

Treatment of sulphate wastewater by freeze desalination

N. Zikalala^{a,*}, J.P. Maree^b, C. Zvinowanda^c, V. Akinwekomi^a, T. Mtombeni^d,
L. Mpenyana-Monyatsi^a

^aDepartment of Environmental, Water and Earth Sciences, Faculty of Science, Tshwane University of Technology, Private Bag X680, Pretoria, 0001, South Africa, email: nomvu.zikalala@gmail.com (N. Zikalala), BologoV@tut.ac.za (V. Akinwekomi); monyatsil@tut.ac.za (L. Mpenyana-Monyatsi)

^bROC Water Technologies, P.O. Box 70075, Die Wilgers, 0041, Pretoria, South Africa, email: maree.jannie@gmail.com

^cDepartment of Applied Chemistry, Faculty of Science, University of Johannesburg, Doornfontein Campus, P.O. Box 17011, Johannesburg, 2028, email: czvinowanda@uj.ac.za

^dFlowCentric, P.O. Box 67255, Highveld, Pretoria, 0169, South Africa, email: mtombenit@gmail.com

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ABSTRACT

Cooling and freezing can be used to produce fresh water from brackish water, industrial brines and leachates from industrial wastes. The aim of this study was to identify how cooling and/or freezing can be used for the recovery of drinking water from sulphate rich solutions associated with various cations. It was found that: (i) If the solution contains only Na_2SO_4 , after pre-treatment with sodium alkalis, it can be removed from solution through cooling down to 0.33 mol/L (31.7 g/L SO_4) through crystallization of $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$; (ii) the solubility of Na_2SO_4 upon cooling is influenced by the Cl-concentration; (iii) the Reverse Osmosis-Cooling (ROC) process is most suitable for treatment of saline solutions rich in Na_2SO_4 , as it can be precipitated through cooling as $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$, followed by reverse osmosis to produce drinking water; (iv) The energy required to cool water, containing 100 g/L Na_2SO_4 from 25°C to 0°C, amounts to 10.66 kWh/t water. When the water is further cooled down to freeze 90% of the water, the energy consumption increased from 10.66 kW/h to 37.74 kWh/t.

Keywords: Freeze desalination; Reverse osmosis cooling

*Corresponding author.

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