



“Gheorghe Asachi” Technical University of Iasi, Romania



ELECTRO-FENTON PROCESS FOR DIBUTYL PHTHALATE DEGRADATION: TOWARD LANDFILLS LEACHATE TREATMENT

Kenza Charifa Hadj Djilani^{1*}, Brahim Bouhadiba¹, Fouad Mekhalef Benhafsa^{2, 3, 4},
Ahmed Hamou¹, Abdelghani Bouchama^{2,5}, Benaouda Bestani⁶, Marcel Popa⁷

¹Laboratory of Environmental and Materials Sciences, Ahmed Ben Bella University
of Oran, B.P. 1524, El M'Naouer-31000, Oran, Algeria

²Centre de Recherche Scientifique et Technique en Analyses Physico-Chimiques (CRAPC),
Zone Industrielle, BP 384 Bou-Ismaïl, Tipaza, Algeria.

³Unité de Recherche en Analyses Physico-Chimiques des Milieux Fluides
et Sols – (URAPC-MFS/ CRAPC), 11, Chemin Doudou Mokhtar, Ben Aknoun – Alger, Algeria.

⁴Laboratory of Advanced Materials and Physicochemistry for the Environment
and Health (MAPES), Djillali Liabes University, P.B. 89 Sidi Bel Abbès 22000, Algeria

⁵Plateau Technique d'Analyses Physico-Chimiques, PTAPC-Mostaganem, Algeria

⁶Laboratory of Structure Elaboration and Application of Molecular Materials (SEAMM), Department of Chemical Engineering,
Faculty of Science and the Technology, Abdelhamid Ibn Badis University of Mostaganem, 27000 Mostaganem, Algeria.

⁷Department of Natural and Synthetic Polymers, “Cristofor Simionescu” Faculty of Chemical Engineering and Environmental
Protection, “Gheorghe Asachi” Technical University of Iasi, 73 D. Mangeron Blvd., 700050 Iasi, Romania

Abstract

Landfill leachate is a complex effluent containing a wide variety of contaminants likely to harm receiving ecosystems. First, an in-depth analysis of the raw leachate was carried out, revealing the presence of several organic and inorganic pollutants, including dibutyl phthalate (DBP), a plasticiser known for its endocrine-disrupting properties and persistence in the environment. DBP was chosen as the model pollutant for the optimisation of the homogeneous Electro-Fenton process (EFP), because of its representativeness and toxicity. The optimisation was carried out on a synthetic matrix containing only DBP, making it possible to assess the effect of various experimental parameters: current intensity, electrolyte dose, concentration of ferrous catalyst, initial concentration of the pollutant, and treatment time. The experiments were carried out in a 250 mL EFP reactor, equipped with a synthetic graphite cathode and a Ti/Pt anode, favouring the in-situ generation of hydrogen peroxide (H_2O_2) and hydroxyl radicals ($\bullet OH$), key reactants in the process. The best performances were obtained under the following conditions: $[DBP]_0 = 120$ mg/L, $[Na_2SO_4] = 3$ g/L, $[Fe^{2+}] = 50$ mg/L, $pH = 3$, for a treatment time of 2 hours. These conditions resulted in a significant reduction in DBP concentration, accompanied by a removal of around 92% of chemical oxygen demand (COD), testifying to a high degree of mineralisation of organic matter in a simple matrix. In a second phase, the optimised conditions were applied to real leachate, in order to assess the effectiveness of the process on a more complex matrix. Overall, a 65% reduction in the total organic load of the leachate was observed, confirming the potential of the Electro-Fenton process for treating persistent organic pollutants in complex real effluents.

Keywords: COD, DBP, Electro-Fenton, synthetic solution, landfill, leachate

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* Author to whom all correspondence should be addressed: e-mail: hadjdjilani.kenza@edu.univ-oran1.dz; Phone: +213 6 58 70 06 59