

The use of polymeric and ceramic ultrafiltration in biologically treated coke oven wastewater polishing

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ABSTRACT

The main scope of the presented research was to treat coke oven wastewater stream after the biological loop using low pressure-driven membrane filtration. The process was focused on reducing the content of substances that could intensify the phenomenon of reverse osmosis membrane fouling. For this purpose, four types of polyethersulphone (PES) ultrafiltration (UF) membranes of molecular weight cut-off (MWCO) equal to 10, 5, 3 and 1 kDa, respectively, and two ceramic disk membranes (5 and 8 kDa) with zirconia active layer were applied in a cross-flow mode filtration performed at the constant pressure. During experiments, the influence of membranes MWCO, type of material, as well as the transmembrane pressure (TMP) on the process capacity and the permeate quality, evaluated based on chemical oxygen demand (COD) value, was examined. Experimental results indicated that in the tested range of TMP (0.1–0.3 MPa), the application of polymeric membranes was more beneficial, since they allowed for the operation at the higher rate of the initial capacity and they were less susceptible to fouling in comparison with ceramic ones. The separation with tested UF polymeric membranes also enabled the better reduction of COD, with the highest rejection of 67% noted for 5 kDa PES membrane at TMP of 0.2 MPa. The 5 kDa membrane was found to be preferable due to its capacity, lowest fouling affinity and contaminants removal efficiency.

Keywords: Coke oven wastewater; Pretreatment; Low-pressure membrane filtration; Ultrafiltration

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