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Green synthesis of hyaluronic acid-silver nanoparticles using microalgae extracts, with evaluation of antimicrobial activity

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Abstract
Silver nanoparticles (AgNPs) exhibit excellent antimicrobial activity but face challenges such as aggregation and reduced effectiveness when used alone. To address these limitations, green synthesis methods utilizing biological agents as reducing agents have been explored to develop AgNP nanocomposites. This study synthesized AgNPs by incorporating hyaluronic acid (HA) with microalgae extracts from Arthrospira platensis, Chlorella vulgaris, and Nannochloropsis sp., resulting in HA-AgNP nanocomposites. The experimental parameters, including pH, extract concentration, temperature and synthesis time, were optimized for the preparation of the HA-AgNPs nanocomposites. The best HA-AgNPs nanocomposites, synthesized by A. platensis (HA-SP-AgNPs), exhibited a Z-average size of 66.98 nm and polydispersity index (PDI) of 0.494, indicating uniformity and stability. FTIR analysis confirmed the presence of functional groups associated with AgNPs, HA and A. platensis, ensuring structural stability. A key finding of the study is that HA-SP-AgNPs demonstrated enhanced antimicrobial activity against bacteria such as Staphylococcus aureus, Escherichia coli, and Bacillus subtilis. Notably, the HA-SP-AgNPs were particularly effective against S. aureus and E. coli compared to AgNPs alone. The results underscore the critical role of HA in enhancing nanoparticle stability and antibacterial efficacy, positioning HA-SP-AgNPs as a promising antimicrobial agent.

Author Keywords
A. platensis; Antimicrobe; Green synthesis; Hyaluronic acid-silver nanoparticle

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