

Characterization of newly synthesized ZrFe₂O₅ nanomaterial and investigations of its tremendous photocatalytic properties under visible light irradiation

Abstract

High functional ZrFe₂O₅ nanoparticles were synthesized using coprecipitation technique. The chemical composition of nanomaterials was studied by energy-dispersive X-ray (EDX). To observe the morphology, field emission scanning electron microscopy (FE-SEM) was used. X-ray diffraction (XRD) technique was utilized to appraise the structure of the synthesized material. The photocatalytic behavior of ZrFe₂O₅ nano-particles was investigated by measuring the degradation rate of toluidine blue O (TBO) dye in aqueous solution in the presence of ZrFe₂O₅ nano-particles under visible light irradiation. A steady decrease in absorption peak under visible light irradiation was observed by increasing exposure time. The degradation efficiency was observed as 92% after 140 min of exposure to visible light. Besides, ZrFe₂O₅ nanophotocatalyst could be recovered and recycled easily. The rate of TBO and total organic carbon (TOC) removal under visible light irradiation decreased by only 5% and 10%, respectively, after seven cycles of use, demonstrating the high photostability of the synthesized nano-photocatalyst material.

Keyword: Coprecipitation technique; Degradation efficiency; Energy dispersive x-ray; Field emission scanning electron microscopy; Photocatalytic behaviors; Photocatalytic property; Synthesized materials; Visible-light irradiation.