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Autoclave assisted chitosan extraction from Whiteleg shrimp (*Liptopeaneus vannamei)* processing shell waste

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Abstract
Shrimp shells are potential sources for shell bio-refinery due to their abundance as a result of waste from processing plants. This waste has not been productively used for any industry. Therefore, the objective of this study was to introduce a reliable and effective chitosan extraction protocol from shellfish waste, using Whiteleg shrimp *(Liptopeaneus vannamei)* shells, with autoclave assisted extraction method. Cleaned and dried shells were deproteinised with Sodium hydroxide (NaOH) at 100°C and subsequently demineralised with Hydrochloric acid for 3 hours. Then decolourised using Potassium permanganate followed by Oxalic acid treatments. To test the most effective autoclave assisted deacetylation technique, in which chitin is converted to chitosan, the dried chitin was subjected to four different treatments: autoclaving at 121˚C & 15 psi for 15 min with 40% NaOH (Treatment 1); 24 hours steeping at 40% NaOH followed by autoclaving at 121˚C & 15 psi for 15 min (Treatment 2); autoclaving at 121˚C & 15 psi for 15 min with 50% NaOH (Treatment 3); 24 hours steeping at 50% NaOH followed by autoclaving at 121˚C & 15 psi for 15 min (Treatment 4). Treatment 4 recorded the highest degree of deacetylation (80.17%) calculated from the Fourier Transform Infra-Red spectra. Even the X-Ray Diffraction spectrum of treatment 4 confirmed the semicrystalline chitosan structure by the evidence of typical fingerprints. Therefore, chitosan extracted by treatment 4 was selected for further characterisation. Scanning Electron Microscopic images showed the typical porous structure that resulted after the removal of $CaCO_3$ by the acid treatment, and it was further evident by the absence of calcium peaks in the Energy-Dispersive Spectroscopy image. This result confirms the effective demineralisation of shells. The differential thermal analysis confirmed that the chitosan extracted by Treatment-4 has good thermal stability up to 350.95°C. Its mean dynamic viscosity was 100.27±0.55 and whiteness value was 73.28±1.12. Therefore, this study confirms 24-hour steeping at 50% NaOH followed by autoclaving at 121˚C & 15 psi for 15 min as the effective deacetylation techniques to extract chitosan from the Whiteleg shrimp shell waste while preserving standard characteristics.

Keywords: Autoclave, Chistosan, Whiteleg shrimp

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