Synthesis and characterization of Manganese doped ZnO nanoparticles

ABSTRACT

Various levels of manganese (Mn)-doped ZnO were synthesized by precipitation method. Characterization was carried out by XRD, TEM, SEM, EDX, BET and the band gap measured by UV-visible reflectance. In the XRD pattern of samples, there is no signature of impurity peaks, which could indicate Mn-related secondary phases. The EDX show the amount of Mn doped on ZnO is slightly lower than the theoretical value. The SEM of 1% Mn-doped ZnO illustrated that morphology is well ordered, has low aggregation, and homogeneous distribution of particle size. High aggregation is observed, however, in other percentages of Mn-doped ZnO. Results of TEM show that more than 50% of the particles for undoped and Mn-doped ZnO use between 15 and 35 nm, with 1% Mn doped ZnO having the highest percentage (77%). The BET shows that the surface area of synthesized catalyst increases when the weight ratio of manganese increases up to 1% Mn, but decreases thereafter. The band gap of 1% Mn-doped ZnO is 2.2 eV which is smaller than the undoped ZnO band gap. The results of characterization show 1% Mn-doped ZnO has the highest surface area, the lowest particles size and the lowest agglomerate. Moreover the calculated band gap of 1% Mn-doped ZnO is lower than others except 0.5%Mn. Additionally, photodegradation of cresols under visible light showed that 1% Mn-doped ZnO had maximum adsorption and rate of photodegradation. In conclusion 1% Mn doped ZnO is suitable as the best photocatalyst to degrade cresols under visible light irradiation.

Keyword: ZnO; Co-precipitation; Manganesedoping; Optical properties; Nanoparticles