



Comparison of antisolvent and eutectic freeze crystallization for recovery of Ni, Co and Mn methanesulfonate hydrates

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In recent years, there has been an urge to develop a greener hydrometallurgical process for the separation of battery-grade Ni, Co and Mn that is in accordance with the principles of circular economy (1). Methane sulfonic acid (MSA) has been proposed as a green alternative to existing sulfuric acid-based hydrometallurgical processes (2,3).

In our study, we have compared antisolvent crystallization (AC) and eutectic freeze crystallization (EFC) as downstream methods for the recovery of Ni, Co and Mn methanesulfonate hydrates from aqueous MSA solutions. Ni(OH)₂, Co(OH)₂ and MnCO₃ were dissolved in aqueous MSA solutions of various molar strengths at room temperature to prepare synthetic feed solutions. Synthetic feed solutions used in this study were prepared to mimic the pregnant solutions obtained from previous hydrometallurgical unit operations.

Then, three water-miscible organic solvents, viz., acetone, isopropanol and acetonitrile (ACN) were screened for the AC process. Additionally, the recovery of Ni, Co and Mn MSA hydrate salts by EFC was investigated as another method to crystallize Ni, Co and Mn MSA hydrate salts from synthetic feed solutions. Various forms of the metal MSA hydrates were crystallized from feed solutions by AC and EFC at different process conditions.

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