THESIS ABSTRACT

The present work aims at the development of a nanocomposite hydrogel purposed for wound healing.

The effect of the reaction solvent on the morphological and electrical properties of magnesium oxide nanoparticles was investigated. Different solvents like water, ethyl alcohol and aqueous CTAB were employed and the resultant nanoparticles varied in size, shape, surface zeta potential and their antibacterial ability. The MgO synthesized in ethyl alcohol exhibited minimum size and maximum ability of bacterial cell annihilation. About 3 log reduction was observed in colony forming units, and about 65% reduction in optical density at 600 nm. FESEM images were taken at different time periods to visualise the gradual rupture of the bacterial cell membrane. For getting an insight on the mechanism via which MgO nanoparticles act on bacterial cells, the reactive oxygen species generated in the cells in the presence of the nanoparticles were quantified. About 10 times more ROS were found to generate in cells, leading to enormous oxidative stress. Ascorbic acid was used to scavenge the ROS generated, and the antibacterial potential of MgO was found to reduce significantly by the scavenging. Hence, generation of ROS was proposed to be the dominant antibacterial mechanism of action of MgO. Fabrication of a nanocomposite was carried out with poly-vinyl alcohol and poly-ethylene glycol-4000 using freeze-thaw method and magnesium oxide nanoparticles were embedded within it. Magnesium oxide nanoparticles was found to have altered the swelling ratio, water content, tensile strength and other properties of the hydrogels, along with increasing their antibacterial efficacy, making these films potential candidates as wound dressing bandages. The nanoparticle leaching from the films were also found to be significantly minimal, reducing the risk of metal accumulation on wounds.

The assessment the performance of the epidermal growth factor loaded PVA-PEG-MgO hydrogels in wound contraction was done on a live rat model. It was found that the bare and unloaded hydrogels both induced cell proliferation, but the growth factor accelerated the process by many folds. The hydrogel films were found to be biocompatible and triggered cell growth. Several parameters indicating wound healing

was studied like wound size contraction, angiogenesis, and re-construction of damaged epithelial layer by microscopic methods.

Keywords: *nanoparticles, hydrogels, nanocomposite, antibacterial mechanism, reactive oxygen species, magnesium oxide*