Characterization of Chitin Extracted from Apple Snail (*Pomacea canaliculata*) Shells: A Preliminary Study for Chitosan Production

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ABSTRACT

Golden apple snails (*Pomacea canaliculata*) are major pests in rice fields, causing significant challenges for farmers. While golden apple snails in Thailand are used for animal feed and wastewater treatment, they remain underutilized. Their shells containing 20-50% of chitin can be extracted into chitosan, a non-toxic natural polymer suitable for Halal applications in health-related industries. Chitosan from snail shells offers an eco-friendly solution to reduce agricultural issues and promote sustainable economic opportunities for local communities. This research aims to extract and characterize chitin from apple snail shells and evaluate its chemical, structural, and morphological properties. The study also examines contaminants like pesticide residues and heavy metals to assess its suitability for diverse applications. The extraction conditions included demineralization with 1 M HCl at 25 °C for 2 hours, deproteinization with 2 M NaOH at 25 °C for 2 hours. Fourier-transform infrared spectroscopy (FT-IR) confirmed functional groups, while Scanning Electron Microscopy (SEM) analyzed microstructure. Heavy metal and pesticide residues were assessed using AOAC methods. The resulting chitin yielded approximately 40.77 % (w/w) of raw apple snail shells. The FT-IR absorption of light brown chitin powder showed 10 major characteristic peaks between 513 and 3430 cm^{-1}. Metals like As, Cd, Pb, and Hg were undetected, except for 0.149 ppb Cu, and no pesticide residues were found. SEM analysis revealed that the particles had a polygonal shape with a rough surface texture. The extraction is limited by chitosan's solubility in acid, requiring large shell fragments and higher solvent volumes, increasing cost and complexity. This study highlights that chitin extracted from apple snail shells offers a sustainable source for chitosan production. Utilizing this abundant but underused resource supports waste reduction and enhances agricultural productivity. Safety assessments, including tests for heavy metals and pesticides, confirm its suitability for applications in the food, pharmaceutical, and medical industries.

Keywords: *Chitin, Chitosan, Apple snail, Industry, Halal*

Introduction

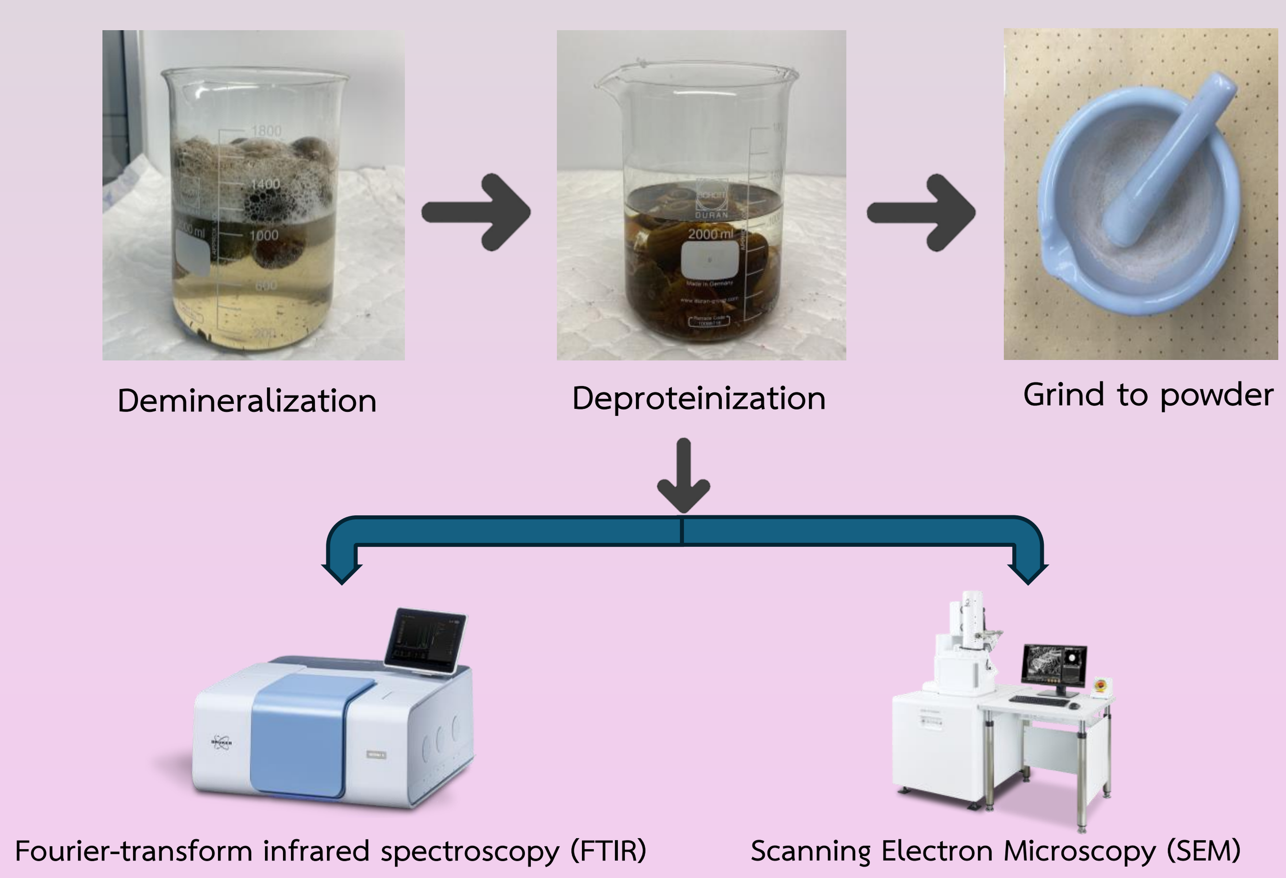
Golden apple snails (*Pomacea canaliculata*), native to South America, have become highly invasive in several Asian countries, especially Thailand, causing severe damage to rice fields and threatening food security. Current control methods, such as chemical pesticides, often worsen the situation by raising environmental and health concerns. However, these snails offer untapped potential due to their high chitin content (20–50%), which can be processed into chitosan, a non-toxic, biodegradable polymer with diverse applications in the food, pharmaceutical, and medical industries. Despite its high potential applications, the use of apple snail shells for chitosan production remains largely unexplored.

