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Beneficiation studies on reject dump magnesite sample from Talur Magnesite Mines, Karnataka

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ABSTRACT

Flotation studies on reject dump magnesite sample were conducted using oleic acid emulsion as collector and sodium silicate as depressant. The representative sample assayed SiO_2 6.1%, MgO 41.85%, CaO 2.25% and Fe_2O_3 1.2%. Mineralogical studies showed that gangue minerals were mostly quartz liberated at grind below 208μ except for serpentine which needs a still finer grind of 107μ. Flotation studies in batch scale (1 kg batch) indicated that a concentrate analysing 2.02% silica with a yield of 58.5% could be obtained by roughing followed by one cleaning while by adding two more cleaning stages, a concentrate with a silica content of 0.9% with a yield of 32.0% could be produced.

***Key words** : Beneficiation studies, Reject dump magnesite, Talur Magnesite, Froth flotation*

INTRODUCTION

A huge quantity, approximately 10000 tonnes of sub grade magnesite was found lying as rejected dump through earlier work in Talur, Karnataka. This area was extensively worked in the past presumably for chromite as well as good quality magnesite. A huge stock of reject dump sample (approximately 10,000 tonnes) was noticed lying unused in Talur mine head. The dispersed veins in the abandoned mines also indicated a promising source. Veins of apparent good as well as siliceous magnesite were noticed in the abandoned mine. With a view to finding amenability of this dump sample to beneficiation, studies were carried out for rejection of silica by froth flotation.

Materials

The magnesite reject dump sample was obtained from Talur mines, Karnataka. The sample was mostly lumps ranging in size from 100-25 mm. The sample

looked very weathered, surface being almost covered with black moss. The sample was crushed in jaw crusher and roll crusher to -10 mesh size for subsequent beneficiation studies. The chemical and size analysis of -10 mesh samples are recorded in Table 1 and 2 respectively.

Table 1 : Chemical analysis of the as received sample

Constituent	Wt%
MgO	41.85
CaO	2.25
SiO_2	6.10
Al_2O_3	0.72
Fe_2O_3	1.20
LOI	45.94

Table 2 : Size and chemical analysis of - 10 mesh sample

Size in micron	Wt %	SiO_2%	
		Assay	Dist
-1700+1180	22.9	5.67	20.7
-1180+850	27.2	5.69	24.7
-850+600	12.8	5.36	11.0
-600+425	9.2	5.78	8.5
-425+300	5.6	6.35	5.7
-300+212	2.3	6.36	2.3
-212+150	5.3	6.87	5.8
-150+106	3.9	8.72	5.4
-106+74	1.9	9.14	2.8
-200	8.9	9.21	13.1
Head (Calc.)	100.0	6.26	100.0

Silica was found to progressively enriched from coarse to finer fractions.

RESULTS & DISCUSSION

Mineralogical characteristics

Mineralogical studies carried out on the sample indicated that it mainly com-

prised of white to greyish white lumps of fine grained magnesite with occasional encrustations and intercalations of brownish matter. Some are brown lumps of altered dunite containing white veins of quartz and carbonate minerals. Specific gravity of rock pieces varies from 2.7 to 3.0. White lumps are compact micro to cryptocrystalline magnesite with pocket of serpentine occasionally associated with different amount of chromite, magnetite, calcite and quartz. Serpentine was also present as disseminated grains in the white mass of magnesite. Brounish lumps of altered dunite are highly limonitised and contain white veinlets of quartz and carbonate minerals. Quartz was present as ostly crystalline variety with wide variation in size. Microscopic examination of -10 mesh representative sample showed a fair liberation of quatz in fractions below 60 mesh and

Table 3 : Size analysis of ground dump sample

	Time of grind, minute				
	4	6	8	10	12
Size in micron	Wt%	Wt%	Wt%	Wt%	Wt%
212	6.5	0.1	—	—	—
-212 +150	26.2	2.7	0.3	0.1	0.1
-150 +106	12.8	10.9	1.5	0.2	0.1
-106 + 74	6.7	9.6	3.5	0.6	0.2
- 74	47.8	76.7	94.7	99.1	99.6
Total	100.0	100.0	100.0	100.0	100.0

Table 4 : Condition of flotation

Reagent	Quantity Kg/t	Condition time, min.	Flotation time, min	Product
Sod. Silicate	0.5	3	-	-
OAE	0.3	2	2.5	Float-I
OAE	0.3	2	3.0	Float-II
OAE	0.3	2	3.0	Float-III
OAE	0.3	2	2.5	Float-IV
OAE	0.3	2	2.0	Float-V

Sod.silicate = Sodium silicate, OAE = Oleic acid emulsion

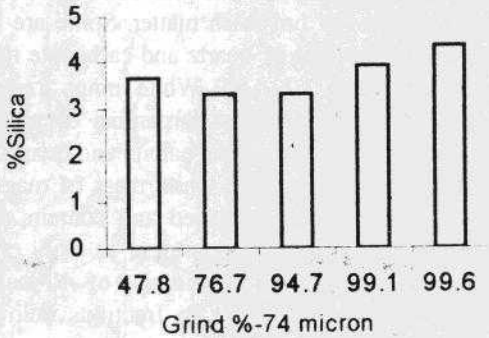

Fig. 1: Silica assay of flotation rougher concentrate for varying grind size

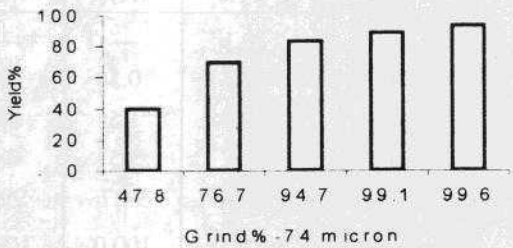

Fig. 2 : Yield of rougher conc. as a function of grind size of the feed to flotation

