Proc. of the Intl. Conf. on Nanotechnology for Better Living, 2016
Editors K. K. Kar, A. Shah and R. Sharma
Vol. 3, No. 1, p. 88
doi:10.3850/978-981-09-7519-7nbl16-rps-88

Synthesis and characterization of rGO-Fe_3O_4-TiO_2 nanocomposite with varying compositions for methylene blue (MB) degradation and As(III) adsorption

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Heavy metals include Copper, Cadmium, Mercury, Arsenic, Chromium, Thallium, Zinc, Nickel and Lead. Because of their bio-accumulative nature, these metals are treated as poisonous at low concentration in biotic systems. In addition, the use of various organic dyes in many industries has also made the ecosystem polluted. Thus, for the sake of these pollutants removal, here a ternary composite made off by graphene oxide, ferric oxide and titania (rGO-Fe_3O_4-TiO_2) with varying compositions is proposed. Here, graphene oxide is synthesized by hummer method, providing high adsorption capacity towards water pollutants.

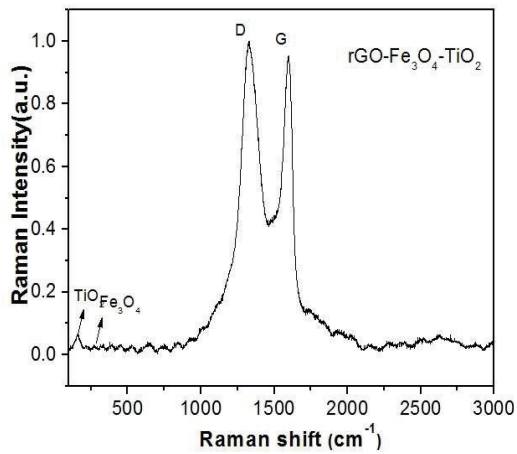

Figure 1: Raman spectra of rGO-TiO_2-Fe_3O_4

The Fe_3O_4 nanoparticles are employed as they have larger surface area, highly reactive surfaces and super magnetic nature. Further, TiO_2 is used mainly as it shows very high photocatalytic activity for organic pollutant degradation. The observed SEM results of nanocomposites reveal that the Fe_3O_4 and TiO_2 nanoparticles are placed over rGO, which enhances the surface area of the resultant nano composite. The nanocomposites are further characterized by Raman spectroscopy, which reveal characteristic peaks corresponding to D and G bands of graphitic structure (Figure 1) The nanocomposites are employed for the removal of methylene blue dye under UV and visible light irradiation as well as for the adsorption of As(III) from wastewater. The ternary nanocomposites exhibit high dye degradation efficiency. This enhancement is attributed to the synergetic interaction and increase in the surface area of rGO–Fe_3O_4–TiO_2. The adsorption efficiency for As(III), is evaluated by the batch adsorption experiment. These results reveal that the rGO–Fe_3O_4–TiO_2 nanocomposite has potential application in water/wastewater treatment.