DEVELOPMENT IN BATTERY METALS SOLVENT EXTRACTION PROCESS DESIGN AND SIMULATION

By

Hannu Laitala

Metso Finland Oy, Finland

Presenter and Corresponding Author

Hannu Laitala

ABSTRACT

During the last decade we have seen a big demand increase for the battery metals like nickel, cobalt, manganese and lithium. At the same time market is demanding higher quality products. Higher quality requirements put pressure on the process design practices. Process design practices must be developed so, that one can not only predict the amount of production, but also the quality of the production.

This means, that modern process design for a solvent extraction plant must be done using a process simulator. A modern SX plant's accurate mass balance can't be calculated manually. Solvent extraction process simulator must be able to calculate not only the main process flows and their compositions, but also calculate the solvent extraction circuit's performance with different feed compositions and amounts. Simulator must also be able to predict how the critical impurities behave in the different circuits. One very important detail is also to model the entrainments in the circuits.

Especially in battery metals solvent extraction processes accepted impurity levels are given in mg/L and this means, that solvent extraction entrainments have big impact how well the SX circuit is performing. Also, SX simulator must be able to predict how the changing process conditions in the different solvent extraction stages changes the chemical equilibrium. Organic phase's metal loading in different stages also affects the chemical equilibrium calculation. Highly loaded organic phase extracts metals differently than a partly or not-loaded organic phase.

Simulator design is also very fast. For a standard SX process, simulator model can be normally done in a few hours. Little bit more complicate case can be simulated in few days and even a totally new simulator can be done in less than a week if the base information is readily available with superior accuracy compared to the process mass balance calculations done without a simulator. Current simulators can also predict problems in SX circuits.

Metso's HSC Sim process simulator is an excellent tool for SX process simulation. HSC Sim is one of the few process simulators, where you can simulate both phases, aqueous and organic, in changing process conditions and given entrainments in every stage and combine the different SX stages to a fully functional SX process. Today HSC Sim models have been used in the process design of several operational SX plants. Several SX plants are being constructed where process simulation has been done by HSC Sim.

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