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Micellar enhanced ultrafiltration for phosphorus removal in domestic wastewater

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ABSTRACT

In this paper, a method of micellar enhanced ultrafiltration (MEUF) with hexadecyltrimethylammonium bromide (CTAB) is proposed to remove phosphate ions from treated domestic wastewaters from the reclamation station of University Campus of Toledo (Spain). This technique is able to reach phosphate rejection coefficients higher than 99% (a phosphate concentration in permeate of 1 mg/L if feed concentration is 95 mg/L). Additional experiments with hexadecylpyridinium chloride (CPC) and octadecylamine acetate (ODA) were performed to compare the behaviors of different surfactants. In the first stage, characterization (in terms of chemical oxygen demand, biological oxygen demand, total suspended solids, volatile suspended solids, phosphorus and nitrogen contents, pH, conductivity and turbidity) of real samples from reclamation station has taken place. After that, ultrafiltration experiments with semi-synthetic solutions in total recirculation mode were performed in order to optimize membrane hydrodynamic conditions and to analyze the influence of surfactant nature and concentration on permeate fluxes and phosphate ion rejection coefficients. Best results in terms of both phosphate rejection coefficient and permeate flux are 95% and 186.4 L/h m^2 (LHM) at 1 mM phosphate concentration, 0.1 mM CTAB concentration, 25°C, tangential velocity 3 m/s and transmembrane pressure 4 bar. One of the novelties of this research lies in the surprisingly high performance of unusually low surfactant concentrations (even 10% CMC). Finally, two more additional variables (temperature and pH value) were analyzed to study the further surfactant regeneration. Unfortunately, none of these methods seem to be suitable since they do not abate phosphate rejection coefficients to low enough levels.

Keywords: Phosphate; Eutrophication; Micellar Enhanced Ultrafiltration

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