

Metallurgical Performance Prediction of Column Flotation using the Artificial Neural Network

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ABSTRACT

Today column flotation has become an acceptable means of froth flotation for a fairly broad range of applications, in particular the cleaning of sulfides. Even after having been used for several years in mineral processing plants, the full potential of the column flotation process is still not fully exploited. There is not prediction of process performance for the complete use of available control capabilities. The on-line estimation of grade usually requires a significant amount of work in maintenance and calibration of on-stream analyzers, in order to maintain good accuracy and high availability. These difficulties and the high cost of investment and maintenance of these devices have encouraged the approach of prediction of metal grade. Therefore, advanced new methods such as Artificial Neural Network (ANN) must be employed. In this paper, a new approach has been proposed for metallurgical performance prediction in flotation columns using ANN. Furthermore, a case study is carried out in an industrial Metso Minerals CISA flotation column (4 m in diameter and 12 m in height) at Sarcheshmeh Copper Concentrator Plant. The values of Cu and Mo grades in the flotation feed and final concentrate, froth height, wash water, the air and non-floated fraction flowrates were used to the simulation by ANN. Feed-forward ANN with 3-13-6-1 and 4-4-8-1 arrangements were used to estimating Cu and Mo grade respectively. The correlation coefficient (R) values for the training and testing sets for Cu and Mo grades were 0.94 and 0.93 and 0.98 and 0.97 respectively. The results discussed in this paper indicate that the proposed model can be used to predict the Cu and Mo grades with a reasonable error. Also analysis demonstrated that prediction of grade for optimizing and controlling column flotation for a wide range of operating conditions is highly effective.

Keywords: Column Flotation, Prediction, Metallurgical Performance, Grade, Artificial Neural Network.

INTRODUCTION

In the last two decades the use of pneumatic flotation columns became wide-spread throughout the mineral processing industry of metallic, non-metallic and coal ores, as well as in waste removal and recycling processes, in the world. Columns out perform conventional mechanical cells in cleaning

operations (better product grade) due to their particular froth operation, discussed in detail by Finch and Dobby (1990).

Flotation columns are long vertical vessels that are continuously fed with pulp of fine solid particles consistent in valuable minerals and gangue solid particles that are with a pulp with 15–40% solids. Figure 1 presents a simplified scheme of a flotation column.