#### Chemical Engineering Journal 210 (2012) 203-211



Contents lists available at SciVerse ScienceDirect

# **Chemical Engineering Journal**

Chemical Engineering Journal

journal homepage: www.elsevier.com/locate/cej

# Degradation of p-nitrophenol by interior microelectrolysis of zero-valent iron/copper-coated magnetic carbon galvanic couples in the intermittent magnetic field

Ping Tang<sup>a,b</sup>, Chunyan Deng<sup>a</sup>, Xiaosheng Tang<sup>c</sup>, Shihui Si<sup>a,\*</sup>, Ke Xiao<sup>a</sup>

<sup>a</sup> College of Chemistry and Chemical Engineering, Central South University, Changsha, Hunan 410083, China
<sup>b</sup> Environmental Science and Engineering College, Hubei Polytechnic University, Huangshi, Hubei 435003, China
<sup>c</sup> College of Life Sciences, Hubei Normal University, Huangshi, Hubei 435002, China

#### HIGHLIGHTS

- The copper-coated magnetic carbon (CCMC) was fabricated by two-step deposition.
- The enhancement effect of Fe<sup>0</sup>/CCMC couples on the corrosion of Fe<sup>0</sup> was studied.
- ► The p-nitrophenol degradation was enhanced by Fe<sup>0</sup>/CCMC couples in the magnetic field.

#### ARTICLE INFO

Article history: Received 14 May 2012 Received in revised form 24 August 2012 Accepted 24 August 2012 Available online 3 September 2012

Keywords: Galvanic couples Intermittent magnetic field Interior microelectrolysis Magnetic carbon

### G R A P H I C A L A B S T R A C T

The copper-coated magnetic carbon (CCMC) was fabricated by pre-deposition of ferric ferrous oxides onto carbon particles and followed by the chemical deposition of copper. Chemical oxygen demand (COD) was a measure of oxygen requirement of a sample that is susceptible to oxidation by strong chemical oxidant and was commonly used to indirectly measure the amount of organic compounds in water. The results showed that galvanic couples composed of zero-valent iron and copper-coated magnetic carbon (Fe<sup>0</sup>/CCMC) enhanced obviously the degradation of p-nitrophenol, comparing with Fe<sup>0</sup> alone.



## ABSTRACT

In this present paper, the copper-coated magnetic carbon (CCMC) was fabricated by pre-deposition of ferric ferrous oxides onto carbon particles and followed by the chemical deposition of copper. Galvanic couples composed of zero-valent iron and copper-coated magnetic carbon (Fe<sup>0</sup>/CCMC) were employed for the treatment of simulative wastewater containing p-nitrophenol (PNP). Under the optimized conditions such as magnetic induction intensity, mass ratio of Fe<sup>0</sup>/CCMC and initial pH, it was found that the degradation rate of PNP greatly increased due to the enhancement of the internal microelectrolysis of Fe<sup>0</sup>/ CCMC couples in the intermittent magnetic field. In addition, the half-life value of COD of simulative wastewater containing PNP was used as a parameter to evaluate the degradation efficiency of PNP by interior microelectrolysis of zero-valent iron/cepper-coated magnetic carbon (Fe<sup>0</sup>/CCMC), respectively. It showed that the degradation efficiency of PNP by interior microelectrolysis of Fe<sup>0</sup>/CCMC was the highest among them. The degradation process could be described as a pseudo-first-order model and liquid chromatography–mass spectrometer (LC–MS) analysis showed that amino-phenol was an intermediate during the degradation of PNP.

© 2012 Elsevier B.V. All rights reserved.

\* Corresponding author. Tel.: +86 73188876490; fax: +86 73188879616. E-mail addresses: sishihui@mail.csu.edu.cn, tptp1216@163.com (S. Si).

1385-8947/\$ - see front matter @ 2012 Elsevier B.V. All rights reserved. http://dx.doi.org/10.1016/j.cej.2012.08.089