Desalination and Water Treatment

Effective removal of Congo red dye from aqueous solution using activated MgO-nanoparticles

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Abstract

Herein, the removal of Congo red (CR) dye from aqueous solution using MgO nanoparticles (MgONPs) was reported. Batch experiments were used to fulfil the objectives of this study. Specifically, the one-factor-at-a-time (OFAAT) mode where the effect of contact time, MgO-NPs dosage, and initial CR dye concentration were appraised. Results were underpinned by advanced and state-ofthe-art analytical techniques. Optimum conditions were observed to be 30 mins of mixing, 1 g of MgO-NPs dosage, and 120 mg/L of initial CR concentration. X-ray fluorescence confirmed that there is no change in elemental constituents of raw and reacted materials except for the reduction of the alkaline generating fraction, that is, MgO, embedded on the nanomaterial. Furthermore, X-ray diffraction confirmed the formation of new phases after the interaction hence confirming dissolution and deposition. Fourier-transform infrared spectroscopy denoted the presence of 879 cm–1 band which is assigned to the asymmetric and symmetric stretching vibrations of the sulfonate (–SO3–) group of CR. Microstructurally, the MgO-NPs comprised uniform flower-like microstructures with mono-dispersed and surface-wide flower-like microspheres and twisted nanosheets hence indicating deposition and dissolution of fractions from the MgO-NPs. Findings from this study will go a long way in curtailing ecological impacts posed by CR-dye in different receiving environments. Future research should look into the upscaling of this technology in industries.