Removal of organic micro-pollutants during drinking water treatment by nanofiltration and reverse osmosis

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ABSTRACT

A study on a flat sheet membrane test unit for nanofiltration (NF) and reverse osmosis (RO) with synthetic and natural waters was carried out in order to evaluate the performance of four NF/RO membranes for the removal of selected organic micro-pollutants. The influence of molecular weight and membrane material on removal efficiencies was shown. Perfluorinated compounds and X-ray contrast agents with molecular weights larger than 300 g/mol are rejected to a percentage of more than 90%. Pharmaceuticals and antibiotics show rejection values larger than 60%. For the substances with a molecular weight between 100 and 200 g/mol there is a large range of rejection values depending on the membrane type. RO membranes usually achieve higher rejection values than NF membranes. Rejection also depends on the type of organic micro-pollutant. Although NF/RO membranes do not reject substances selectively, NF/RO is a suitable treatment technology for their removal if this is desired. However, it has to be considered that water composition is changed drastically by NF/RO such that a post treatment of the permeate may be required to keep up with the drinking water standards. For full-scale application also the dosage of antiscalants has to be taken into account. In Germany there is a lively discussion about the discharge of concentrates when authorities have to decide on the realization of NF/RO plants.

Keywords: NF; Flat sheet membrane test unit; Organic micro-pollutants; Concentrate; Antiscalant

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