Photodegradation of Rhodamine B over Magnetically Separable Fe_3O_4-TiO_2 Photocatalyst

D. I. U. Edirisinghe, P. M. Jayaweera, L. Palliyaguru*

Department of Chemistry, Faculty of Applied Sciences, University of Sri Jayewardenepura, Gangodawila, Nugegoda, Sri Lanka
**lalindapalliyaguru@gmail.com*

Titanium dioxide (TiO_2) is one of the most widely used materials in water purification. One of the largest disadvantages of using TiO_2 in water purification is the high cost and the secondary pollution associated with the catalyst regeneration process. Therefore, use of magnetic titania is highly effective as a catalyst material as it can be carried out via magnetic separation. Results of this investigation show that magnetic titania, Fe_3O_4-TiO_2 can be directly prepared from the HCl leachate of ilmenite. Further, the as-prepared composite was modified to increase TiO_2 percentage by removing a fraction of iron in the leachate using the anionic resin IRA-410Cl. According to the XRD analysis, the crystal planes (310) and (430) corresponding to the 2θ values of 32.62^0 and 53.01^0 respectively, were resulted from Fe_3O_4. Further, for TiO_2, an XRD peak with the crystal plane (101) corresponds for the 2θ value of 23.21^0 was also obtained. In the FTIR spectrum, the presence of peaks at 527 cm^{-1} for Fe-O-Fe and at 1404 cm^{-1} for Ti-O-Ti vibrational modes also confirm the chemical identity of the Fe_3O_4-TiO_2 composite. The mass susceptibility value of $-4.3x10^{-3}$ indicates that it is sufficiently large for the recovery process via magnetic separation. Photodegradation efficiencies of Rhodamine B were tested using as-prepared magnetic titania & Degussa P25. Fe_3O_4-TiO_2 composite bleached the colour by 50% in 25 min, whereas Degussa P25 needed only 18 min. Therefore, Fe_3O_4-TiO_2 may be having a good potential for the application in water purification.

Key words: Ilmenite, Photocatalyst, Magnetic Fe_3O_4-TiO_2 composite, Rhodamine B