



Photocatalytic degradation of catechol in aqueous solutions: a comparison between UV/Fe₂O₃ and Fe₂O₃/sunlight processes

Shahin Raeisivand^a, Mehraban Sadeghi^{a,*}, Sara Hemati^a, Abdolmajid Fadaei^a, Morteza Sedehi^b, Ali Sadeghi^c, Seyed Masih Hoseini^d

^aDepartment of Environmental Health Engineering, School of Health, Shahrekord University of Medical Sciences, Shahrekord, Iran, Tel. +98 38 33330299; Fax: +98 38 33334678; emails: Sadeghi@skums.ac.ir (M. Sadeghi), shahin.raeisivand@gmail.com (S. Raeisivand), hemati.sara88@yahoo.com (S. Hemati), ali2fadaei@yahoo.com (A. Fadaei)

^bDepartment of Epidemiology and Biostatistics, School of Health, Shahrekord University of Medical Sciences, Shahrekord, Iran, email: sedehi56@gmail.com

^cSemnan University, Iran, email: sadeghi943@gmail.com

^dShahrekord University of Medical Sciences, Shahrekord, Iran, email: Masih.hoseini45@yahoo.com

Received 4 October 2018; Accepted 8 March 2019

ABSTRACT

Phenols and phenolic compounds are widely used in everyday life and industry. Environmental stability, solubility in aqueous medium and high toxicity of these compounds are due to their high attention. The purpose of this study is the removal of catechol from wastewater based on the comparative use of two photocatalytic hematite/UV and hematite/sunlight processes. In this experimental laboratory study, the hematite nanoparticles are used with the separate application of UV and sunlight to reduce 10–50 mg L⁻¹ concentration of catechol. The effect of parameters such as hematite concentration, reaction time and pH is studied on the catechol removal efficiency of both processes. The 6-W UV lamp as well as UV-A sunlight is used for radiation on the reactor contents. The remaining catechol concentration in the samples is measured by spectrophotometer within the wavelength of 600 nm. The best catechol removal efficiency by UV/Fe₂O₃ and Fe₂O₃/sunlight processes is 92.3% and 88% obtained at pH = 2, contact time of 60 min, hematite concentration of 4.0 g L⁻¹ and catechol concentration of 50 mg L⁻¹. UV/Fe₂O₃ process with 0.4 g L⁻¹ Fe₂O₃ obtained COD removal of 71.3%, while sunlight/Fe₂O₃ process achieved lower COD removal of 50.9%. The results showed that UV/Fe₂O₃ and Fe₂O₃/sunlight photocatalytic processes have a good potential in catechol removal from aqueous solutions at pilot scale. However, statistical analysis of results did not show a significant difference between the processes. Therefore, it is proposed to study the performance of these processes as a clean and environmentally friendly practice in full scale with real wastewater.

Keywords: Photocatalyst; Hematite nanoparticles; UV radiation; Catechol; Sunlight

* Corresponding author.