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Improving the solid-liquid separation of the final tailings at the DPM Krumovgrad plant and evaluation of the process water chemistry effects on flotation (Université de Liège)

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Improving the solid-liquid separation of the final tailings at the DPM Krumovgrad plant and evaluation the process water chemistry effects on flotation

Master en ingénieur civil des mines et géologue, à finalité spécialisée en "geometallurgy (EMERALD)"

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Summary

This study aims to determine the optimum dosages and type of settling aids, which could improve the efficiency of solid-liquid separation, quality of recycled water, and consolidation of thickener underflow. Then, compared the flotation performance with actual process water and the flotation performance with recycled water separated under optimum condition. Furthermore, perform a mineralogical characterization to determine under which form the main minerals, and the gangue mineral phase occurs in the tailing. Then, identify the gangue, which is generating the suspended colloidal particles and their sedimentation behavior and.

The flotation tail at the DPM plant was flocculated in the presence of metal salt, ionic polyelectrolyte (PAM), and their combinations. The optimal dosage and settling aid were determined considering the turbidity of supernatant water and the initial settling rate of the fine particle. Also, the pH optimization tests were carried out using jar tests to determine the pH under which the optimum flocculation takes place. The result shows that the presence of both PAM and $Ca(OH)_2$ improved the quality of supernatant water and the initial settling than the single PAM uses in the plant. The optimum pH of the flocculation is between 5.25- 6.0 for all the tested coagulant and flocculant.

A lab-scale study was conducted under the limited condition to investigate the influence of processed water on the flotation of precious metals. These results show that the flotation performance under optimal condition is relatively lower compared to the current flotation performance might be due to precipitation of metals hydroxide on the mineral surface. However, further investigation has to be done under the actual plant flowsheet to see the actual influence.

The mineralogical characterization of tailing was done using SEM, XRD, XRF, and optical microscope. The kaolinite, orthoclase, and quartz are responsible for the generation of most fine particles in -20 µm tailing fraction, which reduces the clarity of the recycled water. Also, indicate that there are some gold and electrum associated with the quartz that has lost to the tailing, and the grain size of associate minerals is above 100µm, which is not a favourable size for floating. This causes the low recovery of precious metals. Also, about 12 % of identified gold grains in concentrate ware associated with quartz and moderately liberated.

In conclusion, the use of a combination of coagulant and flocculant more efficient compared to the use of the only flocculant, and it reduces the daily reagent cost at the plant by approximately 95 USD. Also, finer grinding at the SAG and VertiMillTM mill would also increase the grade of precious metals in the concentrate.