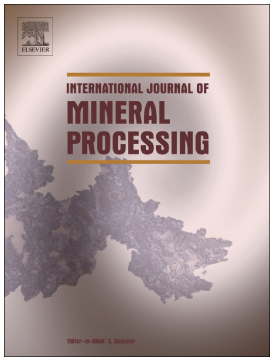

Purification of coal fly ash leach liquor by solvent extraction: Identification of influential factors using Design of Experiments

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Purification of Coal Fly Ash Leach Liquor by Solvent Extraction: Identification of Influential Factors Using Design of Experiments

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Abstract

The solvent extraction of iron and titanium from coal fly ash leach solution was investigated by the use of Design of Experiments. The effect of the factors: hydrogen ion concentration, Primene JMT concentration, aqueous to organic volume phase ratio and temperature on iron and titanium extraction were evaluated. A two level factorial design implemented by statistical software Design Expert® 6, determined the significant factors and any associated interactive effects amongst these factors.

Hydrogen ion concentration and the interaction between the aqueous to organic volume phase ratio with Primene JMT concentration had a significant effect on the extraction of iron while temperature did not. Hydrogen ion concentration and temperature did not have a significant effect on the extraction of titanium, while the interaction between Primene JMT concentration and the aqueous to organic volume phase ratio had a significant effect.

The maximum iron extraction achieved in the implemented design was 33.8% while 99% of titanium could be extracted from the coal fly ash leach solution. Extraction improvement tests showed that at a hydrogen ion concentration of 0.28M, 88% iron and 99% titanium extraction from coal-fly ash leach solution could be achieved.

Keywords
Coal fly ash, solvent extraction, iron, titanium, alumina, Design of Experiments (DOE)

1 Introduction

Operators of aluminium smelters in South Africa use imported alumina as feedstock in the production of high-grade aluminium. The use of locally produced alumina as feedstock to these smelters has the potential to reduce import dependency and provide a more easily accessible and cost competitive alumina feedstock. An alumina resource that has been identified in South Africa that can be exploited to produce this feedstock is coal fly ash (CFA). This ash is generated as a waste product from the burning of coal by power stations

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