Preparation and characterization of nanocomposite of RGO@TiO_2 supported on fique fibers for Photocatalytic degradation of organics dyes

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Abstract

In this work, we developed novel method for obtaining bionanocomposites of reduced graphene oxide (RGO) and TiO_2 nanoparticles (RGO@TiO_2) supported on fique fiber. Fique is a natural fiber obtained of the leaves of the fique plant (*Furcraea sp.*), a xerophytic monocot native which is originally from Andean regions of Colombia, Ecuador, and Peru. However, it is also possible to find this plant in Venezuela and the east coast of Brazil. Initially, we prepared Graphene oxide (GO) using Hummer´s method [(Hummers & Offeman, 1958)] and we obtained the nanocomposite of RGO@TiO_2 by mechanical mix between TiO_2 nanoparticles of ~15 nm and GO in aqueous solution (3.5 mg/mL). The nanocomposite of RGO@TiO_2 was supported on surface of the Fique fibers by immersion for 5 minutes undergo ultrasonic irradiation. Finally, the Fique fibers were dried at 90 ^{0}C by 10 minutes. This heating allowed the partial reduction from GO to RGO (Reduced Graphene Oxide). Nanocomposite RGO@TiO_2, Fique fibers, and precursors (GO and TiO_2) were characterized by X-Ray Diffraction, Raman, X-ray Photoelectron Spectroscopy and Transmission Electronic Microscopy. The results obtained corroborate the formation of precursors and composite material.

For examining the photocatalytic activity of bionanocomposite RGO@TiO_2-Fique for degradation of dyes, we used two dye models; Methylene blue (MB, cationic dye) and Orange II (OII, anionic dye and azo dye). The experiments were carried out using solar light and dye solution of 10, 15 and 20 ppm. We obtained a degradation efficiency of approximately 99% and 80% in an hour for MB and OII, respectively.

References

[1] Hummers, W. S., & Offeman, R. E. (1958). Preparation of Graphitic Oxide. *Journal of the American Chemical Society*, *80*(6), 1339–1339. http://doi.org/10.1021/ja01539a017