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TECHNOLOGY SELECTION AND FLOW SHEET OPTIMISATION FOR NICKEL AND COBALT SULPHATE CRYSTALLISATION PLANTS

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ABSTRACT

The safety and performance of lithium-ion batteries are deeply influenced by impurities in their precursors, necessitating the production of the battery materials such as nickel sulphate and cobalt sulphate to the highest purity. The declining prices of battery materials have put pressure on the producers to optimise the capital and operating expenditures to make the projects economically viable.

Crystallisation is the most important final purification step in producing the high purity battery grade products. The optimal design of nickel and cobalt sulphate crystallisation plants hinges on key technological choices and flow sheet optimisations. A properly designed crystalliser producing large, well-formed crystals allows for improved washing to enable the achievement of the highest purities possible. This paper evaluates the efficacy of Forced Circulation (FC) versus Draft Tube Baffle (DTB) crystallisers, evaluating their respective merits in achieving desired purity levels, capital costs, and operational efficiency.

A further technical innovation is the incorporation of mechanical vapour recompression (MVR) technology which results in a significant reduction in the overall energy input per ton of product when compared with steam heated designs. This paper also investigates the trade off between the capital and operating expenditures for both these heat input options.

This paper describes crystalliser design features to produce battery grade nickel sulphate hexahydrate and cobalt sulphate heptahydrate products, and will compare the operating conditions, crystalliser types, preferred energy source, control of product purity, and trade-off between capital and operating costs.

Keywords: nickel sulphate, cobalt sulphate, crystallisation, MVR, purity