Evaluation of green phosphate rock benefication by the present processing circuit of Esfordi phosphate plant

Hossein Barzegar Ghahfarokhi[1,2], Mohamad Reza Samadzadeh Yazdi[*1,2]

1- Department of Mining and Metallurgical Engineering, Yazd University, Yazd, Iran

2- Mining Technologies Research Institute, Yazd University, Yazd, Iran

* Corresponding author*: samadzadehyazdi@yazd.ac.ir*

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Summary

As the most important phosphate producer in Iran, the Esfordi phosphate complex produces apatite concentrate from the igneous ore by the flotation method. This plant is designed to separate phosphate from iron minerals. There is a type of rock in the Esfordi deposit that contains magnesium-bearing silicate minerals as gangue, which refers to green rock. Although the green rock includes five million tons of the mine reserve with an average grade of 7% P_2O_5, it has not been fed to the beneficiation plant, so far. In this research, the green rock processing was investigated using the current processing plant. A representative sample of green rock was prepared and characterized to evaluate the chemistry, mineralogy, and degree of freedom of apatite minerals. The laboratory magnetic separation and flotation tests along with the plenary sampling and characterization from the processing plant were performed.

Introduction

Esfordi Phosphate Mine has the largest reserves of igneous phosphate in the country. At present, the feed for the dressing plant is supplied from apatite and iron-apatite. The green rock is an alternative feed for the beneficiation plant. The presence of magnesium-bearing silicates and fine particles are the two main obstacles of green rock flotation. In this research, flotation experiments were performed to process green rock, and the performance of the current phosphate processing plant was assessed.

Methodology and Approaches

Sampling was performed in two stages. In the first step, a sample was taken from the stock to identify the characteristics of green rock. The laboratory magnetic separation experiments at different magnetic field intensities and flotation experiments were performed. Fatty acid collector (to float apatite) and corn starch (for depressing iron ores and silicate minerals) were used in the flotation tests. The industrial-scale investigations were made by feeding the green rock to the plant, and sampling procedures were performed from different grinding, classification, and flotation streams.

Results and Conclusions

The results of High-intensity magnetic separation experiments showed that some of the silicate minerals found their way to the iron magnetic separation concentrate (recovery of 10.38% MgO at 5000 gausses). Flotation experiments showed that the recovery for green rock samples was very low and under normal conditions, recovery and P_2O_5 grades of 7.39 and 21.11% were gained, which increased to 38.65 and 27.98% after desliming. The efficiency of feeding green rock to the current circuit was monitored and low flotation recovery was observed along with high froth stability. The efficiency of the grinding circuit and desliming cyclones was also evaluated. Then, suggestions were made to improve the current processing circuit for green rock beneficiation.