International Journal of Fauna and Biological Studies
Available online at www.faunajournal.com

IJFBS International Journal of Fauna And Biological Studies

E-ISSN 2347-2677
P-ISSN 2394-0522
www.faunajournal.com
IJFBS 2022; 9(3): 18-23
Received: 07-03-2022
Accepted: 09-04-2022

Shazia Tabassum Shah
Ph.D. Research scholar,
Barkatullah University Bhopal,
Madhya Pradesh, India

Tehleel Ahmed
Ph.D. Research scholar,
Barkatullah University Bhopal,
Madhya Pradesh, India

Susan Manohar
Department of Zoology,
Govt. MGM PG College Itarsi,
Madhya Pradesh, India

Dr. Rajendra Chauhan
Department of Zoology,
Govt. MVM College Bhopal,
Madhya Pradesh, India

Corresponding Author:
Shazia Tabassum Shah
Ph.D. Research Scholar,
Barkatullah University Bhopal,
Madhya Pradesh, India

Comparative study on extraction and characterization of chitin and chitosan from prawn and crab species collected from local water bodies of Bhopal

Shazia Tabassum Shah, Tehleel Ahmed, Susan Manohar and Dr. Rajendra Chauhan

DOI: https://doi.org/10.22271/23940522.2022.v9.i3a.899

Abstract
Chitin is the main component in the exoskeleton of all Prawn and Crab species and it a biopolymer having the structure almost identical as that of cellulose. The current study focuses on the extraction and characterization of Chitin and chitosan from the exoskeleton of local Prawn and Crab species by sequence of chemical processes involving demineralization, deproteinization and deacetylation. Crustacean Chitin and chitosan having more biological value such as physiological, non-toxicity, bio-digestibility, compatibility, absorption etc. these biological value of chitosan depend on the quality parameters which is related to source of raw material. The obtained chitin was transformed into most useful soluble chitosan. The results obtained showed there is quite difference in the appearance (demineralization product), weight of chitin, percentage of chitin, product appearance and solubility of studied Prawn and crab species.

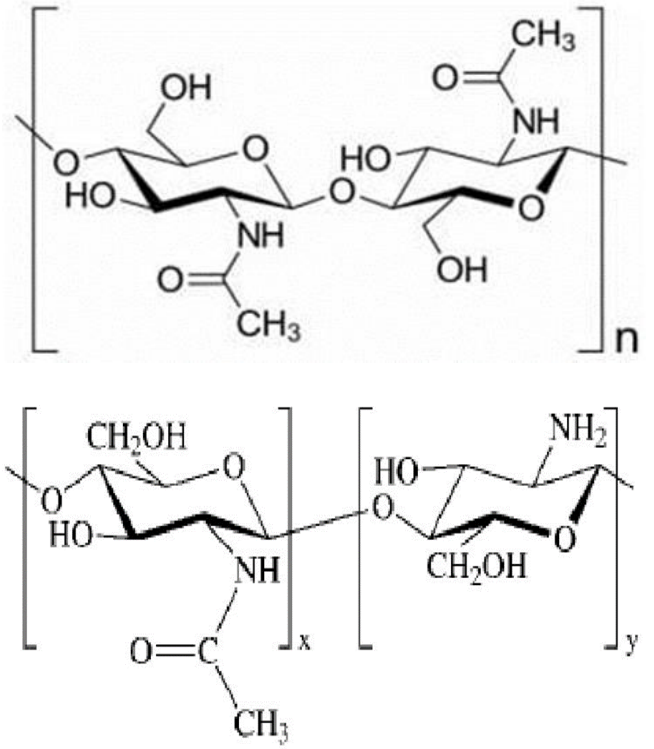
Keywords: Chitin, chitosan, demineralization, deproteinization, deacetylation, extraction, characterization

Introduction
Bhopal, also known as city of lakes is rich in the fresh water bodies but the appropriate exploration of those water resources in term of research in chitin and chitosan can be beneficial for the economic as well as academic prosperity of nation. The crustacean shell wastes obtained from seafood industries have only a low economic value and they are used as either animal feed or organic manure. The crustacean shells are the most important chitin source for commercial use due to their high content and ready availability (Muzzarelli., 1997). Chitin is an abundant polysaccharide, made of Nacetyl-D-glucosamine units connected by β (1, 4) linkage and it is the most abundant biopolymer on earth next to cellulose. There has been a strong demand for chitin and chitosan all over the world especially in Japan. Recently, the major industrial sources of raw material for the production of chitin are the shells of crustaceans such as crabs and 11shrimps (Percot *et al*., 2003). About 10 tons of chitin is produced annually in the aquatic biosphere (Wang *et al*., 1998). Chitosan is a natural polysaccharide comprising of copolymers of glucosamine and N-acetylglucosamine, and can be obtained by the partial deacetylation of chitin. In its crystalline form, chitosan is normally insoluble in aqueous solutions above pH7; however, in dilute acids (pH6.0), the protonated free amino groups on glucosamine facilitate solubility of the molecule (Martino et al., 2005). Chitosan can be obtained by deacetylation of chitin through enzymatic or alkaline method during the course of deacetylation; parts of polymer N-acetyl links are broken with the formation of D-glucosamine units, which contain a free amine group, increasing the polymer's solubility in aqueous means (Kalut, 2008). Chitosan has been widely used in vastly diverse fields, ranging from waste management to food processing, medicine and biotechnology (Kalut, 2008). In agriculture, the use of chitosan has been established to improve the yield of rice and orchid production (Kim, 2010).

