World Academy of Science, Engineering and Technology
International Journal of Chemical and Molecular Engineering
Vol:12, No:01, 2018

ZnO Nanoparticles as Photocatalysts: Synthesis, Characterization and Application

Authors : Pachari Chuenta, Suwat Nanan

Abstract : ZnO nanostructures have been synthesized successfully in high yield via catalyst-free chemical precipitation technique by varying zinc source (either zinc nitrate or zinc acetate) and oxygen source (either oxalic acid or urea) without using any surfactant, organic solvent or capping agent. The ZnO nanostructures were characterized by Fourier transform infrared spectroscopy (FT-IR), X-ray diffractometry (XRD), scanning electron microscopy (SEM), thermal gravimetric analysis (TGA), UV-vis diffuse reflection spectroscopy (UV-vis DRS), and photoluminescence spectroscopy (PL). The FTIR peak in the range of 450-470 cm-1 corresponded to Zn-O stretching in ZnO structure. The synthesized ZnO samples showed well crystalized hexagonal wurtzite structure. SEM micrographs displayed spherical droplet of about 50-100 nm. The band gap of prepared ZnO was found to be 3.4-3.5 eV. The presence of PL peak at 468 nm was attributed to surface defect state. The photocatalytic activity of ZnO was studied by monitoring the photodegradation of reactive red (RR141) azo dye under ultraviolet (UV) light irradiation. Blank experiment was also separately carried out by irradiating the aqueous solution of the dye in absence of the photocatalyst. The initial concentration of the dye was fixed at 10 mgL-1. About 50 mg of ZnO photocatalyst was dispersed in 200 mL dye solution. The sample was collected at a regular time interval during the irradiation and then was analyzed after centrifugation. The concentration of the dye was determined by monitoring the absorbance at its maximum wavelength (λ_{max}) of 544 nm using UV-vis spectroscopic analysis technique. The sources of Zn and O played an important role on photocatalytic performance of the ZnO photocatalyst. ZnO nanoparticles which prepared by zinc acetate and oxalic acid at molar ratio of 1:1 showed high photocatalytic performance of about 97% toward photodegradation of reactive red azo dye (RR141) under UV light irradiation for only 60 min. This work demonstrates the promising potential of ZnO nanomaterials as photocatalysts for environmental remediation.

Keywords : azo dye, chemical precipitation, photocatalytic, ZnO
Conference Title : ICMEM 2018 : International Conference on Molecular Engineering and Mechanics
Conference Location : Sydney, Australia
Conference Dates : January 29-30, 2018