

Green Synthesis of Flower-Like Carrageenan-Silver Nanoparticles and Elucidation of Its Physicochemical and Antibacterial Properties

ABSTRACT

Herein, we report the green synthesis of flower-like carrageenan-silver nanoparticles (c-AgNPs) through a facile hydrothermal reaction at 90 °C for 2 h. The reduction of silver nitrate (AgNO₃) to c-AgNPs was evident by the colour change of the solution from colourless to dark brown and further confirmed by a UV-Vis surface plasmon resonance (SPR) peak at ~420 nm. The FTIR spectra showed that the abundance of functional groups present in the carrageenan were responsible for the reduction and stabilisation of the c-AgNPs. The XRD pattern confirmed the crystalline nature and face-centred cubic structure of the c-AgNPs, while the EDX analysis showed the presence of a high composition of elemental silver (85.87 wt%). Interestingly, the morphological characterisations by SEM and FE-SEM revealed the formation of flower-like c-AgNPs composed of intercrossed and random lamellar petals of approximately 50 nm in thickness. The growth mechanism of flower-like c-AgNPs were elucidated based on the TEM and AFM analyses. The c-AgNPs displayed promising antibacterial properties against *E. coli* and *S. aureus*, with zones of inhibition ranging from 8.0 ± 0.0 to 11.7 ± 0.6 mm and 7.3 ± 0.6 to 9.7 ± 0.6 mm, respectively, as the concentration of c-AgNPs increased from 0.1 to 4 mg/mL.