ALTA 2022
20-27 May | Perth, Australia | Online

DESIGN AND OPERATION OF SOLVENT EXTRACTION PLANTS USING TWO OR MORE EXTRACTANT SYSTEMS

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ABSTRACT

During the early years of commercial solvent extraction systems for metal recovery almost all plants used one extractant to recover a single metal. The metals were copper and uranium. In some uranium plants two solvent extraction circuits using the same extractant but differing operating chemistry were used to separately recover two metals. In the US, uranium plants extracted both Uranium and Vanadium using the same extractant while in Canada a plant extracted uranium and molybdenum using different extractants. One of the reasons for this preponderance of single extractant single metal circuits was that there were few extractants available for other metals.

In the 1990's the Olympic Dam copper uranium deposit in South Australia was developed with separate copper and uranium circuits operating in series flow and using separate extractants, oximes for copper followed by tertiary amines for uranium. This was one of the first large scale solvent extraction plant to use two different extractants.

In more recent times the development of extractants, particularly the organophosphate reagents, (e.g. Cyanex 272®, Ionquest 290) and the emergence of the nickel laterite HPAL and solvent extraction technology. Even more recently, the need to produce battery grade cobalt and nickel salts from both Ni/Co sulphide and lateritic ores has seen the design and operation of multi metal multi extractant chemistry solvent extraction circuits increase. It has been become apparent that some of the design and operational concepts of the original single metal, single extract chemistry systems are not optimum for the newer multi metal circuits.

This paper will examine the special needs involved in the design and operation of these multi metal multi extractant solvent extraction plants. Of particular importance is the need to consider the effects, avoidance and mitigation of the problems caused by inadvertent cross contamination of the extractants. The process design must be supported by the engineering design of the SX plant hardware and the selection of appropriate contamination management strategies. The hardware options include the mixers, settlers, in-settler or stream specific coalescing, management of the operating mixer continuity and use of washing/scrubbing stages to dilute the contaminant to process acceptable levels. The mixer-settler design details have a large impact on the ability to achieve these objectives. The evolution of modern mixer-settler designs is described with the emphasis on operating experience driven changes to address specific occurrences.

Keywords: Solvent extraction, Multi mental SX, Cross contamination of extractants, Battery metals, Mixer-settler design.