, chitosan and sodium alginate.

Keywords: Chitin, Chitosan, Chemical method, Marine by-products

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Introduction

The world's oceans covering more than 70% of the surface represents by marine organisms, which contains biologically active substances such as essential compounds for human nutrition, in particular algae, fish, mollusc, crustacean and plankton. Crustaceans form a very large group of arthropods and includes familiar animals such as crabs, lobsters, crayfish, shrimp, krill and barnacles. A challenge is posed by shellfish processing industries which produce waste each year. With approximately 75% of the total weight of crustaceans ending up as by-products (Brugnerotto *et al.*, 2001; Isa *et al.*, 2012;

Abdulkarim *et al.*, 2013; Kumar and Ravi, 2017). By-products are used in very large quantity and variety of food production occur having important health benefits. Waste during the processing of food is unavoidable and disposal can be one of the major problems for the seafood processing industry which produces a large quantity of marine by-products.

154 billion tons/year of fishery and crustacean's processing are transformed into chitin, chitosan and oligosaccharides, producing waste of 30 million/tons (Lertsutthiwong *et al.*, 2002; Khempaka *et al.*, 2011; Kumirska *et al.*,

2011; Liu *et al.*, 2012). Marine organisms contain various sources of functional groups, including polyunsaturated fatty acids (PUFA), polysaccharides, minerals and vitamins, antioxidants, enzymes and bioactive peptides. The marine organisms comprise approximately one half of the total global biodiversity. Chitin and chitosan is the main structural polysaccharide of arthropods and fungal cell walls containing of about 50-100% of N-acetyl-D-glucosamine and 50-0% of D-glucosamine together with mineral salts and proteins. After cellulose, this is the second most abundant natural biopolymer on earth. Owing to its sugar-like character, this natural polymer is promising in several areas due to its biocompatibility, biodegradability and antimicrobial properties (Sathiadhas and Aswathy, 2004; Raafat and Sahi, 2009; Ramirez *et al.*, 2010).

Chitin is a high molecular weight linear polymer of N-acetyl-D-glucosamine (N-acetyl-2-amino-2-deoxy-D-glucopyranose) units linked by β -D (1-4) bonds. It may be regarded as cellulose with the hydroxyl at position C-2 replaced by an amino acid group like cellulose, it naturally works as a structure polysaccharide. Chitosan is one of the derivatives of chitin and the second most available biopolymer after cellulose. Chitosan is the result of N-deacetylation from chitin and has linear chain of β -(1, 40-linked 2-acetamino-2-deoxy-D-glucopyrananose and 2-amino-2-deoxy- β -D-glucopyranose (Zakaria *et al.*, 2012). The present study was carried out to study the chitin and chitosan extracted in chemical method and activity of chitosan derived from marine shrimp waste (*Trachysalambia aspera*).

Materials and Methods

The shrimp shell wastes were collected from the Kasimadu fish landing center adjacent to Royapuram located near the port of Chennai, India. Collected prawn shell wastes washed thoroughly under running tap water to remove debris and tissues attached to them and it was dried at room temperature for 2 days. Extraction

of chitosan was done by following methods of Zakaria *et al.* (2012).

Chitosan is soluble in dilute organic acid like acetic acid, formic acid, etc., and form high viscous solution. Chitosan solubility depends on distribution of N-acetyl and free amino groups. Protonation of amino groups occurs at pH.

FT-IR spectral analysis:

Extracted chitosan was confirmed by solubility test in dilute acetic acid and characterization was done using Fourier transform infrared

Fig. 1: FT-IR spectral image of chitosan.

spectroscopy (FT-IR) in which spectra of standard chitosan and extracted chitosan were obtained and on the basis of absorption spectra of the standard chitosan the sample were analysed and characterized. Chitosan oligomers production Hydrolysis of chitosan was done by nitrous.

