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Effects of pH and salinity on the separation of magnesium and lithium from brine by nanofiltration

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ABSTRACT

It is difficult to extract lithium because of the high ratio of Mg^{2+} and Li^{+} in most salt lake brines in China. Therefore, the separation process of high Mg^{2+}/Li^{+} ratio salt lake brine by a negatively charged DK nanofiltration membrane was investigated. The stability of the nanofiltration membrane, the concentration polarization phenomenon, and the surface charge of the nanofiltration membrane was first explored. The ability of the membrane to separate Mg^{2+} and Li^{+} at different salinities and pHs was further evaluated. The results indicate that due to the viscosity variation of the solution and the concentration polarization phenomenon, the membrane flux decreases with rising salinity. The Donnan exclusion, dielectric exclusion, and steric hindrance were studied to characterize the ionic fractionations of the nanofiltration membrane. When the salinity was 35 g/L, the Mg^{2+}/Li^{+} reduced to 1.49. The membrane flux remained constant at different pHs, and the retention factor of Mg^{2+} was always higher than that of Li^{+}. It remained at a relatively high level because of the electrostatic interaction between the cations and the negative charge on the functional groups on the membrane surface. The difference of the cation characters makes the retention factor of Mg^{2+} higher. The separation effect was relatively better under lower pH conditions.

Keywords: Nanofiltration; Separation of Mg^{2+}/Li^{+}; Salinity; pH

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