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Synthesis, Characterization of ZnO Nanoparticles and their Application in Removal of Heavy Metals from Waste water

In an effort to reduce the environmental and health effects of heavy metals in wastewater, various techniques have been employed. However, most of these techniques are expensive and ineffective incomplete removal heavy metals from the waters. The objectives of this study were to synthesize ZnO nanoparticles, characterize and apply it in adsorption of heavy metals from waste waters. Precipitation technique was used to synthesize ZnO nanoparticles. Two samples L1 and L2 were synthesized. They were characterized using Power X-ray Diffraction (PXRD), Fourier Transform Infra-Red (FTIR), Scanning Electron Microscopy (SEM) and Energy Dispersive X-ray Spectroscopy (EDX), methods of analysis. The PXRD results showed diffraction peaks which were indexed to ZnO reference as per JCPDS file 80-0075. The size of ZnO nanoparticles was found to be 26 nm. FTIR spectra showed a broad band at around 430 cm⁻¹ with shoulder shape, characteristics of Zn-O bond. The images obtained by SEM showed rod shaped clusters of nanoparticles which were distributed well within a range of 100 nm which is a favorable property to exhibit better photo catalytic activity. The EDX results showed elemental composition of ZnO nanoparticles which showed 54% Zn, 44.07% O and 1.93% Mn impurities for L1 and 55.34% Zn, 42.3% O and 2.37% Mn impurities for L2. The results of heavy metal ions adsorption showed an increase in percentage removal with increase in adsorbent dose and contact time. There was a decrease with increase in heavy metal concentration. In conclusion, ZnO nanoparticles can be used as an adsorbent of waste water from textile and metallurgical industries. Future studies could focus on possibilities of improving and commercializing this material through designing a treatment facility that in co-operates commercial nanoZnO on large scale waste water treatment.

Key Words: Heavy Metals, Adsorption, ZnO Nanoparticles.

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