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Photocatalytic activity of Go/Fe_3O_4 fabricated by Sri Lankan graphite under visible light irradiation

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Graphene oxide (GO) was synthesized using Sri Lankan naturally available graphite by modified Hummer's method. Fe_3O_4 nanoparticles were synthesized successfully by co-precipitation of Fe^{3+} and Fe^{2+} in a 2:1 molar ratio via the addition of NH_4OH. Magnetically separable GO/Fe_3O_4 nanocomposite was fabricated by synthesizing Fe_3O_4 nanoparticles in the presence of GO. The synthesized nanocomposites were characterized by X-ray diffractometry (XRD), Scanning electron microscopy (SEM), and FT-IR spectroscopy. The formation of GO was confirmed by the C(002) peak at 9.39° in the XRD pattern. XRD pattern of the nanoparticles confirms the formation of crystalline Fe_3O_4 nanoparticles, and the diffraction peak corresponds to graphene oxide disappear in the GO/ Fe_3O_4 due to the absence of the folded structure of graphene oxide. SEM image of GO shows the crumpled and wrinkled lamellae structure of graphene oxide, and the images of GO/ Fe_3O_4 show the distribution of Fe_3O_4 nanoparticles with an average size of 107 nm on GO where the folded structure of GO was not present while restacking of the nanosheets, was observed. FT-IR spectrum of GO shows the presence of polar oxygenated functional groups such as carboxylic acid (-COOH), hydroxyl (-OH), and epoxy (-COC-). The photocatalytic performance of the photocatalysts was evaluated on photodegradation of methylene blue under visible light irradiation. The GO/ Fe_3O_4 shows better adsorption behaviour and excellent photocatalytic activity where it could be successfully used for three cycles without significant activity loss. The rate constant for the degradation of MB (0.0187 min^{-1}) at the first cycle decreased to 0.0101 min^{-1} at the third cycle. The conversion of MB decreased from 98.31% at the first cycle to 92.15% at the third cycle. The drop in the conversion is only 6.16% going from cycle 1 to 3, which could be due to the accumulation of the MB molecules at the pore structure. The obtained high photocatalytic activity could be due to the enhanced charge separation resulted due to the presence of GO sheets and better interactions between GO and Fe_3O_4.

Keywords: Graphene oxide, Magnetite, Nanoparticles, Photocatalysis, Methylene blue

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