



Concentration of mine saline water in high-efficiency hybrid RO–NF system

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ABSTRACT

To obtain higher concentration of sodium chloride than in reverse osmosis (RO), the hybrid RO–nanofiltration (NF) system was applied. The use of RO retentate pressure as a driving force in NF decreased the energy consumption in the brine concentration process and increased RO permeate recovery. In such a hybrid system, NF could be regarded as an alternative method of energy recovery. Five NF membranes were tested on the synthetic sodium chloride solution, conducted at 40 bar, with highest rejection coefficients 31.3%. Selected membranes were tested at the higher pressure (50, 55 and 60 bar) on the synthetic sodium chloride solution and on the coal-mine brine RO retentate (60 bar). Based on the obtained results, energy consumption in RO–NF–vapour compression (VC) system was estimated and compared with the RO–VC system. The energy consumption in the RO–NF hybrid system with VC (123.3 kWh/m³ of brine with 290 g/dm³ NaCl) was lower than in the currently used RO–VC system (213.2 kWh/m³ of brine with 290 g/dm³ NaCl without energy recovery and 204.6 kWh/m³ of brine with 290 g/dm³ NaCl with energy recovery).

Keywords: Nanofiltration; Energy recovery; Saturated brine; Mine water

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