



University of Zabol  
Graduate school  
Faculty of Science  
Department of Chemistry

**The Thesis Submitted for the Degree of M.Sc (in the field  
of Organic Chemistry)**

**Preparation, Characterization and Study of  
Antibacterial Properties of a Novel  
Nanocomposite Based on Chitosan-Grafted-  
Polyaniline/ Silver/Montmorillonite**

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## **Abstract**

In this study, a novel nanocomposite base on chitosan grafted polyaniline/Ag/ montmorillonite was synthesized. The silver nanoparticles (AgNPs) were successfully prepared using the wet chemical reduction method into the lamellar space layer of montmorillonite /chitosan. AgNO<sub>3</sub>, montmorillonite, chitosan grafted polyaniline and NaBH<sub>4</sub> were used as the silver precursor, the solid support, the natural polymeric stabilizer, and the chemical reduction agent, respectively. Polyaniline was chemically grafted onto chitosan by using ammonium peroxydisulphate initiator. The AgNPs and nanocomposites were characterized using ultraviolet-visible spectrophotometer, powder X-ray diffractometer, field emission scanning electron microscope, and Fourier transform infrared spectrophotometer. The UV-visible analysis showed the maximum surface plasmon resonance peak at 391-403 nm, which confirms the formation of silver nanoparticles. The average diameters of the AgNPs were found to be in the range of 8.3-11.4 nm using X-ray diffraction analysis. The field emission scanning electron microscope images showed the silver crystals were of the face-centered cubic type. Finally, the antibacterial activity of the obtained nanocomposites was also evaluated against bacteria of Gram positive *Staphylococcus aureus* and Gram negative *Escherichia coli* using the paper disc diffusion method. The results showed that the obtained nanocomposites were effective against two bacteria.

*Keywords:* Silver nanoparticles; Chitosan; Montmorillonite; Nanocomposite; Antibacterial properties