Optimization of arsenic removal from pyrite ash by NaOH leaching using central composite design

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ABSTRACT

The objective of this study was to leach arsenic from pyrite ash waste under basic conditions with sodium hydroxide (NaOH) by optimizing the leaching process using response surface methodology (RSM). For optimization of this process, the central composite design (CCD), the most popular of the many classes of RSM designs, was employed. The effects of temperature, leaching time, and NaOH concentration on the leaching of arsenic were investigated. The arsenic leaching yield increased with increasing temperature. Unlike the temperature, the leaching time had a negligible effect on the yield. The arsenic leaching yield of pyrite ash waste was in the range of 67–93%. The optimum conditions identified for arsenic leaching from pyrite ash were as follows: NaOH concentration at 3 M, leaching temperature at 89˚C, and leaching time of 182 min. Under these conditions, an average leaching yield of 92.15% was achieved from pyrite ash. The results of this study showed that NaOH can be used as a potential extractant for the removal of arsenic from pyrite ash. The regression equation and analysis of variance were obtained using MINITAB. A model was obtained by means of variance analysis at 0.967 confidence level.

Keywords: Statistical modeling; Pyrite ash; Arsenic; Alkaline leaching