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Decomposition of Fe-EDTA in Nuclear Waste Water by using Underwater discharge Plasma

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EDTA contained in decontamination wastes can cause complexation of radioactive cations resulting from its various treatment process such as chemical precipitation, and ion exchange etc. It might also import for elevated leachability and higher mobility of cationic contaminants from conditioned wastes such as waste immobilized in cement or other matrices. Therefore, various chelated or unchlelated EDTAs must be treated to environmentally safe materials. AOPs(Advanced Oxidation Processes) using ozone, hydrogen peroxide, ultrasound, ultraviolet radiation, photocatalystic oxidation, and gamma-ray radiation alone or in combination in this respect are considered as possible methods of ecologically safe remedial treatment for the degradation of non-biodegradable organics including EDTA. In the present study, an underwater discharge system, one of the AOPs, was applied to degrading aqueous Fe-EDTA which is one of the major products of decontamination processes. An underwater discharge system produces shockwave, ultraviolet radiation, and various radical species during plasma-discharge in water. An 1L batch reactor with continuous gas bubbling was used in this study. Peak voltage and repetition rate of pulse were fixed with 16kV and 6kHz, respectively. It was found that Fe-EDTA degradation could be raised considerably by adding H_2O_2 solution. The maximum Fe-EDTA degradation yields were obtained by the synergistic action of underwater discharge in the presence of ozone and H_2O_2 at pH 7. By adding 10mL H_2O_2 at pH 7 to an aqueous solution of Fe-EDTA and passing through 1.2×10^3 mg L^{-1} O_3 at 200 mL min^{-1} rate, we could get maximum degradation efficiency. In these optimum operating conditions, Fe-EDTA decomposition percentage attained maximum 98.5% when its residence time was 90 minutes, while the TOC degradation percentage of aqueous solution was maximum 66.5%. Analysis of by-products resulting from Fe-EDTA degradation in underwater discharge system was performed by HPLC(Waters). In this analysis, we could observe that Fe-EDTA was replaced with more degradable compounds such as nitrilotriacetic, glycolic, formic, oxalic, and iminodiacetic acids.