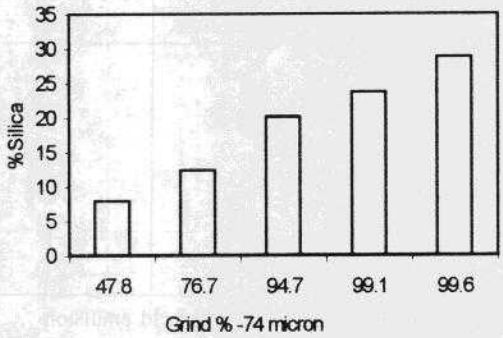

Fig. 3 : Silica content of rougher tails for different size

serpentine in fractions below 150 mesh. Stains limonite of the grains may interfere in the process of beneficiation and dilute the grade of magnesite concentrate.

Beneficiation Studies :

Flotation of magnetise at varying grind size

In deciding the approach for beneficiation, in view of our past experience on earlier sample from the same source, froth flotation route was selected for the beneficiation studies in order to have a simple circuit and keeping the final grade as the objective in view.

Table 5 : Conditions for cleaning the rouhger floats

Stages of Cleaning	Reagent	Qty/kg/t	Conditioning time, min.	Flotation time, min.	Products
I	Sod. Silic.	0.05	2.5	6.0	Cl. Tail-I
II	Sod. Silic.	0.05	2.0	4.5	Cl. Tail-II
III	Sod. Silic.	0.05	2.0	4.5	Cl.tail III Cl.conce-IV

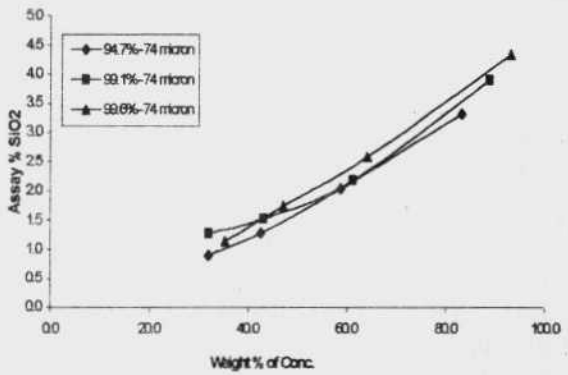

Fig. 4 : Silica content of magnesite cleaner concentrate as a function of yield for different grain size

Five batches of dump sample each weighing 1kg. taken from -10 prepared sample were ground in laboratory rod mill for different length of time keeping the solid : water as 2:1 in the mill. The size analysis of the ground products are given in Table 3. The pulps were then transferred to the cell and floated under

the conditions recorded in Table 4. Flotation test were carried out in Fagergren cell. Oleic acid emulsion was used as frother /collector for magnesite and sodium silicate as depressant for quartz and silicates. fine floats were ... and assayed for SiO_2 content.

The results indicated that the silica content in the rougher concentrate was decreasing with the increase in fineness upto a grind of 94.7% -74 micron but with still finer grinding, the silica content in the concentrate started increasing. The silica content of rougher concentrate at the grind of 76.7% -74 micron and 94.7% -74 micron was found to be almost identical (~3.31%) with the yield being substantially higher at the later grinding condtion.. Tailings became progressively richer in silica with finer grind.

Cleaning of magnesite rougher concentrate

In the next series of test, the rougher floats from grind of 94.7, 99.1 and 99.6% -74 micron were then cleaned thrice under the conditions given below in Table 5 and the results are indicated in Fig. 4.

The results indicated that after three cleaning, although there is a marginal increase in yield from 32.0 to 35.4 with the increasing fineness, the silica content in the final concentrate also increased from 0.9 to 1.14%. Thus the grind of 94.7% -74 micron was found to be optimum. The results also indicated that at 94.7% -74 micron grind, yields of 32.0%, 42.6% and 58.8% with silica content of 0.90%, 1.28% and 2.03% could be obtained by 3, 2 and 1 cleaning respectively. The pellets made from the concentrate and fired at 1750°C showed good performance.

It could thus be concluded that even from this weathered sample a clean concentrate with silica content less than even 1.0% with reasonably good yield could be produced by the process of flotation .

CONCLUSION

A reject dump magnesite sample of Talur mines was studied. The representative sample assayed SiO_2 6.1%, MgO 41.85%, CaO 2.25%, and Fe_2O_3, 1.2%. Mineralogical studies showed that gangue minerals were mostly quartz liberated at grinds below 208μ but for surpentine it requires below 107μ. Response to flotation of this sample was encouraging. Studies in bench scale (1 kg batch) indicated that a concentrate analysing 2.02 % silica with an yield of 58.8% could be obtained while by adding two more cleaning stages, a concentrate with a silica content of 0.9 % with an yield of 32.0% could be produced . Based on the batch tests in Fagergren cells, bulk flotation tests were carried out in a Denver sub-aeration unit cell with samples ground to 94.7% - 74μ with the same dosage

of reagents as done earlier. Larger batches in unit cells also confirmed these results. Pellets were made from this concentrate and fired at 1750°C .The fired pellets showed good properties.

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