

Decolorization kinetic studies of Congo red catalyzed by Co-doped CdS nanoparticles

H.R. Pouretedal^{a*}, S.D. Mirghaderi^b, M.H. Keshavarz^a

^aFaculty of Science, Malek-Ashtaru University of Technology, Shahin-Shahr, Iran
Tel. +98 (312) 5912253; Fax +98 (312)-5220420; email: HR_POURETEDAL@mut-es.ac.ir

^bDepartment of Chemistry, Azad University, Shahreza Branch, Iran

Received 7 October 2009; Accepted in revised form 18 January 2010

ABSTRACT

The Cd_{0.97}Co_{0.03}S nanoparticles were prepared by using a controlled co-precipitation method. The nanoparticles were characterized by using UV-Vis spectra, XRD patterns and TEM image. The blue shift in the band gap of CdS semiconductor was observed with decreasing of the particle size. The XRD patterns prove the zinc-blend-type of Cd_{0.97}Co_{0.03}S nanoparticles. The size of nanoparticles less than 50 nm was confirmed through TEM image. The decolorization kinetics of Congo red catalyzed by prepared nanoparticles was studied under UV and sunlight irradiations. The decolorization study of dye with the initial concentration 20 mg/L shows the pseudo-first order kinetics with the apparent rate constant $1.35 \times 10^{-2} \text{ min}^{-1}$ at pH 7. The Cd_{0.97}Co_{0.03}S photocatalyst also indicates an excellent reactivity for bleaching of dye under sunlight irradiation with the apparent rate constant of $1.01 \times 10^{-2} \text{ min}^{-1}$. Degradation of 92–82% of Congo red was obtained in five cycles of reuse of proposed photocatalyst and dissolution of photocatalyst was found to be less than 0.2%.

Keywords: Decolorization; Cadmium sulfide; Cobalt; Nanoparticles; Congo red

* Corresponding author.