Desalination and Water Treatment
www.deswater.com

doi:10.5004/dwt.2017.21029

82 (2017) 332–337
July

Toxicity evaluation of phenol by-products resulted from degradation of phenol by Fe (III)-doped TiO_2/UV process

Saeedeh Hemmati Borji[a,b], Simin Nasseri[a,b,*], Ramin Nabizadeh[a,c], Amir Hossein Mahvi[a,d], Mohammad Reza Zare[e]

[a]*Department of Environmental Health Engineering, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran, Tel. +98 21 88978396, email: saeedeh.hemmati@yahoo.com (S.H. Borji), Tel. +98 21 88978396, email: naserise@tums.ac.ir (S. Nasseri), Tel. +98 21 88954914, email: rnabizadeh@tums.ac.ir (R. Nabizadeh), Tel. +98 21 88951400, e-mail: ahmahvi@yahoo.com (A.H. Mahvi)*
[b]*Center for Water Quality Research (CWQR), Institute for Environmental Research (IER), Tehran University of Medical Sciences, Tehran, Iran*
[c]*Center for Air Pollution Research (CAPR), Institute for Environmental Research (IER), Tehran University ofMedical Sciences, Tehran, Iran*
[d]*Center for Solid Waste Research (CSWR), Institute for Environmental Research (IER), Tehran University of Medical Sciences, Tehran, Iran*
[e]*Department of Environmental Health Engineering, Evaz School of Public Health, Larestan School of Medical Sciences, Larestan, Iran, Tel. +98 917 108 2125, email: zaremohammad1363@yahoo.com (M.R. Zare)*

Received 19 September 2016; Accepted 13 June 2017

ABSTRACT

The objective of this study was the evaluation of phenol toxicity and by-products resulted from its degradation by Fe (III)-doped TiO_2/UV process. 10 mg/L of phenol solution was manipulated for degradation by Fe (III)-doped TiO_2 (synthesized by sol-gel method) under UV ray. By-products detected using GC-MS. In order to toxicity assessment of phenol by-products, the effluent was used in bioassay tests performed using *Daphnia magna* at 24, 48, 72, and 96 h exposure and 50% lethal concentration (LC_{50}) was determined using probit analysis in SPSS ver. 16.0 software. Results indicated that after 210 min, phenol concentration was decreased to 1.022 mg/L. Detected by-products consisted of catechol, resorcinol, hydroquinone, glycerol, glutaric acid, oxalic acid, 1,2,3–benzenetriol, phenol, acetic acid, and E–2–butenedioicacid. According to the obtained values of LC_{50}s, the effluent toxicity was 6–9-fold higher than that of initial phenol solution at all of the exposure times. Results of the present study confirmed that the by-products of phenol oxidation by Fe(III)-doped TiO_2/UV may introduce more toxic effects on *Daphnia magna* and this phenomenon should be considered in the future applications.

Keywords: Phenol; By-product toxicity; Fe (III)-doped TiO_2; *Daphnia magna;* LC50

*Corresponding author.