

## Antibacterial Activity of Calendula officinalis Extract Loaded Chitosan Nanoparticles

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**Abstract :** Nanoparticle based formulations of drug delivery systems have shown their potential in improving the performance of existing drugs and have opened avenues for new therapies. Calendula extract is a low cost, wide spectrum bioactive material that has been used for a long term therapy of various infections. Aim: The aim of this study was to develop Calendula officinalis extract based nanoformulations and to study the antibacterial activity of either Calendula extract loaded chitosan nanoparticles or Calendula extract coated silver nanoparticles for increased bioavailability and their long term effect. Methods: Chitosan nanoparticles were prepared by the process of ionotropic gelation, based on interaction between the negative groups of tri polyphosphate (TPP) and positively charged amino groups of chitosan. The size of the Calendula extract-loaded chitosan particles was determined using dynamic light scattering and scanning electron microscopy. Antibacterial activities of these formulations were determined based on minimum inhibitory concentration and time kill studies. In addition, silver nanoparticles were also synthesized in the presence of Calendula extract and characterized by UV visible spectrum, DLS and XRD. Experiments were conducted on 96-plates against two Gram-positive bacteria; Staphylococcus aureus and Bacillus subtilis two Gram-negative bacteria; Escherichia coli and Pseudomonas aeruginosa. Results: Results demonstrated time dependent antibacterial activity against different microbes studied. Both Calendula extract and Calendula extract loaded chitosan nanoparticles have shown good antimicrobial activity against both Gram positive and Gram negative bacteria. Conclusion: Calendula extract loaded chitosan nanoparticles and calendula extract coated silver nanoparticles are potential antibacterial for their long term antibacterial effects.

**Keywords :** antibacterial, Calendula extract, chitosan nanoparticles, silver nanoparticles

**Conference Title :** ICBBS 2014 : International Conference on Biotechnology and Biological Sciences

**Conference Location :** Singapore, Singapore

**Conference Dates :** September 11-12, 2014