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Processing of Beach Sand Minerals of Maharastra Coast

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Abstract

In the present paper, an attempt has been made to beneficiate beach sand minerals of Maharastra coast. For this purpose, beach sand mineral samples were collected from two different coastal places namely; Pirawadi and Kotherwadi area. The samples obtained were subjected for characterization and beneficiation studies. The characterization studies were mainly carried out by mineralogical analyses. The mineralogical analyses indicated 12-15% Ilmenite, 5-7% Magnetite and 65-70% Quartz in Pirawadi sample. Similarly Kotherwadi sample showed the presence of 10-12% Ilmanite along with 40-45% quartz. The studies also indicated the increased heavy mineral concentration in finer size (-75 μ) fractions. Further, the beneficiation studies were carried out using Perm roll magnetic separator using different variables such as particle size, magnetic intensity, roll speed, splitter position etc. From the studies it was possible to recover 80-85% magnetic minerals under different conditions.

INTRODUCTION

India has large reserves of beach sand minerals in the coastal stretches around the country. Among these, ilmanite is the largest constituent of the minerals other being rutile, leucoxene, zircon, sillimanite, garnet and monazite. Ilmenite and rutile are exploitable minerals of beach sand and they also occur in fully liberated state. The exploration studies of these minerals indicated the estimation around 630 mt out of which ilmanite contributes to 348 mt (Rao, et. Al. 2001, Mohan and Rajamanickam 2001). The reserves of beach sand mainly occur in: Eastern India i.e. Andhra Pradesh, Orissa, and Tamilnadu. Western India: Kerala, Karnataka and Marharastra area. From the literature it may be observed that only three deposits, namely chavara in kerala, manaval kuruchi in Tamilnadu, and Chatrapura (OSCOM) in Orissa are under commercial exploitation. Manaval kurichi with 20-40% HM extends about 7 km and mainly rich in ilmanite along with monozite in recoverable proportion. Chavara deposit having 40-70% HM extends for aout 22 km from Kayamkulam to Neendakara is rich in high grade ilmanite. Unlike these deposits, Chatrapura with 20% HM has deposit extending over 18 km and contains medium to low grade ilmanite (Mukherjee 1998).

Apart from these it may be observed that significant exploration work has been carried out on beach sand deposits of Maharastra coast (Gujar 2004). It has also been reported that appreciable quantity of ilmanite occur between Jaigad to vijay durg. Apart from these variable quantities of ilmanite and magnetite were reported around Ratnagiri district. Therefore, in the present paper, an attempt has been made to beneficiate beach sand minerals from Pirawadi and Kotharwadi area in Ratnagiri district of Maharastra coast.

EXPERIMENTAL

A. Material Preparation

Beach sand samples were collected from Pirawadi and Kotharwadi area in Ratnagiri districts of

Maharastra coast and the samples obtained were about 250 micron in size and were initially subjected for drying. Representative samples were prepared from the dried samples and subjected for de sliming process and dried.

B. Size Analysis and Dense Medium Analysis

The representative sample obtained from both the deposits were subjected for size Anlysis using standard laboratory sieves. Further, in order to know the heavy minerals present the representative samples were subjected for dense media separation using bromoform as the media with different size fractions.

C. Mineralogical Studies

To identify the different mineral constituents present in samples, the representative samples were subjected for the mineralogical analyses. From the mineralogical studies approximate percentage of different minerals and their presence in finer size fractions were also assessed.

RESULTS AND DISCUSSIONS

Size Analysis and Dense Media Analysis

The results of the studies are given in Figure 1and 2. From Figure 1, it may be observed that the 80% passing size for the Pirwadi sample was found to be 270 micirons whereas for the Kotharwadi sample 80% passing size was found to be 380 microns. Therefore, here it may be said that the Kotharwadi sample was more coarse grained than that of the Pirwadi sample. From Figure 2 it may be seen that the finer size fractions contain more heavy minerals rather than coarse size fractions. As reported in size analysis the dense media analysis has also reported the heavy minerals in fine size fractions in Pirawadi sample than that of Kotherwadi sample.

