

**Facile Synthesis of Fe<sub>3</sub>O<sub>4</sub>/TiO<sub>2</sub> Composite with Enhanced Magnetic and Photocatalytic Properties for Water Purification****Wathsala K.L. \*, Kulathunga M.U.S., Jayaweera P.M., Palliyaguru L.***Department of Chemistry, University of Sri Jayewardenepura, Gangodawila, Nugegoda**\*lakshaniwathsala2015@gmail.com***Abstract**

The regeneration of TiO<sub>2</sub> used in water purification via photocatalytic reactions is usually carried out using flocculation, and centrifugation. However, the major drawbacks in these methods are the needs of additional process controls, equipment, and energy. Use of magnetic separation in water treatment could be highly effective in both efficiency and operating cost over the other methods. In this study, ilmenite (Fe TiO<sub>3</sub>), a naturally available mineral widely used in TiO<sub>2</sub> production, is modified into Fe<sub>3</sub>O<sub>4</sub>/TiO<sub>2</sub> magnetic composite with enhanced magnetic and photocatalytic activity. The synthesized composite material was tested for photo degradation potential of a common herbicide 1,2-dichlorophenoxyacetic acid. The synthesized Fe<sub>3</sub>O<sub>4</sub>/TiO<sub>2</sub> was characterized using X-ray diffraction (XRD) patterns, X-ray fluorescence (XRF) spectroscopy, and FTIR spectroscopy. The mass susceptibility values of both ilmenite and the synthesized Fe<sub>3</sub>O<sub>4</sub>/TiO<sub>2</sub> were also measured. The morphology of the composite particles was also analyzed by scanning electron microscopy (SEM). The identity of the synthesized Fe<sub>3</sub>O<sub>4</sub>/TiO<sub>2</sub> was confirmed by the XRD pattern. FTIR peaks corresponding to Fe-O-O bending and Fe-O asymmetric stretching were observed at 533 cm<sup>-1</sup> and 1,384 cm<sup>-1</sup>, respectively. The analysis of the synthesized Fe<sub>3</sub>O<sub>4</sub>/TiO<sub>2</sub> with XRF data revealed the presence of both Fe (54%) and Ti (44%) and trace amounts of silicon, manganese, and aluminum. SEM data showed mostly spherical particles of sub-micron size. Magnetic susceptibility measurements indicate a strong diamagnetism in the composite material with a mass susceptibility of 8.05x10<sup>-3</sup> m<sup>3</sup>kg which is much higher than the parent material, ilmenite (3.01x10<sup>-3</sup> m<sup>3</sup>kg). According to the catalytic data the synthesised nanocomposite shows a strong propensity to remove a common herbicide, 1,2-dichlorophenoxyacetic acid, from an aqueous solution through photocatalytic degradation with approximately 65% removal efficiency. These results clearly confirm the synthesis of an environmentally significant photocatalyst with considerable magnetic properties.

**Keywords:** Fe<sub>3</sub>O<sub>4</sub>/TiO<sub>2</sub>, Ilmenite, Organic pollutants, 1, 2-dichlorophenoxyacetic acid, Photocatalysis