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The recovery of gold from tailings material by means of an organic ligand in a gas phase

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ABSTRACT

Current research is now starting to focus on the gas phase extraction of metals using organic volatile ligands because it reduces many problems associated with the extraction of metals using conventional mineral processing methods. The tailings from the Ergo plant were used as the source of gold for the gas phase extraction process. Acetylacetone, trifluoroacetylacetone and hexafluoroacetylacetone were identified from literature as potential ligands for the gas phase extraction. However, fluorinated acetylacetone derivatives were not used in the process due to safety considerations and only acetylacetone was used for the investigations. The gas phase extraction was shown to be dependent on the reaction temperature, bed mass and flow rate of the volatile organic ligand. The extraction was shown to increase from 190^0C to 250^0C i.e. extraction percentage increased from 27.7% at 190^0C to 64.8% at 250^0C with constant ligand flow rate of 1 mL/min and 50g bed mass within a time period of 240 minutes. The extraction increased with an increase in ligand flow rate from 1 mL/min to 6 mL/min i.e. 64.8% was extracted at 1 mL/min and 78% extracted at 6mL/min at 250^0C and 50g bed mass within a time period of 240 minutes. The extraction percentage decreased with increasing bed mass from 30g to 70g i.e. 48.8 % was extracted for a 30g bed mass and only 24.5% of gold was extracted for a 70g bed mass at constant temperature of 210^0C and a constant ligand flow rate of 1 mL/min. Shrinking core reaction models were used to model the data and their fit evaluated on the experimental data. The reaction process was shown to be chemical reaction controlled. There is a need to further investigate the effect of particle size on the extraction and to find the effect of other metals within the tailings sample on the gas phase extraction process.