

# NANO WORLD SUMMIT: CURRENT AND FUTURE PERSPECTIVES

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## Metal-clay nanocomplex reinforced polyethylene nanocomposites: An excellent antimicrobial and cytocompatible material

**Mangala Joshi**

Indian Institute of Technology Delhi, India

Polymeric materials reinforced with nanoscale reinforcements or polymer nanocomposites has generated considerable amount of research attention over the past three decades in the field of applied material sciences due to exceptional property enhancement at low nano-reinforcement threshold. Various functional enhancements of polymer nanocomposites are reported giving rise to novel materials with unique properties which is mainly attributed to nano-reinforcements dispersed at molecular level in the host polymeric matrix. As a nano-reinforcement for polyethylene, a metal-clay “nanocomplex” was synthesized in-lab to develop antimicrobial polyethylene nanocomposites. Inherently antimicrobial nanoparticles of silver, copper and zinc are loaded to nanoclays. Nanoclays like montmorillonite are layered silicates, capable of adsorbing cations/nanoparticles. The nanocomplex of metal NPs deposited in-situ over nanoclays was developed using ion exchange reactions and reduction procedure. The nanocomplex was further incorporated in polyethylene with varying concentrations to form polyethylene nanocomposite through melt-intercalation route. The polyethylene nanocomposites showed a disordered intercalated morphology and improved mechanical properties. Antibacterial and antifungal tests demonstrate excellent bioactivity even at low loadings and excellent cytocompatible behavior against human erythrocytes and human dermal fibroblast cell line *in-vitro*. Further, histopathological analysis of rat epidermis surgically stitched with nanocomposites was evaluated *in-vivo*. The bio-compatible nanocomposites can be potentially used as a material of choice in manufacturing biomedical devices, catheters, equipment housings, tubing etc., as it is highly effective in reducing nosocomial infections especially in microbe rich environment like hospitals and out-patient clinics.

mangalajoshi9@gmail.com