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Original Paper | Published: 05 July 2007

Comparative study of chemical and electrochemical Fenton treatment of organic pollutants in wastewater

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Journal of Applied Electrochemistry **37**, 985–990 (2007)

701 Accesses | **37** Citations | Metrics

Abstract

The technological and economic aspects of using the Fenton process to treat industrial wastewater containing morpholyne and diethylethanolamine, as well as sodium salts of naphthalene sulfonic acid and of ethylenediaminetetraacetic acid based on data obtained in pilot tests are discussed. Chemical Fenton technology was tested using commercial 30–35% solutions of H_2O_2 and iron (II) salts, which was followed by the additional electrochemical destruction of organic pollutants in an undivided reactor with catalytic stable anodes (CSA) and 1 g L^{-1} NaCl as a supporting electrolyte and a source of active chlorine. An alternative electrochemical method involving the electrogeneration of hydrogen peroxide in polluted water at the gas -diffusion cathode was studied both with the addition of ferrous salt to the electrolyte

prior to electrolysis (in-cell electro-Fenton) as well as with the post-electrolysis addition of Fe^{2+} in another reactor (ex-cell electro-Fenton). The accumulation of hydrogen peroxide in concentrations sufficient for the mineralization of organic pollutants was achieved in both cases with near 100% current efficiency. In comparison with wastewater treatment processes which use a purchased hydrogen peroxide reagent, the Fenton-like processes achieved an economic savings of as much as 64.5% in running costs due to the on-site electrochemical generation of H_2O_2. Preparative electrolysis in the membrane reactor showed higher current efficiencies and lower specific energy consumptions for H_2O_2 electrogeneration in comparison with the results of tests carried out in an undivided cell.

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Cite this article

Agladze, G.R., Tsurtsumia, G.S., Jung, B.I. *et al.* Comparative study of chemical and electrochemical Fenton treatment of organic pollutants in wastewater. *J Appl Electrochem* **37**, 985–990 (2007). https://doi.org/10.1007/s10800-007-9325-1

Received	Accepted	Published
07 March 2006	17 March 2007	05 July 2007

Issue Date

September 2007

DOI

https://doi.org/10.1007/s10800-007-9325-1

Keywords

Electro-Fenton **Gas-diffusion electrode**

Hydrogen peroxide

Proton-exchange membrane

Wastewater treatment

Not logged in - 5.178.173.177

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