Objectives

This research aims to extract and characterize chitin from apple snail shells and evaluate its chemical, structural, and morphological properties. The study also examines contaminants like pesticide residues and heavy metals to assess its suitability for diverse applications.

Methodology

The extraction conditions included demineralization with 1 M HCl at 25 °C for 2 hours, deproteinization with 2 M NaOH at 25 °C for 2 hours. Fourier-transform infrared spectroscopy (FT-IR) confirmed functional groups, while Scanning Electron Microscopy (SEM) analyzed microstructure. Heavy metal and pesticide residues were assessed using AOAC methods.



Conclusion

In conclusion, this study demonstrated the potential of utilizing golden apple snail (*Pomacea canaliculata*) shells as a valuable source of chitin, which can be processed into chitosan for a variety of applications in the food, pharmaceutical, and medical industries. The extraction and characterization of chitin from these shells revealed promising properties, including its non-toxic, biodegradable, and Halal-compliant nature. Additionally, the assessment of contaminants confirms the material's safety for use in various industries. By tapping into this underutilized resource, we can not only address the environmental and agricultural challenges posed by the snails but also create sustainable economic opportunities for local communities.

Acknowledgement

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Results & Discussion

The resulting chitin yielded approximately 40.77 % (w/w) of raw apple snail shells. The FT-IR absorption of light brown chitin powder showed 10 major characteristic peaks between 513 and 3430 cm^{-1}. SEM analysis revealed that the particles had a polygonal shape with a rough surface texture. Metals like As, Cd, Pb, and Hg were undetected, except for 0.149 ppb Cu, and no pesticide residues were found.

