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Control of ionic composition of wastewater treated by reverse osmosis membranes to increase product total dissolved solids and reduce concentrate utilization costs

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ABSTRACT

The severe requirements for wastewater post treatment quality prompts us to look for new solutions to produce quality water with reduced biochemical elements concentrations. One of the most promising solutions is the use of reverse osmosis. Reverse osmosis membranes reject pollutions in ionic state and seem more efficient as does not depend on biological process. Reverse osmosis is already efficiently used for post treatment of wastewater after biological process to improve water quality. The significant disadvantage of reverse osmosis process is the concentrate handling. Concentrate stream should be disposed and often conditions should be provided. This article is a continued research program to utilize concentrate streams by reduction of concentrate volume by 100–300 times. This enables us to reduce radically the concentrate amounts to eighter withdraw these amounts by road or together with the sludge. The necessity to remove monovalent ions and reduce their concentration by 20–100 times (such as ammonia ion) requires to use membranes with high rejection, thus removal of small amounts of ammonia provides large amounts of concentrate with high total dissolved solids (TDS) values. In this article an attempt is undertaken to apply the newly developed technique to separate monovalent and divalent ions to increase the TDS value of permeate (product water) and increase the amount of salts discharged into water sources. The increase of permeate TDS provides the smaller TDS in concentrate that provides easier reduction of concentrate volume with lower costs.

Keywords: Reverse osmosis; Concentrate handling; Nanofiltration; Low rejection membranes; Reduction of concentrate flow; Rejection of biogenic elements

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