Catalytic removal of Alizarin Red using chromium manganese oxide nanorods: degradation and kinetic studies

ABSTRACT

Dye removal through photocatalytic degradation employing nanomaterials as catalysts is a growing research area. In current studies, photocatalytic alizarin red (AR) dye degradation has been investigated by designing a series of Cr based manganese oxide nanomaterials (MH1–MH5). Synthesized nanomaterials were characterized by powder X-ray diffraction, scanning electron microscopy/energy dispersive x-ray, Brunauer–Emmett–Teller, and photoluminescence techniques and were utilized for photocatalytic AR dye degradation under UV light. AR dye degradation was monitored by UV–visible spectroscopy and percent degradation was studied for the effect of time, catalyst dose, different dye concentrations, and different pH values of dye solution. All the catalysts have shown more than 80% dye degradation exhibiting good catalytic efficiencies for dye removal. The catalytic pathway was analyzed by applying the kinetic model. A pseudo second-order model was found the best fitted kinetic model indicating a chemically-rate controlled mechanism. Values of constant R2 for all the factors studied were close to unity depicting a good correlation between experimental data.

Keyword: Alizarin Red (AR); Photocatalysis; Degradation; UV light; Nanomaterials; Kinetics