A STUDY ON THE EXTRACTION & APPLICATIONS OF CHITOSAN IN THE FOOD INDUSTRY

N.D. Wanni Arachchi

(09/8095)

Degree of Master of Science

Department of Chemical and Process Engineering

University of Moratuwa
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Thesis/Dissertation submitted in partial fulfillment of the requirements for the degree

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DECLARATION

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Signature of the supervisor Date

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ABSTRACT

Chitin and chitosan are renewable natural biopolymers having extensive applications in food and many other industries due to their low toxicity, biocompatibility, biodegradability, etc. The main industrial raw material for chitin production is waste from seafood industries that consist of exoskeleton remains of crustaceans.

Isolation of chitin from prawn shells involved demineralization, deproteinization and purification processes. Chitin was converted to chitosan through deacetylation using 45% NaOH by different physical treatments; steeping at ambient temperature, thermal heating and microwave radiation. Chitosan produced from chitin was characterized using FTIR analysis. Antimicrobial activity of chitosan against *E-coli* and *Aspergillus niger* was investigated by agar dilution assay where as an indirect method of cellulose yield was tested for *Acetobacter xylinum*. Properties of purified chitosan dehydrated by different methods (freeze, vacuum and normal oven drying) were determined by FTIR, viscometry and antibacterial activity.

Prawn shells contain mainly chitin, protein and minerals; the chitin content was approximately 22 %. Among the different physical treatments for deacetylation, conventional thermal heating and microwave radiation methods gave DDA values in the range of 69 – 99 % where as steeping did not give significant DDA value even after 10 days. Microwave radiation was the most energy, time and cost effective method for deacetylation as it reduced reaction time significantly.

Chitosan had effective antimicrobial properties against three microorganism species studied. Antimicrobial activity of chitosan depends on its DDA, concentration and microorganism species.

Purification of chitosan by dissolving in acetic acid reduced DDA by approximately 10 %. The dehydration method used to dry purified chitosan had an effect on antimicrobial properties since freeze drying gave higher antimicrobial activity because of better retainment of active amine sites. However the method of drying has not influenced the molecular weight and DDA.

This study ultimately addressed a major concern in Sri Lankan seafood industry by adding value to a waste product.

Keywords: Chitin, Chitosan, DDA, Antimicrobial Activity

DEDICATION

I lovingly dedicate this thesis to my parents and husband,

who supported me each step of the way.

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LIST OF ABBREVIATIONS

Abbreviation	**Description**
DDA	Degree of Deacetylation
FTIR	Fourier Transformation of Infrared
HMWC	High Molecular Weight Chitosan
HPLC	High Performance Liquid Chromatography
IR	Infrared
LMWC	Low Molecular Weight Chitosan
NMR	Nuclear Magnetic Resonance
RNA	Ribonucleic Acid