Effect of chitosan and hydroxypropyl methylcellulose on size and antibacterial activity of copper nanoparticles

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Research Abstract

Background: Nanomaterials exhibit better antibacterial activity because of their distinct structural/ morphological characteristics. Particle size and shape of the nanomaterials are the two significant parameters which affect the resultant antibacterial property. Different biopolymers have been explored to prepare capped metal nanoparticles with controlled/desired particle size and morphology.

Methods: The present research work explains the effect of chitosan (CH) and hydroxypropyl methylcellulose (HPMC) on the shape and size of the copper nanoparticles (Cu NPs) and their antibacterial activity. The CH-Cu and HPMC-Cu NPs were achieved by facile precipitation technique using ascorbic acid as a nucleating agent.

Results: Instrumental analysis by fourier transform infrared spectroscopy, x-ray diffraction, field emission scanning electron microscopy-energy dispersive x-ray analysis and transmission electron microscope confirmed the successful synthesis of Cu NPs. Scanning and transmission electron microscopic studies revealed that the formed NPs have a spherical structure with different diameters of ~8 ± 2 nm for CH-Cu and ~38 ±2 nm for HPMC-Cu NPs. Crystalline size calculated using Debye–Scherrer equation from XRD results were also in good agreement with the above results. The developed materials CH-Cu NPs and HPMC-Cu demonstrated excellent antibacterial activity against both gram-positive and gram-negative bacteria. It was observed that the CH-Cu NPs showed a higher inhibition zone when compared to that of the HPMC-Cu NPs.

Conclusions*:* The biopolymer capped Cu NPs of smaller particle size exhibit much better antibacterial activity and the particle size of the Cu NPs (nm) can be finetuned with the aid of selecting the most appropriate biopolymer.

Keywords: Chitosan, Hydroxypropyl methylcellulose, Copper nanoparticels,