Effect of Alkaline Type in Controlling Interfacial Chemistry, Rheology and Leaching Behaviour of Gold Concentrates

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ABSTRACT

In this paper, the effect of ore mineralogy and alkali type in temporal rheological behaviour of two refractory flotation gold concentrate and their corresponding bio-oxidised mineral dispersions have been investigated. Caustic soda modified pulps showed different particle zeta potentials from the quicklime modified pulps over pH range 2 – 12. The magnitudes of the zeta potentials observed for both pulps were markedly low, indicative of significant electrical double layer screening. At high pH (>10), the two flotation concentrates displayed positive zeta potentials, regardless of the pH modifier. On the other hand, quicklime pH modified bio-oxidised pulp particles were electropositive at high pH whilst the caustic soda modified pulps showed deprotonated particles. The predominant species leached from the concentrates and their bio-oxidised ores at pH 10.5 were Ca and S. Noticeable amounts of Cu, K, As, Ni, Zn, Fe, Al and Au were also incongruently leached. Significant back precipitation of the Ca ions were observed in the concentrates when caustic soda was deployed in comparison with the quicklime modified pulp. Furthermore, simultaneous co-precipitation of Ca, S and Cu ions was observed for the quicklime modified jarosite-bearing bio-oxidised pulps in contrast with that of caustic soda. Non-Newtonian, plastic, thixotropic rheological behaviour was displayed by the pulps at pH 10.5 over a 480 min leaching time. In addition, shear thickening and thinning behaviour were displayed by the pulps upon pH modification with caustic soda and quicklime, respectively. The results suggest emergence of van der Waals and non-DLVO attractive forces such as adsorbed Ca(II) ion-particle bridging, surface nucleation and cementation for the stronger rheology of quicklime modified pulps, in contrast with caustic soda modified pulps.