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Electrodialysis reversal: Process and cost approximations for treating coal-bed methane waters

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ABSTRACT

Brackish waters with total dissolved solids (TDS) concentrations less than 10,000 mg/L are extracted from coal-beds in the Wyoming Powder River basin to facilitate the production of coal-bed methane. These waters frequently require treatment before disposal or use. Electrodialysis reversal (EDR) has not yet been used to treat these waters but this technology should be suitable. The question is whether EDR would be cost-effective. The purpose of this work, then, was to develop models for predicting the cost of EDR for brackish waters. These models, developed from data available in the literature, were found to predict actual EDR costs as a function of TDS removal, influent flow rate, chemical rejection efficiency, water recovery, electricity use, and labor cost within 10% of reported values. The total amortized cost for removing 1,000 mg/L of TDS from 10,000 m^3/d of influent assuming no concentrate disposal costs was predicted to range from \$0.23/m^3 to \$0.85/m^3 and was highly dependent on capital cost and facility life. Concentrate disposal costs significantly affected total treatment cost, providing a total treatment cost range from \$0.38/m^3 to \$6.38/m^3, depending on concentrate disposal cost and water recovery. Pilot demonstrations of EDR in the Powder River basin should be conducted to determine the achievable water recovery when treating these waters.

Keywords: Electrodialysis; Electrodialysis reversal; Costs; Desalination; Coal-bed methane water; Water treatment

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