Results and Discussion

Chitosan showed the characteristics amide absorption bands at 1641cm⁻¹, 4060cm⁻¹ and 1153cm⁻¹ representing amide-I, II and III groups. Figure 1 shows the FT-IR of chitosan. The following absorption bands, 2516 cm⁻¹ representing C-N asymmetric band stretching: 1653cm⁻¹ representing amide-I band and C-O stretch of acetyl group: 1153cm⁻¹ exhibiting amide-II band and N-H stretch, 1375cm⁻¹ shows asymmetric C-H bending of CH₂ group and 1071cm⁻¹ showing skeletal vibration involving bridge C-O stretch.

Chitin and chitosan was separated by standard chemical method and it was characterized by FT-IR spectrum. The FT-IR shows the following characteristic peaks of alginate appeared at 3429, 1620 and 1421 cm⁻¹ corresponding to hydroxyl (OH), carbonyl (C=O) and carboxyl (COOH), respectively. The IR spectrum of F-C-SA shows

characteristics peaks of fibrin, chitosan and sodium alginate.

Conclusion

Chitosan offers more advantages like low immunogenicity, biodegradability and biocompatibility to be used for tissue engineering purpose. Such tissue growth model thus can be used not only for evaluating the anticancer activities of new drugs but also can provide information about the regulation of both autocrine and paracrine growth factors that control cancer cell growth.

References

- Abdulkarim A, Isa MT, Abdulsalam S, Muhammad AJ and Ameh AO. (2013) Extraction and characterisation of chitin and chitosan from mussel shell. *Extraction* 3(2): 108-114.
- Brugnerotto J, Lizardi J, Goycoolea FM, Argüelles-Monal W, Desbrieres J and Rinaudo M. (2001) An infrared investigation in relation with chitin and chitosan characterization. *Polymer* 42(8): 3569-3580.
- Isa MT, Ameh AO, Gabriel JO and Adama KK. (2012) Extraction and characterization of chitin from Nigerian Sources. *Leonardo Electronic J Practices Technol.* 21: 73-81.
- Kumar MY and Ravi A. (2017) Extraction and

- characterization of chitosan from shrimp waste for application in the feed industry. *Int J Sci Environ Technol* 6(4): 2548-2557.
- Khempaka S, Chitsatchapong C and Molee W. (2011) Effect of chitin and protein constituents in shrimp head meal on growth performance, nutrient digestibility, intestinal microbial populations, volatile fatty acids, and ammonia production in broilers. *J Appl Poultry Res*. 20(1): 1-11.
- Kumirska J, Weinhold MX, Thöming J and Stepnowski P. (2011) Biomedical activity of chitin/chitosan based materials-influence of physicochemical properties apart from molecular weight and degree of N-acetylation. *Polymers* 3(4): 1875-1901.
- Lertsutthiwong P, How NC, Chandkrachang S and Stevens WF. (2002) Effect of chemical treatment on the characteristics of shrimp chitosan. *J Metals Mater Minerals* 12(1): 11-18.
- Liu S, Sun J, Yu L, Zhang C, Bi J, Zhu, F and Yang Q. (2012) Extraction and characterization of chitin from the beetle *Holotrichia parallela* Motschulsky. *Molecules* 17(4): 4604-4611.
- Raafat D and Sahl HG. (2009) Chitosan and its antimicrobial potential- a critical literature survey. *Microbial Biotechnol* 2(2): 186-201.
- Ramírez MA, Rodríguez AT, Alfonso L and Peniche C. (2010) Chitin and its derivatives as biopolymers with potential agricultural applications. *Biotechnol Aplicada* 27(4): 270-276.
- Sathiadhas R and Aswathy N. (2004) Techno-economic analysis of production and marketing of marine by-products in India. *J Indian Fish Assoc*. 31: 155-165.
- Zakaria Z, Izzah Z, Jawaaid M and Hassan A. (2012) Effect of degree of deacetylation of chitosan on thermal stability and compatibility of chitosan-polyamide blend. *BioResources* 7(4): 5568-5580.