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Synthesis of Ag doped TiO_2 nano-particles and study of their efficacy towards degradation of rhodamine -B dye

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Azo dyes present in textile wastewater require removal due to their negative environmental and health effects. Although there are several ways to treat such wastewater, this study focused on photocatalytic degradation by modified titanium dioxide (TiO_2) and commercial TiO_2 Degussa P25 nanoparticles (NPs).Modified titanium dioxide (TiO_2) is produced by doping silver (Ag) to commercial TiO_2 Degussa P25 to enhance its activity.

Study focused on the application of ultraviolet light emitting diodes (UV-LED) as an alternate source for the photocatalytic degradation of rhodamine-B dye which was used as a model compound. A simple reactor arrangement was made to carry out the photocatalytic degradation of dye. The effect of catalyst loading on degradation has been investigated. The complete mineralization of MB dye (4× 10−6 M) was confirmed. Results demonstrated that the UV-LED/TiO_2 process can effectively degrade rhodamine-B dye. Activity of Ag loaded TiO_2 was enhanced in comparison to commercial Degussa P25 TiO_2.

Modified Ag doped TiO_2 nanoparticles are synthesized by using $AgNO_3$ as silver source to be deposited up on TiO_2 NPs. Synthesized particles are characterized by X-ray crystallography (XRD). Figure 1 shows the XRD pictograph.

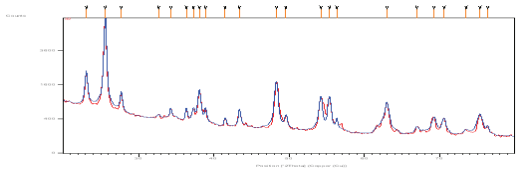

Figure 1: XRD of Ag/TiO_2

Highest intensity peak at 2θ, 56.62^0 confirms the presence of TiO_2 (56.7^0 corresponding to relevant JCPDS file) while as peak at 38.08^0 (Corresponding JCPDS 38.11^0) confirms presence of Ag. The Scherer formula given in Eq. 1 is used to find the size of nano particles.

$$\text{Particle size } D = 0.9\lambda / (\beta \cos \theta) \qquad (1)$$

Where λ is the wavelength of the X-rays, θ is the diffraction angle, and β is the corrected full width, at half-maximum of the peak. Scherer particle size of NPs is 18 nm.

Comparison of degradation of dye by various concentrations of commercial Degussa P25 TiO_2 is shown in Figure 2 .Comparison at concentration of 0.625 wt% with Ag doped TiO_2 is also shown. As is clear degradation is enhanced by utilization of Ag doped TiO_2 at corresponding NP particle concentration.

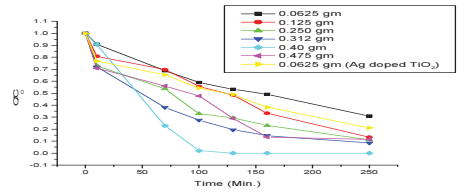

Figure 2: Degradation of Rhodamine-B by commercial and Ag doped TiO_2

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