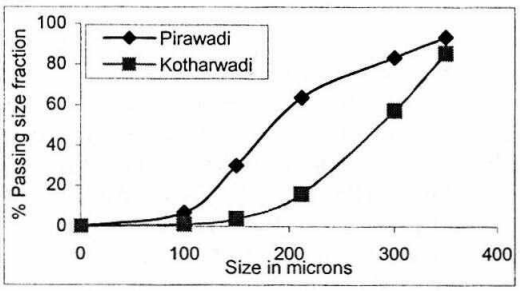

Fig.1: Size Analyses of the Beach Sand Samples

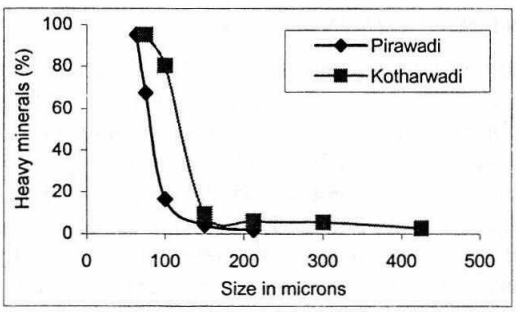

Fig. 2: Dense Media Analyses of the Beach Sand Samples

Table I: Mineralogical Analysis of Pirawadi Sample

Mineral	Percentage	Grain size (μ)	% Mineral in – 75μ size fraction
Quartz and feldspar	65-70	100-400	4-5
Ilmenite	12-15	40-100	55-60
Sea Shell	5-7	----	1-2
Magnetite	5-7	40-100	-
Goethite	5-7	100-300	traces
Stamolite	2-5	--	10-15
Iron oxide and amphibole	1-2	----	10-15
Zircon, Garnet,Chlorite	Traces	---	Traces

Mineralogical Studies

Mineralogical studies of the samples indicated that both the samples predominantly consists of quartz and feldspar. Other constituents being ilmanite, sea shell, magnetite, goethite etc. The results of the studies are given in Table I and II

Comparison of the results shows that the magnetite is present in significant quantity in Pirawadi sample. However, the Kotherwadi sample showed magnetite content in traces. Therefore, from the mineralogical studies it may be said that the presence of the higher amount of magnetite in Pirawadi sample may affect the beneficiation process.

C. Beneficiation Studies

From the characterization studies it was observed that the heavy mineral constituents are concentrated in –150 micron size fractions. Therefore, the beneficiation studies were carried out using these size fractions only.

Table II: Mineralogical Analysis of Kotharwadi Sample

Mineral	Percentage	Grain size (μ)	% Mineral in – 100μ size fraction
Quartz and feldspar	40-45	100-400	8-10
Ilmenite	10-12	40-150	60-65
Sea Shell	35-40	----	4-5
Iron oxide	5-7	----	10-15
Amphibole	traces	----	2-3
Stamolite	1	----	traces
Zircon, Garnet, Chlorite, Monazite, Magnetite	Traces	---	Traces

The beneficiation process was carried out by using Perm-Roll Magnetic separator (Laboratory model), During the studies effect of different variables such as, magnetic intensity, splitter angle and speed of roll were analysed and are discussed below.

In order know the effects of different variables initially some experiments were carried at different magnetic intensities of 11000 to 14000 Gauss at a roll speed of 100 rpm. The results of the studies carried with both the samples are given in Figure 3. From Figure 3 it may seen that a maximum recovery of 79 and 73% can be obtained at 14000 G using a roll speed of 100 rpm. From the results it may also be observed that the recovery of magnetic minerals in Kotherwadi sample is higher than that of the Pirawadi sample. This phenomenon may be attributed to the grain size of the magnetic minerals in the sample. From the mineralogical studies it may be observed that fine size grains (-75 μ) and present in Pirawadi sample than that of Kotherwadi sample (-100 μ). From the studies it was also observed that significant amount of magnetite was recovered in Pirawadi sample, which was indicated by the reddish brown colour of the concentrate. Hence, from the studies it was inferred that it may not be possible to recover a clean concentrate of Ilmenite from Pirawadi sample as the magnetite present in the beach sand mineral contaminate the Ilmenite concentrate.

