



RESEARCH ARTICLE

Degradation of 1,4-dioxane from water and plating industry wastewater using electrochemical batch and plug flow reactors

Sibel Barisci¹ · Rominder Suri¹

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Abstract

The occurrence of 1,4-dioxane in the water has received significant attention due to its possible adverse effects to the environment and human health. The conventional techniques used for wastewater treatment are insufficient for the complete removal of 1,4-dioxane. Therefore, there is a need to develop technologies that can provide higher and faster 1,4-dioxane degradation capabilities. In this study, Electrochemical oxidation of 1,4-dioxane in laboratory water and electroplating industry wastewater was carried out in batch and plug flow reactor (PFR) configurations. Different process parameters were investigated and process optimization was performed. For the batch reactor, complete degradation of 1,4-dioxane from laboratory water was observed in 40 min with a pseudo-first order rate constant of 0.1076 min^{-1} . For the simulated plating industry wastewater, 85.4% 1,4-dioxane was removed, while TOC and COD removals were 51% and 79%, respectively. For the PFR, 91% 1,4-dioxane degradation were observed for simulated wastewater, while COD removal was 99%. Since the electrochemical PFR showed the best performance, plating industry wastewater was treated via PFR under optimized conditions where 83% 1,4-dioxane degradation was achieved. Metal removals from the wastewater were also ranged between 88 and 99% via PFR. The electrical energy per order (EE/O) value of electrochemical treatment of 1,4-dioxane via electrochemical PFR was 6.62 kWh/m^3 during the treatment of plating wastewater. 1,4-dioxane-2-one and 1,4-dioxane-2-ol were identified for the first time during electrochemical treatment of plating wastewater.

✉ Rominder Suri
rominder.suri@temple.edu

Sibel Barisci
sibel.barisci@temple.edu

¹ Civil and Environmental Engineering Department, Water and Environmental Technology (WET) Center, Temple University, 1947 N 12Th Street, Philadelphia, PA 19122, USA

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