Coagulant compatibility issue in Central Africa

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Problem Statement

- A copper site in the African Copper Belt was struggling with silica occurrences threatening to disrupt the Solvent Extraction (SX) circuit whenever the plant was running in an aqueous-continuous state.
- In August 2018, the customer considered the option of using a coagulant to mitigate the impact of silica from the incoming Pregnant Leach Solution (PLS) and asked Solvay to assist with this project.

Solvay's Approach

- Solvay proposed a pilot plant test to investigate the impact of coagulant on the copper SX plant and its ability to remove silica from the PLS.
- The objective was to run two circuits side-by-side configured with one extraction and stripping stage under the operating parameters set as per Table 1:
  - A control circuit fed with original plant PLS
  - A test circuit fed with plant PLS treated with the coagulant at the supplier's recommended dosage of 100 ppm
- Laboratory tests were performed on the treated and control PLS samples to assess silica and total suspended solids content. Phase disengagement time (PDT), dispersion band depth, stage efficiencies and entrainment values were also recorded (Table 2).

Results

- Within 2 hours of operations, the main differences that became physically apparent between the 2 circuits were as follows:
  - PDT: For both the extract and strip stages, PDT of the test circuit was significantly higher than in the "control" circuit with a stable emulsion noticeable in the extract stage
  - Aqueous-in-Organic (A-in-O) entrainment was significantly higher in the "test" circuit than in the "control" circuit
  - The coagulant-treated PLS exhibited a lower level of silica than the control PLS (Figure 1), but also resulted in an increase in crud levels and haziness in the raffinate
- Solvay's pilot plant test led to the conclusion that, without ambiguity, the coagulant had a detrimental effect on solvent extraction, forming a stable emulsion in the organic phase that caused elevated PDT and high A-in-O entrainment.
- For future testwork, Solvay recommended the use of a solid-liquid separation step, such as filtration or clarifier, for rapid removal of coagulated silica from the PLS before entry to the SX circuit.
- Based on Solvay's recommendations, the plant chose not to use coagulant, considering the potential copper loss of $500, 000 USD per day if any of the SX plants were to stop due to the impacts of applying coagulant.

Table 1 – Operating parameters

PLS Flowrate (L/min)	4.0 – 4.4
LE Flowrate (L/min)	2.6 – 3.0
Org. Flowrate (L/min)	8.3 – 8.7
Organic reagent concentration	30 % V/V
Duration operation	5 hours
Continuous mode	Organic
Mixer speed (rpm)	250
Org. bed depth (cm)	10 cm
Aqu. bed depth (cm)	17 cm

Table 2 – Test results summary

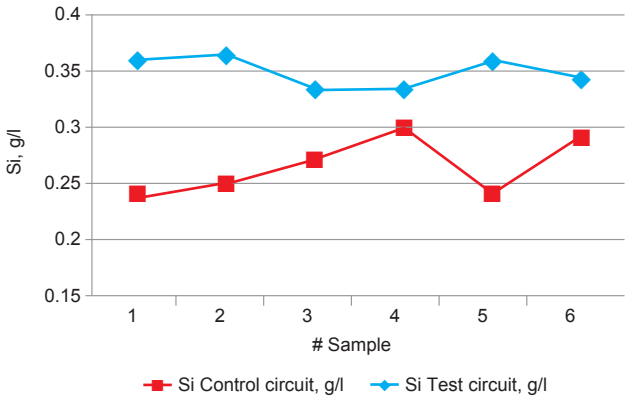
Aqueous entrainment from E1 stage for side-by-side pilot trial

Time Period	A-in-O Entrainment (ppm)		Increase (%)
	Control	Test	
Period 1	6250	9787	57
Period 2	5417	26124	382

Extract and strip PDT (second)

Time Period	Extract PDT		Strip PDT	
	Control	Test	Control	Test
Period 1	207	> 600	192	300
Period 2	200	> 600	180	308
Period 3	201	> 600	178	301

Silica concentration in the PLS



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