DEPROTEINATION AND DEMINERALIZATION OF SHRIMP WASTE USING LACTIC ACID BACTERIA FOR THE PRODUCTION OF CRUDE CHITIN AND CHITOSAN

Farramae C. Francisco, Rhoda Mae C. Simora, Sharon N. Nuñal
Institute of Fish Processing Technology, College of Fisheries and Ocean Sciences,
University of the Philippines Visayas, Miagao, Iloilo, Philippines

INTRODUCTION

In seafood industries, shellfish waste management is a huge problem especially the crustacean sector which lacks cost-effective outlets for their waste (Raja et. al., 2012). Crustacean shells are the most important chitin source for commercial use due to their high content and ready availability (Subasinghe, 1995). The conventional methods for chitin extraction from crustaceans are chemical processes which involve the use of strong acid for demineralization and strong base for deproteination. It has been reported that chemical chitin purification is extremely hazardous, energy consuming and damaging to the environment owing to the high mineral acid and base involved (Healy et. al., 2003).

OBJECTIVES

- Produce crude chitin from shrimp waste through lactic acid bacteria treatment coupled with mild chemical post treatment for chitin conversion into chitosan
- Compare in terms of solubility and proximate composition.

METHODOLOGY

Shrimp waste flakes with 5% glucose (Treatment A), 5% cassava flour (Treatment B), (Control) no added carbon source were mixed with lactic acid bacteria (10% v/w).

The mixture were left for treatment at 37°C for 7 days.

Recovered crude chitin were further analyzed and converted into chitin

Crude chitin were converted into chitosan by mixing it with 55% NaOH solution in a water bath at 95°C for 4 hours.

Crude chitosan were further tested and analyzed

RESULTS

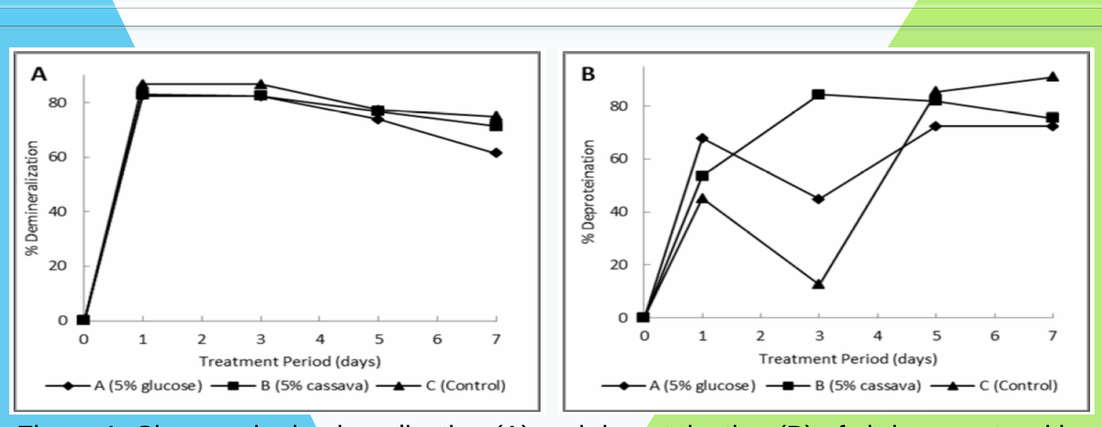

Figure 1. Changes in demineralization (A) and deproteination (B) of shrimp waste with LAB over the 7-day treatment period.

Demineralization (%) in 5% glucose and 5% cassava was highest during the first day of treatment which was 82% and 83%, respectively. Deproteination (%) was highest in 5% cassava starch on the 3rd day of treatment at 84.4% (Fig. 1).

Table 1. Quality of crude chitin and chitosan

Property	Synthesized		
	A	B	C
Chitin			
Protein (%)	0.094[a]	0.085[a]	0.081[a]
Ash (%)	0.76[a]	0.9[b]	1.3[c]
Solubility (%)	44.3[a]	59.0[ab]	39.0[a]
Chitosan			
Protein (%)	0.032[a]	0.033[a]	0.039[b]
Ash (%)	0.8[a]	1.1[b]	1.3[c]
Solubility (%)	56.0[a]	48.0[b]	41.0[c]
Degree of deacetylation (%)	33.0[a]	29.0[a]	26.0[a]

Superscripts in row denote significant difference (α = 0.05) based on one way ANOVA analysis

The obtained chitin from 5% cassava and 5% glucose had a residual ash and protein below 1% and solubility of 59% and 44.3%, respectively. Chitosan produced from 5% cassava and 5% glucose had protein content below 0.05%; residual ash was 1.1% and 0.8%, respectively. Chitosan solubility and degree of deacetylation were 56% and 33% in 5% glucose and 48% and 29% in 5% cassava, respectively.

CONCLUSION

The results of the present study showed that chitin for its conversion to chitosan can be produced through microbial treatment of lactic acid bacteria. The advantage this alternative technology offers over that of chemical extraction is large reduction in chemicals needed thus less effluent production and generation of a protein-rich liquor, although the demineralization process should be improved to achieve greater degree of deacetylation. The use of other carbohydrate sources such as corn starch, potato starch and sweet potato starch offer cheap alternative. Shelf life of produced chitin and chitosan must also be studied.

REFERENCES

Healy M., Green A., Healy A., 2003 Bioprocessing of marine crustacean shell waste. Acta Biotechnologica 23:151-160.

Raja R., Chellaram C., John A. A., 2012 Antibacterial properties of chitin from shell wastes. Indian Journal of Innovations and Developments 1:7-10.

Subasinghe S., 1995 The development of crustacean and mollusk industries for chitin and chitosan resources. In: Chitin and chitosan the versatile environmentally friendly modern materials. Zakaria M. B., Muda W. M. W., Abdullah M. P. (eds), Universiti Kebangsaan Malaysia, pp. 27-34.

ACKNOWLEDGEMENT

The authors are grateful to the Philippine Department of Science and Technology (DOST) – Accelerated Science and Technology Human Resource Development Program (ASTHRDP) and to the Office of the Vice Chancellor for Research and Extension of the University of the Philippines Visayas for the financial support.

Farramae C. Francisco
farramaefrancisco@gmail.com
Rhoda Mae C. Simora
rcsimora@up.edu.ph
Sharon N. Nuñal
shachi1030@gmail.com