Structural representation of Chitin and Chitosan

Chitin is made up of modified glucose monosaccharides. Glucose exists as a ring of carbon and oxygen molecules. Bonds between glucose molecules are known as *glycosidic bonds*.

The oxygens that typically form hydroxyl groups bonded to the carbon ring can also form a bond with another carbon instead of a hydrogen. In this way, monosaccharides can be linked together in long chains. Chitin is formed by a series of glycosidic bonds between substituted glucose molecules. Chitin is considered as an absorbable surgical suture with great mechanical properties, biocompatibility, and biodegradability (Ciucă and Mihăilescu, 2015).



Material and Methods

Sample collection

Fresh local species of prawn and crab were collected from the local water bodies of Bhopal. Sample were kept chilled in ice during transportation to the laboratory. The shell were completely separated from the sample in the laboratory, cleaned, washed and then oven dried at 70c for 24 h or longer until they were completely dried. The dried shells were ground using a grinder and sieved into the size 800um before mixing with cod liver oil. The mixture was dried in the oven at 60-70C for overnight until the moisture content were removed. The powder obtained from the above process under goes a various steps.

Fig 1: Crab

Fig 2: Raw shell of Crab

Fig 3: Fine grinded powder of Crab

Fig 4: Prawn

Fig 5: Raw shell of pawn

Fig 6: Fine grinded powder of prawn

Crab shell	Prawn shell
The powdered form of dried scales were demineralized with 2.5% of 1NHCL with ratio of ground shell to the solution of 1:20 and then kept on the magnetic stirrer for 2hours. It is then filtered using whatman filter paper, And then washed with neutral water. After filtration the demineralized filtrate dried in hot air oven for overnight at 60c.	The powdered form of dried scales were demineralized with 2.5% of 1NHCL with ratio of ground shell to the solution of 1:20 and then kept on the magnetic stirrer for 2hours. It is then filtered using whatman filter paper, And then washed with neutral water. After filtration the demineralized filtrate dried in hot air oven for overnight at 60c.

Deproteinization

The Demineralized shell were treated with 2% of KOH solution with ratio of powder shell to the solution of 1:20 with constant stirring on the magnetic stirrer for 2hour at 37C. Now sample were then filtered using whatman filter paper and filtrate were washed with neutral water for 30 mins until ph neutral. The deproteinized shell were dried in the oven at 60C for 24 hours.

Decolourization

The demineralized powder was treated with acetone. the powder was washed with acetone for 2-3 times. After washing with acetone the powder was further dry in hot air oven at 60-70c.

Deacetylation

The obtained chitin was dissolved in 40% of NAOH solution, with a ratio of 1:20 and boiled at 70-80c for 2 hours with continue stirring in magnetic stirrer. After cooling the sample was washed with distilled water and filtered the obtained chitin.

Precipitation

Chitosan was purified by precipitation method. The chitosan obtained was dissolved in 2% glacial acetic acid solution with 1:100, for 4 hours with constant stirring ,The solution was obtained in a separate flask and 0.5mol/dm3 NAOH was added. The solution was kept for 5-10 minutes so that precipitation occurs. The precipitates were filtered, washed and dried at 110c in hot air oven for 1 hour.

Characterization of chitosan by FTIR

The FTIR spectra was used to identify the active fictional group in the compound. A small amount of chitosan of crab and prawn in the form of powder was incorporated into the selenium bromide crystal. The vertical rod is pulled down in a drug sample placed over the crystal. FTIR spectrum was run. The detected IR spectrum was smoothed. Finally, the functional group were detected by comparing the obtained IR ranges with reference range available.

