The photodegradation of organic compounds by ZnO nanopowder

ABSTRACT

The commercialized ZnO nanopowder has been employed in this study to investigate the photocatalytic degradation of two organic compounds, Methylene Blue (MB) and Phenol Red (PR) in an aqueous suspension of ZnO nanoparticles under UV light irradiation. This study has considered ZnO as the photocatalyst because it has been reported as a suitable substitute for TiO2 in certain application. For the characterization of the ZnO photocatalyst, X-ray diffraction (XRD), transmission electron microscopy (TEM), specific surface area analysis (BET), and UV-visible spectroscopy were exploited. X-ray diffractometry result for the ZnO nanoparticles exhibit normal crystalline phase features. All observed peaks can be indexed to the pure hexagonal wurtzite crystal structures, with the space group of P63mc. From the XRD pattern, no diffraction peaks from other impurities have been observed. In addition, TEM measurement shows that most of the nanoparticles are spherical and rod-like in shape and fairly monodispersed. A significant degradation of the organic compounds were observed in the presence of the catalyst without the irradiation of the UV light and the degradation increases significantly when irradiated with the UV light for a certain period of time. Besides, for the same period of irradiation, the photodegradation of the organic compounds was increased as the photocatalyst loading increases. The BET measurement for ZnO was 11.9 m2/g. The effect of some parameters such as initial concentration of organic compounds and photocatalyst loading were also determined.

Keyword: Heterogeneous photocatalyst; Methylene blue; Nanostructures; Phenol red; Zinc oxide