Desalination and Water Treatment
www.deswater.com

doi: 10.5004/dwt.2018.23058

132 (2018) 197–204
November

Application of response surface methodology to optimize the bipolar membrane electrodialysis process of preparing polyferric sulphate

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Received 25 January 2018; Accepted 1 September 2018

ABSTRACT

Response surface methodology (RSM) is employed to optimize the bipolar membrane electrodialysis (BMED) process of preparing the polyferric sulphate (PFS). An experimental design is carried out based on Box-Behnken design to evaluate the effects of current density, operation time and feed molar ratio on basicity of polyferric sulphate. Results show that all the independent variables and quadratic of feed molar ratio have significant effect on the response values. High current density and feed molar ratio can promote the effect of operation time on basicity. Be different from the interaction between current density and feed molar ratio and the interaction between operation time and feed molar ratio, the interaction effect between current density and operation time is slight. In addition, the optimal operation condition is as follows: current density is 20 mA/cm^2, operation time is 180 mins and feed molar ratio is 3.04. Moreover, the actual basicity under the optimal condition is 19.15% ± 0.84%, which is agreed with predicted value (19.46%), indicating that RSM is an accurate tool to predict the PFS basicity and optimize the BMED process of preparing PFS.

Keywords: Electrodialysis; Response surface methodology; Polyferric sulphate; Box-Behnken design; Ion exchange membrane

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