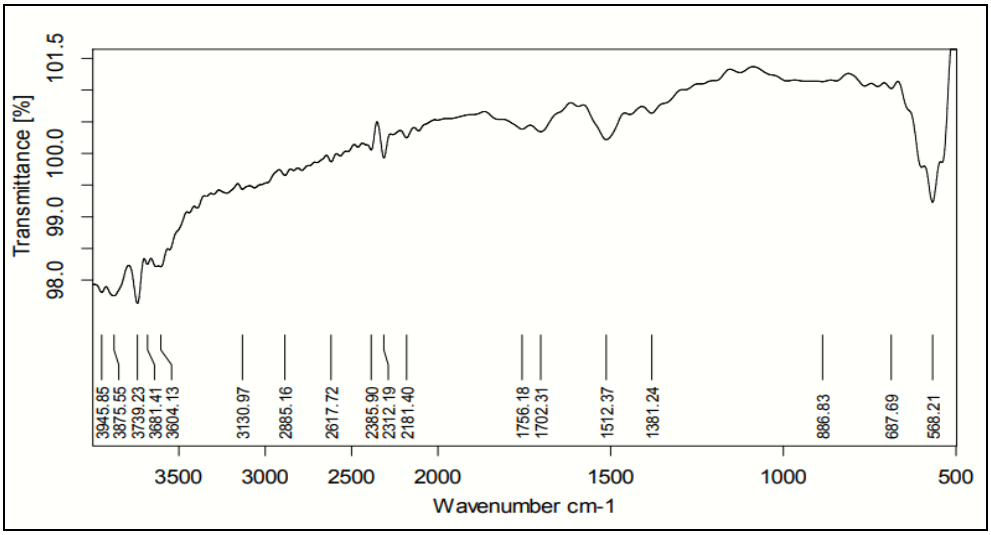


Fig 7: Characterization of Chitosan obtained from the sample of Crab by FTITR

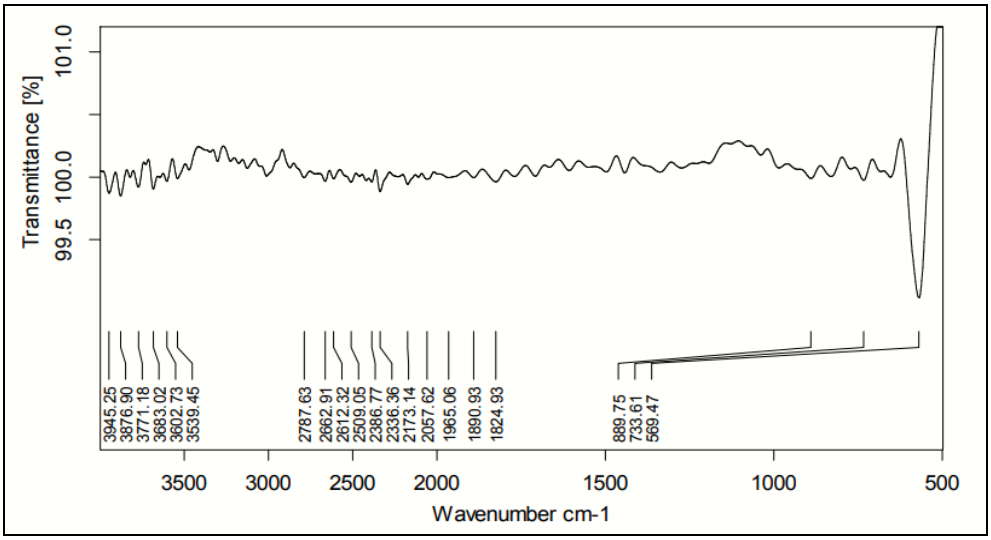


Fig 8: Characterization of Chitosan obtained from the sample of Prawn by FTITR

Results and Discussion

Chitosan was extracted from these two different organism that is crab and prawn by demineralization and deproteinization (figure)

Fig 7: Demineralized Crab chitin

Fig 8: Demineralized Prawn Chitin

Fig 9: Deproteinzed crab chitin

Fig 10: Deproteinized prawn chitin

Fig 11: Decolourized crab chitin

Fig 13: Deacetylated Crab Chitin

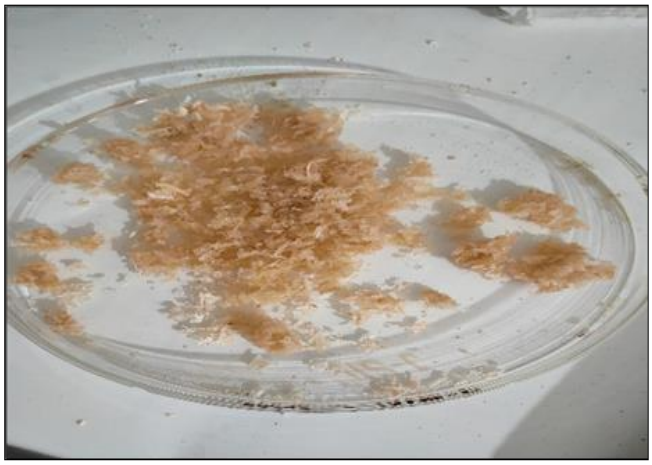


Fig 12: Decolourized prawn chitin

Fig 14: Deacetylated prawn chitin

Fig 15: Final chitosn after precipitation

Percentage yield

Yield (%) of chitosan was calculated as the total weight of chitosan powder extracted to the total weight of dry shells used for chitin chemical modification.

