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Experimental investigation on the removal of phenol from simulated wastewater by reverse electrodialysis reactor

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ABSTRACT

The removal of phenol from simulated wastewater by a reverse electrodialysis reactor (REDR) wastewater treatment system is experimentally investigated in independent or synergetic degradation circulation mode under specific conditions. Results demonstrated that the total degradation efficiencies ($\eta_{de,tot}$) and the total chemical oxygen demand (COD) removal efficiencies ($\eta_{COD,tot}$) in an independent degradative circulation mode were better than those in a synergetic degradative circulation mode. After 2 h of treatment, the $\eta_{de,tot}$ of phenol reached 100% and 99.7%, and $\eta_{COD,tot}$ reached 59.6% and 51.3%, under two circulation modes, respectively. However, the synergistic degradation cycle mode achieved a balance between hydrogen ion production and consumption during the wastewater treatment process. When the synergetic circulation mode was applied, the pH of the wastewater was always maintained at around 3 without the addition of acid, which reduced the wastewater treatment costs. Moreover, the general current efficiency and the energy consumption of REDR in the synergetic degradative circulation mode were 51.1% and 168.8 kWh/kgCOD, respectively, after 2 h. Therefore, the implementation of REDR with a suitable circulation mode and operating conditions offered a viable alternative to achieve a win-win situation for both energy and the environment.

Keywords: Reverse electrodialysis; Salinity gradient energy; Phenol; Energy efficiency; Electrochemical advanced oxidation processes

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