



Application of green iron-based persulfate/O₃ activator on explosive mineralization from aqueous solution

Masoumeh Khatebasreh^{a,b}, Fahimeh Teimouri^{a,*}, Mohammad Hassan Ehrampoush^a, Aliasghar Ebrahimi^a, Mohsen Sadani^c

^aEnvironmental Science and Technology Research Center, Department of Environmental Health Engineering, School of Public Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran, emails: f.teimouri@ssu.ac.ir (F. Teimouri), Khatebasreh_4@yahoo.com (M. Khatebasreh), ehrampoush@yahoo.com (M.H. Ehrampoush), ebrahimi20007@gmail.co (A. Ebrahimi)

^bStudent Research Committee, Shahid Sadoughi University of Medical Sciences, Yazd, Iran

^cDepartment of Environmental Health Engineering, School of Public Health and Safety, Shahid Beheshti University of Medical Sciences, Tehran, Iran, email: m.sadani82@gmail.com

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ABSTRACT

Energetic compounds are widely used in various activities, including military exercises and conflicts. Researchers recently proved that these compounds could persuade apoptosis through DNA damage, endoplasmic reticulum stress, and mitochondrial dysfunction in Hep3B and HepG2 cells. This study investigated the possibility of potassium ferrate as an eco-friendly and simultaneous activator (PS/PF/O₃) for explosive degradation from an aqueous solution. Taguchi design method was used for evaluating the effect of different operational parameters. chemical oxygen demand (COD) and total organic carbon (TOC) removals were considered responses of the study experiments by analysis of variance (ANOVA). The optimum condition was achieved at neutral pH value and an oxidant dose of 19 mM; 40 mg/L of 2,4,6-trinitrotoluene within 60 min responded to almost 89.3% of COD and 75.7% of TOC removal by PS/PF/O₃ process. In the mentioned condition, 2,4,6-trinitrobenzaldehyde, 2,4,6-trinitrobenzoic acid, and 1,3,5-trinitrobenzene were the main intermediates detected by liquid chromatography–mass spectrometry analysis. Also, this reaction chain was subsequently continued, and nitrate ions were identified as a key factor for mineralization. Bioassay test also demonstrated a considerable reduction in toxicity after each process. The dispersion test of *Daphnia magna* assay on treated red-water ranked as follows: stock solution (high toxicity) >> PF/O₃ effluent > PS/PF/O₃ (low toxicity). Degradation of 2,4,6-trinitrotoluene was in accordance with the pseudo-first-order kinetic model ($R^2 = 0.98$). It can be concluded that potassium ferrate makes the PS/O₃ process a reliable technique for explosive mineralization (as a green iron-based activator).

Keywords: Nitroaromatic; 2,4,6-Trinitrotoluene; Advanced oxidation process; Persulfate; Toxicity; Intermediate

* Corresponding author.