

Microwave assisted green synthesis and characterization of silver/montmorillonite heterostructures with improved antimicrobial properties

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Abstract

Silver (Ag)/montmorillonite (Mt) heterostructures were effectively synthesized utilising microwave (MW) irradiation technique in the absence of any reducing agent. Compared to conventional thermal reduction processes, this approach is simple, faster and environmentally friendly. The MW process yielded Mt surfaces with uniform distribution of Ag nanoparticles with an average size of 8–10 nm. The presence of reducing agents was found to inhibit the formation of Ag nanoparticles in MW synthesis. The method was also successfully used for the preparation of Ag/organically modified Mt. However, the transmission electron microscopy analysis showed that, on the surface of Mt which is organically modified, the Ag nanoparticles have a tendency to aggregate forming bigger Ag clusters. The nanostructures prepared by the MW assisted method showed substantially higher levels of antimicrobial properties against Gram-positive bacteria, i.e., *S. aureus* and *B. cereus* as well as Gram-negative bacteria namely *E. coli*, *P. aeruginosa* and *S. enterica*.