Removal and recovery of sodium hydroxide (NaOH) from industrial wastewater by two-stage diffusion dialysis (DD) and electrodialysis (ED) processes

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ABSTRACT

In this study, a two-stage diffusion dialysis (DD) and electrodialysis (ED) system for the removal and recovery of sodium hydroxide from industrial wastewater were investigated. The study was carried out at laboratory scale using food industry wastewater. Sodium hydroxide is commonly used as principal strong base by various chemical industries. The processed wastewater therefore enhances the pH levels of receiving water bodies that affects the physiological functions of aquatic organisms, plants, and makes the water inappropriate for human consumption. 1.0-μm PTFE (Advantec, USA), forward osmosis (FO) (Hydration Technology Innovation) membranes, platinum coated over titanium anode, and graphite cathode were used in this study. In the first stage of the DD process, NaOH from the feed solution (FS) i.e. wastewater to draw solution (DS) i.e. deionized water (DI) was carried out through PTFE membrane in a diffusion cell. The initial concentration of NaOH in the FS was from 1 to 3 M and in the first step, 60 to 62% of NaOH was diffused from the FS to DS. In the second step of the DD process, further 48 to 50% NaOH was transferred from the FS to DS and overall 80 to 83% NaOH was removed from the FS. In the second stage, the DS collected from diffusion cell was transferred to the ED cell as the FS for further treatment and recovery of caustic soda. During the ED process, 15.0 V was applied for 5.0 h batch time. Sodium cations were transported from the FS to DS under the influence of electric potential through FO membrane and up to 44% of NaOH was recovered.

Keywords: Industrial wastewater; Caustic soda; Diffusion dialysis; Electrodialysis

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