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ELECTROCHEMICAL TREATMENT OF HEMODIALYSIS WASTEWATER FROM A CLINIC USING MODIFIED SURFACES WITH TRANSITION METAL OXIDES

Hemodialysis is an extracorporeal kidney replacement procedure to remove impurities or waste products from the blood. It is used to treat kidney failure and go out into wastewater. This research considered synthetic water from hemodialysis under acid and basic conditions. To better simulate the presence of organic compounds, 10 mg/L of amoxicillin (AMX), an antibiotic commonly present in wastewater from clinics and hospitals, was added. Electro-coagulation (EC) and electro-oxidation (EO) were combined sequentially to treat hemodialysis wastewater. EC was performed using a cylindrical SS-304 bar electrode (f = 0.8 cm) as an anode and a concentric Ti mesh as the counter electrode. A 3.0 V cell potential was maintained over one hour of electrolysis in acidic pH (pH = 5.06, ⊠ = 227 mS/cm). This treatment yielded a removal efficiency of 86 ± 1.25 % of AMX contaminate (pH = 8.21, ⊠ = 217.26 mS/cm, i = 11.36 mA, E = 0.568 kWh/m3). After EC, it was necessary to include a filtration or separation process to remove the Fe(OH)3 and [AMX-cation-AMX] sludge generated (2.3 g). This separation employed a settler. Subsequently, the supernatant was placed in an EO cell to remove residual organic compounds as AMX. It used a similar cell arrangement as in EC but changed the anode to IrO2-Ta2O5|Ti (70:30) (f = 0.5 cm) to perform the EO of the pharmaceutical product. During this step, the team achieved an overall removal efficiency of AMX of 100 % (pH = 8.14, ⊠ = 179.83 mS/cm, E = 500 kWh/m3). EO was performed using a continuous 10 mA cell current for 2 h. EO generated reaction products ADP 1, ADP 2, and ADP 3. Additionally, this process decreased the content of ‘salty’cations, Na+, K+, Ca2+, and Mg2+, while generating Cl2 gas at the electrode.

Keywords

hemodialysis wastewater, electro-coagulation, electro-oxidation, amoxicillin, clinic.

Reference

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