ISSN: 1391-8796
Proceedings of 10th Ruhuna International Science & Technology Conference
University of Ruhuna, Matara, Sri Lanka
January 18, 2023

Photocatalytic degradation of textile dyes by Graphene Oxide and Graphitic Carbon Nitride Nanocomposite (GO/g-C_3N_4)

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Photocatalytic activity of nanoparticles has become an emerging research field in the world. Attention on nanocomposites of graphene oxide (GO) and graphitic carbon nitride (g-C_3N_4) is increasing because of the metal-free composition and higher photocatalytic activity. Synthesis, characterization, and application of these nanocomposites (GO/g-C_3N_4) for degradation of organic dyes under visible light are reported. The objective of the present study was to study photocatalytic degradation of the textile dye Reactive black 5 (RB 5) by GO/g-C_3N_4 nanocomposites under visible light irradiation. According to literature methods, GO was prepared by oxidizing graphite powder via the modified Hummers method, g-C_3N_4 by thermal polycondensation of urea and the nanocomposite GO/g-C_3N_4 (1:1) by mixing aqueous suspensions of GO and g-C_3N_4 at pH= 3. The above nanocomposite was characterized by UV-visible, FTIR, X-ray diffraction spectroscopy, and scanning electron microscopy. Maximum absorbance for GO, g-C_3N_4, and GO/g-C_3N_4 (1:1) were 232 nm, 415 nm, and 423 nm respectively. In the absence of the catalyst and visible light, photodegradation did not take place. The optimum condition for photocatalytic degradation of RB 5 by GO/g-C_3N_4 (1:1) was solar irradiation of a mixture of an aqueous solution of RB 5 (60 ppm, 100 mL) and the catalyst (30 mg), at pH = 4. Under these conditions, 97 % of degradation occurred within 60 min. The reusability of the catalyst five times was successful. Studies with the scavengers Na_2-EDTA, t-butanol, and p-benzoquinone suggested that the above photocatalytic degradation process is mainly by superoxide radicals.

Keywords: Nanocomposite, Photocatalytic degradation, Reactive Black Five, Graphene Oxide, Graphitic Carbon Nitride.

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