

ABSTRACT

This research involved development of leaching models which characterise the carbonate leaching of a carnotite uranium ore from an industrial uranium processing facility. For confidentiality purposes, the name of the uranium processing facility was not explicitly stated. Fundamental, empirical, and linear multi-variable leaching models were developed. The fundamental model was developed from first principles and resulted in a differential equation governing the rate of disappearance of uranium from ore particles. This differential equation was solved by expressing the amount of uranium present in the particles in terms of fractional conversion. Empirical models were developed by fitting leaching data to four different exponential functions of forms analogous to the actual leaching profiles from the industrial plant. The multi-variable linear leaching model was constructed using a Microsoft excel linear regression statistical tool. All three types of models developed were found to predict the performance of a leaching process with reasonable accuracy. From the multi-variable leaching model it was found that even though the carbonate leaching of uranium is highly temperature driven, it is possible to operate the leaching process at low temperatures and still attain high leach efficiencies. This is achieved by adjusting other leach variables to compensate for reduced leach temperatures which has a potential of reducing energy costs by half, obtain high leach efficiencies and produce 20% more uranium. A mobile phone application based on the linear multi-variable model was developed as a portable process management tool. The mobile application was developed using a Livecode software and enabled easy visualisation of the effects of different values of leach variables on leaching process efficiency.