

Pellet reactor pretreatment: A feasible method to reduce scaling in bipolar membrane electro dialysis

Abstract

This study aims to evaluate the feasibility of a pellet reactor in reducing the scaling potential in electro dialysis with bipolar membranes for water containing a high concentration of calcium by adding sodium carbonate to precipitate carbonate as calcium carbonate on granular seed material. The optimized operating condition obtained at pH 11.1, and a ratio of $[\text{CO}_3^{2-}]:[\text{Ca}^{2+}]+1.2:1$ enabled to obtain 90% efficiency of calcium removal from real water. The efficiency of scaling potential removal was validated by comparing the scaling level on the membrane surface of two electro dialysis batches of a washing water, with and without pretreatment. For the latter, scalants were found at both sides of the cation exchange membrane (FKB), diluate and base sides, identified as calcium and magnesium precipitates. Furthermore, there was also a severe scaling effect at the base side of the bipolar membrane (FBM). However, a different observation was found for the pretreated water. SEM and elemental analysis for both FKB and FBM membranes demonstrated less scaling on both membrane surfaces.

Keywords

Bipolar membrane electro dialysis; Pellet reactor; Pretreatment; Scaling; Water treatment