CONCENTRATION OF LIMONITE BY MAGNETIC SEPARATION WITH PREVIOUS TREATMENT BY MEANS OF THE SOLUTION OF A SURFACE ACTIVE AGENT

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ABSTRACT

The present article examines the influence of the surface tension of water on the magnetic separation. It is shown that by using a suitable surfactant at the ambient temperature for the reduction of the surface tension of the pulp, it is possible: either to reduce size consist of the minerals to be treated; or to reduce the magnetic field intesity for the treatment of minerals of given magnetic susceptibility; or to separate minerals of weaker magnetic susceptibility. The influence of the surface tension which has been modified after the admixture of a suitable surfactant is particularly marked when new processes of magnetic ore separation are introduced, which use the technique of superconductors. The results of separation tests concerning ore from the "Omarska" iron ore mine presented in the article.

INTRODUCTION

Magnetic separators which make use of very high field intensities and of greater field gradients than those obtained with conventional electromagnets have two potential field of application:

- an extension of magnetic separation to minerals of little magnetic susceptibility,

- the separation of minerals of strong magnetic susceptibility, for which the normally available magnetic forces are too weak to overcome the mechanical resistance in a reasonable time.

It is, however, necessary in these two cases to produce a great force of attraction. A fresh look must be taken on the technique used up till mow so that the weak magnetic forces developed become of the same order of magnitude as the antagonistic forces due to the viscosity of the water, to its surface tension and to the velocity of the pulp.

The method that comprised the pre – treatment of mineral particles by surface active agents and performance of wet magnetic separation in the same environment, enabled reducing the particle dimension from 23 μm down to 18 μm, while retaining at the same time, the quality of product on the level that was attained with coarser particles.

It was also significant that, as a result of these investigations, the correlation between the surface tension of the fluid where the magnetic separation was carried out and minimum diameter of mineral particle was established.

The coefficient "k" used as a correcting factor in our calculations of minimum diameter of particle was experimentally determined for the reagent used. This factor was also experimentally confirmed upon samples of limonite from "Omarska"

THEORETICAL ANALYSIS

According to experimental data obtained in our investigations, Stockes expression for resistence of fluid to the grain movement should be adjusted on surface of aqueous solution of the surface active agent.

$$F_d = 3\pi\eta dv \qquad (1)$$

where η = viscosity fluid, v = velocity fluid.

Coefficient by which resistence of fluid to a solid body moving in water should be adjusted, involves two parts:

- coefficient k_1, taking into account influence of surface tension on viscosity,

$$k_1 = \frac{\gamma}{\gamma^*} = \omega \qquad (2)$$

tailings in the coarse size (- 4 mm) with an iron assay of 6.60%.

* Direct concentration tests were carried out with the sample ground to minus 0.074 mm in size and it can be deduced that, 24.2% of the fed material was obtained as the magnetite concentrates with an iron content of 69.10% and the recovery of 74.9%.

* Although the evaluation of pre-concentration and direct concentration tests has given compatible results in terms of metal content and recovery values, pre-concentration route has performed an advantageous occasion with the discharge of the 44.4% of fed material in coarse size. Therefore the removal of that fraction of material without applying any grinding operation will make the process profitable in terms of a considerable amount of energy saving.

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REFERENCES

"Ore Mining and Processing Complex at Hasancelebi (Turkey): Volume 2 Mine Facilities", USSR State Union Institute for Designing Mining Enterprises, Leningrad, (1980).

"Ore Mining and Processing Complex at Hasancelebi (Turkey) Feasibility Study Volume 1 Economics on Construction and Operation of the Complex", USSR State Union Institute for Designing Mining Enterprises, Leningrad, (1980).

"Ore Mining and Processing Complex at Hasancelebi (Turkey) Feasibility Study Volume 2 Mine Facilities Drawings", USSR State Union Institute for Designing Mining Enterprises, Leningrad, (1980).

"Ore Mining and Processing Complex at Hasancelebi (Turkey): Feasibility Study- Adjusted Techno-Economic Findings Based on Results of Consideration of the Feasibility Study by the Customer", USSR State Union Institute for Designing Mining Enterprises, Leningrad, (1981).

"Price negotiators stand their ground", Metal Bulletin, 15 January, (1988).

"CVRD hopes %3 on DR pellet will convince blast furnace sector", Metal Bulletin, 9 March, (1998).

"CVRD criticises iron ore pricing", Metal Bulletin, 26 March, (1998).

"CVRD compromises on blast furnace pellet price", Metal Bulletin, 30 April, (1998).

"Re evaluation of Hasançelebi-Turkey Iron Ore Deposit", Final Report, ITU, Development Foundation Research and Development Office, June (1999).

David, M., Geostatistical Ore Reserve Estimation, Elsevier Science Publishers, Amsterdam, (1977).

David, M., Handbook of Applied Advanced Geostatistical Ore Reserve Estimation, Elsevier Science Publishers, Amsterdam, ISBN: 0-444-42918-2, (1988).

Knudsen, H.P. and Kim, Y.C., "A Short Course on Geostatistical Ore Reserve Estimation" The University of Arizona, Department of Mining and Geological Engineering, May, (1978).