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The Role of Calcination Temperature on the Photocatalytic Efficiency of Ag/ZnO for Brilliant Blue dye Removel from Aqueous Solutions

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Abstract

In the current study , zinc oxide (ZnO) nanoparticles are prepared using the Hydrothermal technique at a temperature of 160 °C, the prepared smaples are incinerated for calcinated for 2 hr ,the influence of calcination temperatures ranging from 300 to 600 ◦C on the structural and optical characteristics of ZnO NPs was investigated.

Ag/ZnO nanocomposites are successfully synthesise with different amount of Ag loadings by photo deposition process using inert environment nitrogen gas.

The chemical and physical properties of the prepared nanocomposites were characterised using different techniques such as XRD, FE-SEM, TEM, BET, EDS, and UV-vis spectroscopy techniques. XRD of ZnO NPs examination revealed an increase in crystallite size as the calcination temperature increased, presumably due to the merger of smaller crystallites into larger ones. Results show doping silver ions on the surface of ZnO, did not show any peaks for Ag in XRD characterization . Moreover, the average size of nanocomposite with Ag loading at 0.03, 0.07 ,0.1 , 0.2, 0.3 and 0.7 wt% were about 27.8, 27.21, 26.6, 24.51, 24,22 , 21.17 nm respectively. The UV-visible showed that the energy gap of zinc oxide was reduced from 3.32 to 3.31 after doping silver nanoparticles.

The photodegradation of brilliant blue dye was studied using ultraviolet light under different conditions in the presence of Ag/ZnO, studying the effect of factors such as the effect of calcination temperatures, Ag content, dye concentration, mass of catalyst and the effect of incident light.

The results show the samples calcined at 500 °C showed excellent photocatalytic efficiency (PDE%) about 96%.

Ag loading at 0.7 %wt produced the highest degradation efficiency among the others, and the efficiency of the silver doping zinc oxide surface increased. It also showed that the photocatalytic degradation rate increased with decreasing concentration of brilliant blue dye. The percent degradation of modified catalysts rise with increase in amount of catalyst. Increasing the intensity of the light led to an increase in the rate of photocatalytic degradation .