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COMBINATION OF ELECTROCHEMICAL OXIDATION AND BIOELECTROCHEMICAL PROCESS TO TREAT WASTEWATER

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Abstract

The electrochemical oxidation process is an environmentally friendly promising treatment option with different advantages to treat wastewater. The application of electrochemical oxidation processes to pollutants has attracted attention because it offers various advantages over other conventional treatment systems. For example, electrochemical oxidation processes don't require high temperature and pressure as well as limited land requirements and no need for chemical addition, which can reduce carbon footprint. Electrochemical oxidation, however, requires a high operating cost due to the high-energy consumption for the wastewater treatment, limiting field application thus far. One of the potential solutions to reduce high costs is combining of electrochemical oxidation process with biological treatment, reducing operating cost and treatment time. Hybrid processes, such as the case of the electrochemical oxidation process and biological processing, can be combined through sequencing the electrochemical oxidation process as pre-treatment or as post-treatment depending on the characteristic of the used wastewater. In this study, we combined two promising technologies and aimed to treat wastewater with a bioelectrochemical system (partial), then treat it electrochemically with an electrochemical oxidation process (as a post-treatment) to efficiently remove chemical oxygen demand and nitrogen simultaneously, and so the treatment time and cost can be less than other systems. Hence, the goal was to treat wastewater faster in a smaller space with a coupled electrochemical oxidation process and bioelectrochemical system. First, the anodic biofilms were enriched on electrodes with a projected surface area of 0.95 cm^2. In the bioelectrochemical reactor, we treated wastewater by a polarizing working electrode at 0 $V_{Ag/AgCl}$ in 3-electrode electrochemical cell. Then, we treated partially treated wastewater electrochemically by applying 10 $V_{Ag/AgCl}$. We compared the wastewater treatment efficiency in only bioelectrochemical system, only the electrochemical oxidation process, and electrochemical oxidation process as post-treatment after the bioelectrochemical system. Our results demonstrated that the coupled treatment increased ammonia and chemical oxygen demand removal rates compared to using only a single treatment method.

Keywords: bioelectrochemical systems, electrochemical oxidation process, wastewater treatment, chemical oxygen demand, nitrogen