PHOTOCATALYTIC DEGRADATION OF METHYLENE BLUE ON TIO_2/CNT NANOPARTICLES SYNTHESIZED VIA CVD METHOD

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ABSTRACT

There has been growing concern on the environmental effects of the discharge of industrial effluents to the environment, of which textile dyes are major. They are toxic to some micro organisms and cause destruction to their catalytic capabilities. These dyes have chemical structures that make them difficult to be decomposed in natural systems; hence a need for an adequate water treatment system (Hagfeldt *et al.* 1995). Heterogeneous photo catalysis offers promise as a method for water purification and remediation.Titanium dioxide as compared to other photocatalyst such as ZnO, CdS and WO_3 has been found to be the most promising material for industrial use. This is due to its stability to photocorrosion, inexpensive and requiring low energy in the photodegradation method.The purpose of this study is to develop novel photocatalytic nanocomposite systems for the complete removal of organic contaminants that can be found in waste water streams that directly impact the health and safety of various sectors. In this study, the photocatalytic nanocomposites of TiO_2/CNT at different loadings were successfully synthesized. The prepared supported titanate carbon nanotubes composites with different loadings were synthesized using metal–organic chemical vapour deposition method (MOCVD). The prepared catalysts were characterized by High Resolution scanning electron microscopy (HR-SEM), and transition electron microscopy (HR-TEM), and energy dispersive X-ray spectroscopy (EDX). To assess the crystallographic phases, the samples were analyzed by X-ray diffraction (XRD). Nitrogen absorption at 77 K was used to measure the surface area of the materials. Fourier Transform Infrared spectroscopy (FTIR) was employed to identify various functional groups present. The results revealed that an increase in TiO_2 loading increased the surface area. The XRD clearly shows that all the supported TiO_2 consist of a mixture of anatase and rutile TiO_2. The SEM micrographs of TiO_2 /CNT composite show the TiO_2 phase is well dispersed upon the CNTs network. The EDX analysis confirms the presence of Ti, C and O, while FTIR confirms the presence of the hydroxyl groups and Ti-O bonds. The catalytic efficiency of the supported nanostructure synthesized was evaluated by the photo-degradation studies using methylene blue (MB).Preliminary results on photocatalysis of Methylene blue has shown that after 2 hours the degradation of the dye was 60%, and that is very low as compared to what has been reported in literature by Wang *et* al, 2003.

References:

1. A. Hagfeldt, M. Graetzel, Chem. Rev 49 (1995) 49-68.
2. B.L.X. Wang, M Yan and L. Li, Mater. Chem. Phys., 78 (2003) 184-188

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