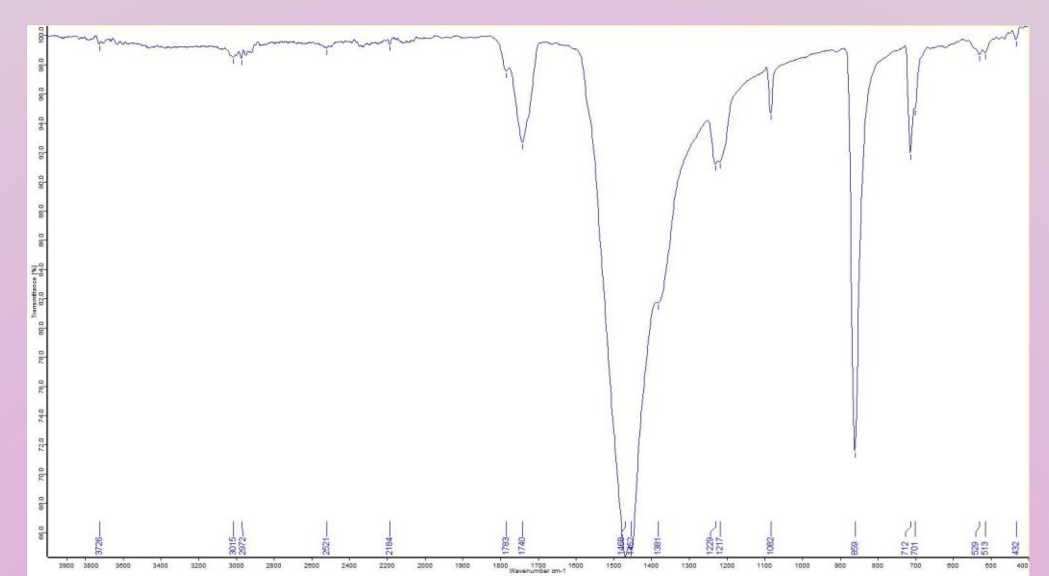

Figure 1. FT-IR spectrum of chitin extracted from golden apple snail shells

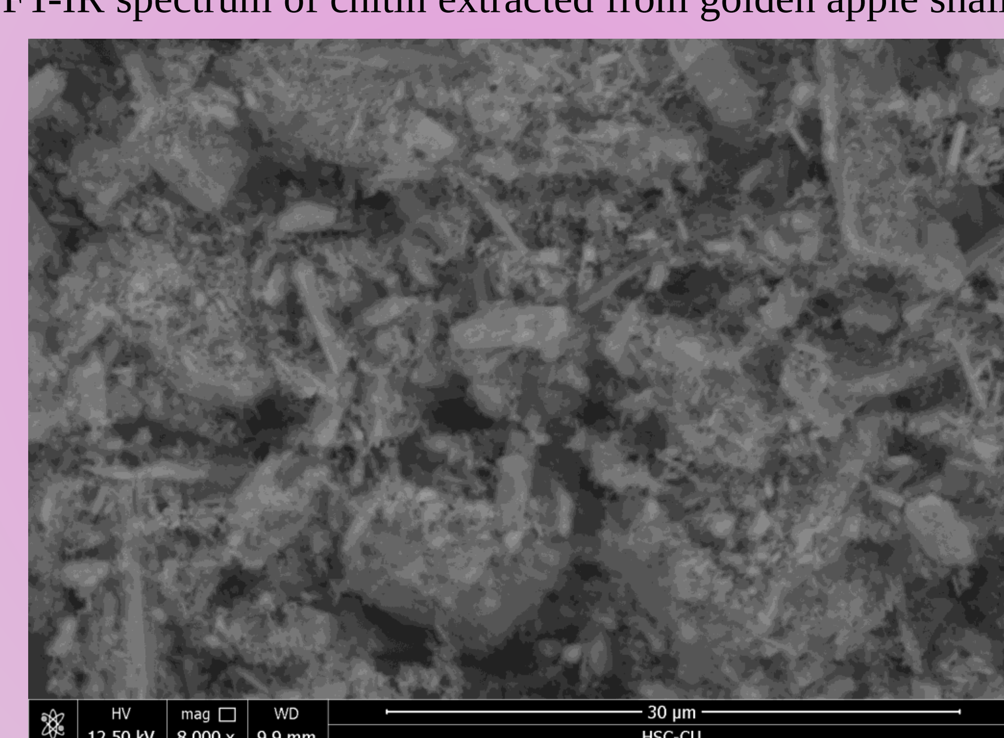

Figure 2. SEM analysis of the microstructure of chitin extracted from golden apple snail shells

Table 1. Analysis of Heavy metal residues

Item	Method	Unit	Result	LOD	LOQ
Arsenic (As)	In-house method base on AOAC (2019) 986.15	ppb	Not Detected	-	-
Cadmium (Cd)	In-house method base on AOAC (2019) 986.15	ppb	Not Detected	-	-
Copper (Cu)	In-house method base on AOAC (2019) 986.15	ppb	0.149	-	-
Lead (Pb)	In-house method base on AOAC (2019) 986.15	ppb	Not Detected	-	-
Mercury (Hg)	In-house method base on AOAC (2019) 986.15	ppb	Not Detected	-	-

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