ABSTRACT

Three sets of *nanoparticles (ZnO, Gd/ZnO, Sm/ZnO, La/ZnO), (TiO_2, Gd/TiO_2, Sm/ TiO_2, La/TiO_2) and (SiO_2, Gd/SiO_2, Sm/SiO_2, La/SiO_2)* were fabricated by sol-gel method using appropriate precursors with and without using surfactant (Sodium Dodecyl Sulphate)below its CMC value. The synthesized samples were characterized by *Thermo gravimetric Analysis*/Differential scanning calorimetry (TGA/DSC) for their thermal properties, by scanning electron microscopy (SEM) for morphology of nanoparticles, by Transmission electron microscopy (TEM) for particle size, by *X-Ray Diffraction* (XRD) for crystal structure and crystallite size, and *Fourier Transform Infrared Spectroscopy* (FTIR) was used to analyze metal-oxygen bonding and functional groups. All characterization techniques confirmed the synthesis of nanoparticles. The average size of all nanoparticles was observed below 30nm and results obtained from TEM and XRD for particle size are in agreement with each other. *Solid phase UV-visible absorption spectrophotometer (SPS)* analysis was performed to study optical band gap of metal oxide nanoparticles and effect of doping on the band gap of nanoparticles. It was observed that band gap of undoped nanoparticles were higher than the band gap of same material in bulk form and band gap of lanthanide doped nanomaterials was less than undoped material. The observed optical band gap value for ZnO was 3.62eV, for TiO_2 was 3.69eV and for SiO_2 was 3.58eV. Catalytic activity was done by photodegradation of a highly neurotoxic, industrial pollutant Methylene Blue at different reaction conditions for time intervals 30 minutes, 60 minutes and 120 minutes using UV-light, Sunlight and dark. The photocatalytic degradation of MB was studied by using UV-Vis spectrophotometer in kinetic mode and first order rate constant (k) was calculated. Maximum degradation (26.146%) with k-value 0.1031 $Sec^{-1}$was made Gd/ZnO nanoparticles after 120 minute reaction in UV-light. It was also observed that photodegradation activity of Gd/ZnO, Sm/ZnO and Sm/TiO_2 was approximately equal with a slight difference. Also SiO_2 and Ln (Ln= Gd,Sm,La) doped SiO_2 have lower catalytic degradation activity as compared to *(ZnO, Gd/ZnO, Sm/ZnO, La/ZnO) and (TiO_2, Gd/TiO_2, Sm/ TiO_2, La/TiO_2)*. Results suggested that these nanoparticles may be envisaged for the treatment of waste water.