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The Influence of Acidic Demineralization on the Characteristics of Chitosan Extracted from Shrimp Waste

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Abstract

In recent years, there has been a significant increase in the shrimp production industry, reaching a milestone of 8 million tons annually. However, around 30-50 percent of shrimp aquaculture is generated as waste, posing a significant environmental and climate threat. Extraction of chitosan from shrimp shell waste has emerged as a preferred industrial option to address this issue and promote circular economy principles and EU Green Deal targets. Shrimp shells contain valuable minerals such as magnesium, calcium, and phosphorus, which can be crucial in chitosan extraction. The initial step in this process is the demineralization of shrimp shells, where the current research aimed to evaluate the impact of different acidic demineralization concentrations on chitosan characteristics. This evaluation was conducted under stabilized deproteinization and deacetylation stages at 50℃. Shrimp shell waste was collected from an indoor shrimp farm in Lithuania, and mineral content analysis was performed using inductively coupled plasma mass spectrometry (ICP-MS). Furthermore, FT-IR spectroscopic analysis was carried out to confirm the formation of chitosan using various acidic concentrations (1%, 2%, 3%, 4%, and 10%) of HCl for demineralization, followed by 4% and 50% alkaline deproteinization and deacetylation, respectively. The study determined the extracted chitosan's moisture content, ash content, yield, deacetylation degree, and morphological structure. The results indicated that calcium was the most abundant mineral in shrimp shells, with a content of 6.85%. The formation of chitosan was verified through FT-IR analysis, comparing it with commercial chitosan as a reference. The moisture content ranged from 1.3% to 5%, while the ash content ranged from 1.1% to 2.1%. Interestingly, the degree of deacetylation under 2% acidic demineralization was higher than that of commercial chitosan. Additionally, the research suggested that lower concentrations of acidic demineralization are more likely to yield higher amounts of chitosan. Overall, the outcomes of this research are intended to be applied in optimizing the chemical extraction of chitosan from shrimp waste by manipulating the extraction stages.

Keywords: Shrimp waste, Chitosan, Acidic Demineralization

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