

Extraction, Purification and Characterization of Chitosan from Crab, Shrimp and Insect Shells

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This study aimed to extract, purify and characterize chitosan from crab (*Portunus pelagicus*), shrimp (*Litopenaeus vannamei*) and insect (*Hermetia illucens*) shells. The extraction and purification of crab chitosan were done using a previously developed method consisting of pre-treatment, demineralization, deproteinization, pigment removal, deacetylation and purification. The extraction and purification of chitosan from shrimp and insect shells were done with some modifications. X-Ray Diffraction (XRD) and Fourier Transform Infrared spectroscopy (FTIR) were used for the identification of purified chitosan. Two patterns and the peak positions of XRD were almost similar between standard chitosan and chitosan purified from 3 species. Vibration of functional groups of chitosan in the FTIR was comparable with the standard wavelengths of standard chitosan in literature. Crab (33%) and shrimp (33%) resulted in significantly higher ($P<0.05$) chitosan yield than insects (24%). Physico-chemical, antioxidant and antimicrobial properties of chitosan purified from 3 species were determined in comparison with standard chitosan. The degree of deacetylation was significantly higher ($P<0.05$) in crab and insect chitosan compared to standard chitosan, whereas it was ($P<0.05$) lowest in shrimp chitosan. Moisture & ash contents and water & fat binding capacities were highest ($P<0.05$) in insects among the three species. Crab and shrimp chitosan had significantly higher ($P<0.05$) whiteness index compared to standard and insect chitosan. According to the DPPH (1, 1-diphenyl-2-picrylhydrazyl) and FRAP (Ferric ion Reducing Antioxidant Power assay) assays, insect chitosan had a significantly higher ($P<0.05$) antioxidant activity than crab, shrimp and standard chitosan. Chitosan from all the species showed antimicrobial properties against *Candida*, *Staphylococcus*, *Pseudomonas* and *E. coli*, except shrimp chitosan which did not show antimicrobial activity against *Staphylococcus*. In conclusion, physico-chemical, antioxidant and antimicrobial properties of chitosan can vary with the species from which it is extracted.

Keywords: Chitin, Chitosan, Crab, Insects, Shrimp

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