Therefore, further studies were carried out using Kotherwadi sample. For this purpose studies were carried out using magnetic intensities of o 13000 and 14000 Gauss. At different magnetic roll speed and splitter position. The results of the studies are given in Figures 4 and 5. From the figures it may be observed that the recovery of the magnetic mineral was increased with increase in roll speed and there was a marginal effect of splitter position on the recovery. From the results it may also be seen that a maximum recovery of 83.73 and 85.79% magnetic mineral could be obtained at 13000 and 14000 Gauss and a roll speed of 140 rpm.

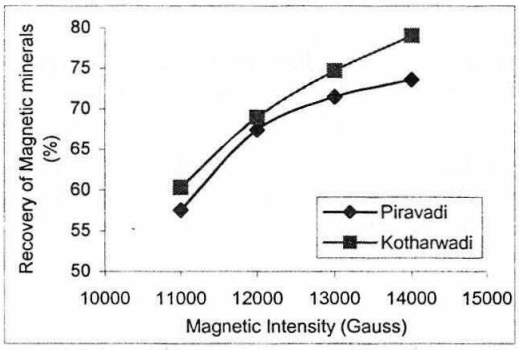

Fig. 3: Effect Magnetic Intensity on Recovery of Magnetic Minerals at a Roll Speed of 100 rpm

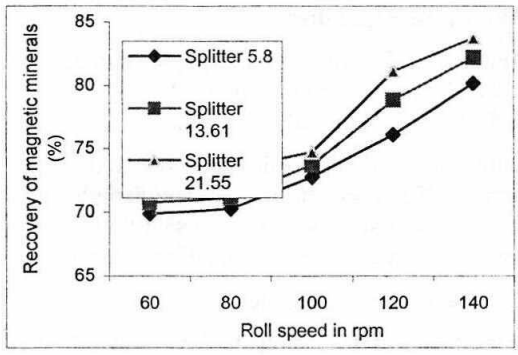

Fig. 4: Effect of Roll Speed on the Recovery of Magnetic Minerals at 13000 Gauss

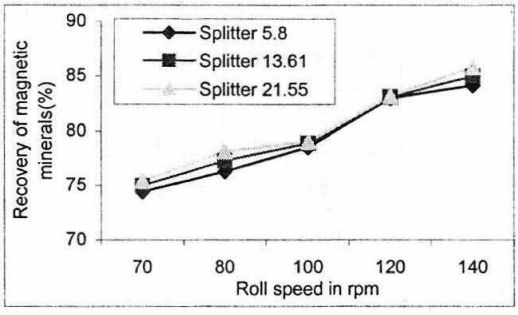

Fig. 5: Effect of Roll Speed on the Recovery of Magnetic Minerals at 14000 Gauss

CONCLUSIONS

From the studies following conclusions were drawn:

1. Size analysis and dense media analysis have indicated that the Pirawadi sample comprises of smaller size fractions compared to Kotharwadi sample and both the samples have indicated that the heavy minerals are concentrated in the finer size fraction than that of the coarser size fraction.
2. The mineralogical studies indicated that the of quartz and feldspar as the Major constituents. Other constituents being ilmanite, sea shell, magnetite, goethite etc.
3. From the beneficiation studies it may be concluded that better results were obtained in case of Kotharwadi sample compared to Pirawadi sample which may be attributed to the presence of heavy minerals in finer size fractions (-75μ) as well as high amount of magnetite (5-7%) in the Pirawadi sample compared to coarser size fractions (–150μ) as well as negligible amount of magnitite in Kotharwadi Sample.

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REFERENCES

[1] Gujar, A. R. (2004) Placer mineral exploration: Contribution and future projection of NIO, in Placer 2004 (Eds.). V. J. Loveson and D. D. Misra, Allied Publishers PVT Ltd.

[2] Mukherjee, T. K. (1998) Mining and processing of Titanium minerals in India, Metals Materials and Processes Vol 10, pp 85-98

[3] Mohan, P. M. and Rajamanickam G. V., Indian Beach Placers- A Review, hand book of placer mineral deposits, G. V. Rajamanickam (Editor) New Academic Publishers, 1st Edition.

[4] Rao, A. Y., Nagabushanam, B., Dash, A. K., Ratul Paul and Ravi, G. S. 2001 Present exploitation status and future prospects of beach placers and their industrial applications: in Some aspects of Mineral development in India, (Eds.) Subba Rao, K. V. and Rajasekhar Reddy, D. Andhra University, Published by GSI and Andhra University.