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Membrane derived from pineapple biowaste for water filtration in aquaculture environment: Effect of zinc oxide nanoparticle

Abstract

This study evaluates bacterial cellulose (BC) membranes reinforced with zinc oxide nanoparticles (ZnO-NP) derived from pineapple biowaste. While BC membranes are widely studied, their use in aquaculture and ZnO reinforcement remains underexplored. Membranes were synthesized with 0.25–1.0 wt% ZnO-NP and characterized by SEM, XRD, FTIR, tensile strength, antibacterial activity, filtration efficacy, and analysis using one-way ANOVA. Results showed ZnO-NP enhanced membrane crystallinity and tensile strength, with 0.25 wt% being optimal. The membranes exhibited improved antibacterial activity, reducing bacterial content by 90.6 % and contaminants by 57 %, enhancing water quality for aquaculture and supporting sustainability and the long-term viability of aquaculture.

Keywords

Acetate membrane; Antibacterial activity; Bacterial cellulose; Pineapple biowaste; ZnO nanoparticle