



“Gheorghe Asachi” Technical University of Iasi, Romania



ELECTROCHEMICAL RECLAMATION OF WASTEWATER RESULTED FROM PETROLEUM TANKER TRUCK CLEANING

Konstantinos Dermentzis^{1*}, Dimitrios Marmanis¹, Achilleas Christoforidis¹,
Konstantinos Ouzounis²

¹Eastern Macedonia and Thrace Institute of Technology, Department of Petroleum and Mechanical Engineering, 65404 Agios Loucas, Kavala, Greece

²Democritus University of Thrace, Department of Environmental Engineering, 67100 Xanthi, Greece

Abstract

Petroleum tanker trucks are integral vehicles for delivering fuel and other petrochemical products from place to place and must be cleaned regularly. Pressure washing with hot or cold water serving to remove oil and filth from the tanker truck container, produces oily waste water with an oil concentration of about 300-500 mg L⁻¹ which, according to environmental standards and regulations worldwide, must be disposed of and treated properly. In the present paper an integrated electrochemical treatment for oily wastewater reclamation is presented comprising a) the electrocoagulation process with sacrificial iron and aluminum electrodes, b) the electrooxidation process with platinized titanium (Ti/Pt) and boron doped diamond (BDD) electrodes and c) the electro-Fenton process with iron electrodes and added hydrogen hydroxide. A simulated oil tanker truck washing wastewater was prepared by mixing heating oil with fresh water and separating the aqueous from the oily phase in a separation funnel. The COD of the obtained oily wastewater was 456 mg L⁻¹. The effect of crucial parameters on oil removal, such as pH, applied current density, initial oil concentration and electro-processing time was explored. During the electrocoagulation treatment at the current density of 5 mA cm² using iron and aluminum electrodes, COD was only partially removed by 8 and 11% respectively. The COD removal could drastically be increased exceeding 80 % by performing the electrocoagulation process after initial addition of the surfactant sodium dodecyl sulfate. The electro-oxidation process with platinized titanium (Ti/Pt) and boron doped diamond (BDD) electrodes at the applied current density of 20 mA/cm² reduces COD to 15 and 36 % at 25 °C and to 28 % and >98 % at 60 °C respectively. Finally the electro-Fenton process with Fe electrodes and supplied H₂O₂ in acidic solution at the applied current densities of 5 and 10 mA cm², led to a COD reduction beyond 90% in only a few minutes of electro-processing time.

Key words: electrocoagulation, electro-Fenton, electro-oxidation, oily wastewater, surfactant

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