$$\text{Yield \%)} = \frac{\text{Total weight of chitosan powder extracted}}{\text{Total weight of dry shells}}$$

S. No.	Name of sample	Colour of extracted powder	Weight of raw shell (gm)	Weight of extracted chitin (gm)	% yield
1.	*Prawn*	Yellow	3.12 gram	0.55	17.62%

S. No.	Name of sample	Colour of extracted powder	Weight of raw shell (gm)	Weight of extracted chitosan (gm)	% yield
1.	*Prawn*	Pale white	3.12 gram	0.31 gram	9.93%

S. No.	Name of sample	Colour of extracted powder	Weight of raw shell (gm)	Weight of extracted chitin (gm)	% yield
1.	*Crab*	Light brown	9.05 gram	8.52	94.14%

S. No.	Name of sample	Colour of extracted powder	Weight of raw shell (gm)	Weight of extracted chitosaan (gm)	% yield
1.	*Crab*	Dark brown	9.05 gram	7.9 gram	87.29%

Conclusion

Chitosan a valuable bio-polymer which was extracted from prawn and crab through a various chemical process including demineralization, proteinization, and deacetylation. The adapted chemical method is effective for obtaining highly purified chitin. Extracted chitosan was characterized using FTIR analysis. The FTIR spectra for chitosan gave a characteristics of Alcoholic group band is3945.85-3604.13 and carboxylic group band is 1756-1512.37 in crab and in prawn the alcoholic group and carboxylic group band is 3945.24-3602.73 and 2509.05 respectively. The percentage yield obtained from crab chitosan is more than prawn chitosan

References

1. Ali M, Shakeel M, Mehmood K. Extraction and characterization of high purity chitosan by rapid and simple techniques from mud crabs taken from Abbottabad. Pak. J Pharm. Sci. 2019;32(1):171-175.
2. Zamri AI, Latiff NF, Abdullah QH, Ahmad F. Extraction and optimization of chitosan from razor clam (*Ensis arcuatus*) shells by using response surface methodology (RSM). Food Research. 2020;4(3):674-678.
3. Shahidi F, Synowiecki J. Isolation and characterization of nutrients and value-added products from snow crab (*Chionoecetes opilio*) and shrimp (*Pandalus borealis*) processing discards. Journal of agricultural and food chemistry. 1991;39(8):1527-1532.
4. Farhana S Ghory, Quddusi B Kazmi and Feroz A Siddiqui. First report of laboratory reared developmental stages of *Palaemon sewelli* (KEMP, 1925) (Crustacea: Caridea: Palaemonidae: Palaemonidae). Int. J Biol. Sci. 2021;3(2):38-44.
   DOI: 10.33545/26649926.2021.v3.i2a.79
5. Hussain MR, Iman M, Maji TK. Determination of degree of deacetylation of chitosan and their effect on the release behavior of essential oil from chitosan and chitosan-gelatin complex microcapsules. International Journal of Advanced Engineering Applications. 2013;6(4):4-12.
6. Majekodunmi SO. Current development of extraction, characterization and evaluation of properties of chitosan and its use in medicine and pharmaceutical industry. American Journal of Polymer Science. 2016;6(3):86-91
7. Knorr D. Recovery and utilization of chitin and chitosan in food processing waste management. Food Technol. 1991;45(1):114-123.
8. Khan TA, Peh KK, Ch'ng HS. Reporting degree of deacetylation values of chitosan: the influence of analytical methods. J Pharm Pharmaceut Sci. 2002;5(3):205-212.
9. Aranaz I, Mengíbar M, Harris R, Paños I, Miralles B, Acosta N, *et al*. Functional characterization of chitin and chitosan. Current chemical biology. 2009;3(2):203-230.
10. Zargar V, Asghari M, Dashti A. A review on chitin and chitosan polymers: structure, chemistry, solubility, derivatives, and applications. Chem Bio Eng Reviews. 2015;2(3):204-226.
11. Cheba BA. Chitin and chitosan: marine biopolymers with unique properties and versatile applications. Global Journal of Biotechnology & Biochemistry. 2011;6(3):149-153.