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Photocatalytic Degradation of Toxic Phenols Using Zinc Oxide Doped Prussian Blue Nanocomposite

Authors : Rachna, Uma Shanker

Abstract : Aromatic phenols, being priority pollutants, are found in various industrial effluents and seeking the attention of environmentalists worldwide, owing to their life-threatening effects. In the present study, the coupling of zinc oxide with Prussian blue was achieved involving co-precipitation synthesis process using Azadirachta indica plant extract. The fabricated nanocatalyst was employed for the sunlight mediated photodegradation of various phenols (Phenol, 3-Aminophenol, and 2,4-Dinitrophenol). Doping of zinc oxide with Prussian blue caused an increase in the surface area to value 80.109 m^2g^{-1} and also enhanced the semiconducting tendency of the nanocomposite with band gap energy 1.101 eV. The experiment was performed at different parameters of phenols concentration, catalyst amount, pH, time, and exposure of sunlight. The obtained results showed a lower elimination of 2,4-DNP (93%) than 3-AP (97%) and phenol (95%) owing to their molecular weight and basicity differences. In comparison to the starting material (zinc oxide and Prussian blue), nanocomposite was more capable in degrading the phenols and lowered the t1/2 value of phenol (4.405 h), 3-AP (4.04 h) and 2,4-DNP (4.68 h) to a greater extent. Effect of different foreign anions was also studied to check nanocomposite's liability under natural conditions. The extent of charge recombination being the most limiting factor in the photodegradation of pollutants was determined through the photoluminescence. Sunlight active ZnO@FeHCF nanocomposite was proven to exhibit good catalytic ability up to 10 cycles.

Keywords : nanocomposite, phenols, photodegradation, sunlight, water
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