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# Extraction of chitosan-based piezoelectric thin film from shrimp shell waste

[AIMS Materials Science](#) • Article • Open Access • 2026 • DOI: 10.3934/matiersci.2026006Hisham, Firzanah<sup>a</sup>; Ahmad, Kartini<sup>a</sup>; Mohd Hatta, Maziat Akmal<sup>a</sup>; Ahmad, Farah<sup>b</sup><sup>a</sup>Department of Science in Engineering, Kulliyah of Engineering, International Islamic University Malaysia, Gombak, Selangor, 53100, Malaysia[Show all information](#)[Full text](#) [Export](#) [Save to list](#)[Document](#) [Impact](#) [Cited by \(0\)](#) [References \(51\)](#) [Similar documents](#)

## Abstract

In this study, we explored the potential of chitosan, a natural polysaccharide derived from shrimp shell waste, for piezoelectric applications in biomedical, food, and agricultural industries. Despite limited research on its piezoelectric properties, chitosan has gained attention due to its non-toxicity and energy-harvesting potential. We focused on optimizing the extraction of chitosan from shrimp shell waste for these applications. Chitin powder was treated with NaOH concentrations ranging from 30% to 60% to remove acetyl groups and create chitosan. The best results for chitosan extraction were achieved using a 50% NaOH solution. Piezoelectric properties of chitosan thin films dissolved in formic acid were also analyzed, showing the best performance with a piezoelectric constant ( $k$ ) of 0.3158, maximum charge ( $Q_m$ ) of 64.1, and a low loss tangent ( $\tan \delta$ ) of 0.0156. Later, the biological assessment of the chitosan thin films, namely the antimicrobial and biocompatibility analyses, were performed to evaluate their interaction with biological systems and to determine their potential for biomedical and biotechnological applications. The results indicated that the chitosan thin film exhibited no cytotoxic effects, highlighting its promise as a safe and suitable material for diverse biomedical uses. © 2026 the Author(s), licensee AIMS Press. This is an open access article distributed under the terms of the Creative Commons Attribution License (<https://creativecommons.org/licenses/by/4.0>)

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