Abstract

An effective ternary catalyst system was developed using the co-precipitation method, incorporating Eud at concentrations of 2 and 4 wt.% alongside a fixed amount (3 wt.%) of Thioglycolic Acid (TGA)-doped copper tungstate ($CuWO_4$) nanostructures (NSs). This study primarily aimed to enhance the dye degradation efficiency of $CuWO_4$ by modifying its recombination rate through doping, thereby improving its multifunctional role as both a catalyst and antibacterial agent. The dopants influenced the particle size, dispersion, and optical characteristics of $CuWO_4$. Key variables, including Eud concentration, fixed TGA quantity, reaction temperature, and duration, played roles in shaping these properties. The TGA/Eud-doped $CuWO_4$ nanostructures, featuring a porous morphology, showed significant degradation activity for Rhodamine Blue (RhB) dye.