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ABSTRACT

Artificial neural network (ANN) and Response Surface Methodology based on a 2^{5-1} fractional factorial design were used as tools for simulation and optimisation of the dissolution process for Azaraegbelu clay. A feedforward neural network model with Levenberg-Marquard back propagating training algorithm was adapted to predict the response (alumina yield). The studied input variables were temperature, stirring speed, clay to acid dosage, leaching time and leachant concentration. The raw clay was characterized for structure elucidation via FTIR, SEM and X-ray diffraction spectroscopic techniques and the result indicates that the clay is predominantly kaolinite. Leachant concentration and dosage ratio were found to be the most significant process parameter with p-value of 0.0001. The performance of the ANN and RSM model showed adequate prediction of the response, with AAD of 11.6% and 3.6%, and R^2 of 0.9733 and 0.9568, respectively. A non-dominated optimal response of 81.45% yield of alumina at 4.6M sulphuric acid concentration, 214mins leaching time, 0.085g/ml dosage and 214rpm stirring speed was established as a viable route for reduced material and operating cost via RSM.

Keywords: Alumina dissolution, ANN Modelling, Azaraegbelu, Clay, RSM.

1.0 Introduction

A given volume of aluminium weighs less than one-third as much as the same volume of steel. Its high strength-to-weight ratio makes aluminium useful in the construction of aircraft, railroad, cars, and automobiles, and for other applications in which mobility and energy conservation are important. However, the conventional raw material for the production of alumina (bauxite) is not readily available to meet industrial demand for its production. It is therefore necessary to look for

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