Abstract

Water contaminated by oil, dyes and micropollutant as Bisphenol A (BPA) pose challenges to the management of water resources. In this small scale laboratory experiment we report the synthesis of superparamagnetic iron-oxide nanoparticles (SPION) and their nanocomposite with β-cyclodextrin (SPION /β-CD). Fourier transform infra red spectroscopy (FTIR), X-ray diffraction (XRD), scanning electron microscopy (SEM), energy dispersive X-ray (EDX), high resolution transmission electron microscopy (HRTEM), small area electron diffraction (SAED), Photoluminescence (PL), UV–Vis spectroscopy, Mossbauer and Vibrating Sample Magnetometry (VSM). Visible light assisted photo-oxidation of BPA was investigated in presence of SPION and SPION/β-CD. The treatment performances were evaluated in terms of BPA degradation using UV-Visible spectrophotometer, Gas Chromatography-Mass spectrometry (GC-MS), Total Organic Carbon analysis (TOC), Chemical Oxygen Demand analysis (COD) and CO₂ emission. 82.55% degradation was achieved through photodegradation under solar illumination. The magnetic nanocomposite was capable of scavenging oil from water as determined from oil sorption studies and magnetic separation thereof. An oil retention capacity of 7.2g/g of nanocomposite has been observed. In addition 94.22% degradation of malachite green dye was also achieved in a 2h sunlight driven photocatalysis process. Interestingly, the higher removal efficiency and reusability studies confirm the suitability for oil spill remediation. Magnetically recoverable, photocatalytic, bio-compatible nanocomposite of SPION and with β-cyclodextrin were prepared by the simple technique and utilized for multi pollutant removal and has a higher reusability and potential biomedical applications.