

CORPORATE NEWS

RATIONAL UTILISATION OF LOW GRADE IRON ORE FINES AND SLIMES

Growing dumps of iron ore fines

Due to low off take of fines in the early years of operation of Indian Iron and Steel Company (IISCO), 30 million tonnes of fines analysing 56-61% Fe and about 8 million tonnes of fines of 58.50% Fe have accumulated at Gua and Dalli mines respectively. Despite spectacular change in the technology since the seventies in favour of greater consumption of fines against lumps, a substantial part of the fines is still going into waste dumps. Recoverable reserves of iron ore fines and low grade iron ore from the existing dumps in the country is given in Table 1.

Table 1

Material in dumps	Mine	Quantity in million tonnes	Analysis %		
			Fe	SiO ₂	Al ₂ O ₃
Fines	Gua	30.0	59.0	2.46	5.95
Fines	Dalli	7.5	58.50	4.83	7.17
Low grade ore	All India	2762.0	<62	-	-

Need for beneficiation

From the stand point of utilisation of resources and minimising environmental pollution caused by dumps of fines and slimes, NML has suggested for judicious use of these materials. R & D studies at different laboratories in India have resulted in appropriate methods of recovery of values from these so called wastes. Gravity separation technique and/or magnetic separation has indicated the possibility of obtaining concentrates with reasonably low alumina from fines and slimes.

While there is considerable scope for reduction of alumina and silica from fines there is very little scope for reduction of alumina from iron ore lumps being used in steel mills.

Research and Development (R & D)

R & D carried out on bench and pilot plant scale for enrichment of fines and slimes, by different organisations viz., NML, RDCIS, IBM, RRL (Bhubaneswar), RRL (Bhopal), NMDC and Tata Steel etc., has demonstrated that the fines can be upgraded through separation of aluminous matter by suitable gravity and/or magnetic separation techniques. Similarly, substantial quantity of fines with appreciably low alumina could be recovered from slimes. Very recently, an exhaustive study on lowering of alumina to a level of 2.5% was completed by NML. This study was conducted on 7 samples and a composite sample from Barsua. Based on the study a tentative flowsheet has been prepared for producing the desired product from both the fines and slime. Results of the investigations carried out in this regard at NML and elsewhere are given in Table 2.

Demand for steel in India

The projected demand for steel in 2011-12 is estimated at 57 million tonnes. Ministry of Steel and Mines, Government of India has formulated a growth plan for steel and production of iron ore the details of which are furnished in Table 3.

Table 2

Sl. No.	Mines	Process	Feed Analysis (%)			Conc. Analysis (%)			Conc. Yield (%)
			Fe	SiO ₂	Al ₂ O ₃	Fe	SiO ₂	Al ₂ O ₃	
Sample : Fines (Study at NML)									
1	Gua	Scrubbing, Screening Classification, Jigging	59.0	2.46	5.95	63.8	2.12	2.48	63.8
2	Dalli	Same as above plus Spiralling	58.5	4.83	7.17	65.4	2.12	1.87	65.4
3	Noamundi	Jigging	59.4	1.95	6.28	62.3	1.27	4.32	63.2
4	Sesa Goa	Jigging	56.9	-	-	-	61.6	-	-
5	Codli	HMS, Tabling, Spiralling	51.5	-	-	-	65.0	-	-
6	Bailadila 14	Jigging	55.7	7.00	6.00	66.0	2.80	1.90	-
7	Rajhara	Tabling	54.8	11.16	4.46	63.1	-	-	-
8	Barsua	Scrubbing, Screening Classification, Jigging, Tabling/Spiralling	66.03	1.15	1.21	66.51	1.01	1.06	57.3
		- do -	62.62	2.22	4.24	64.08	1.49	2.83	52.1
		- do -	64.03	2.58	3.66	65.07	1.60	2.87	77.5
		- do -	58.60	1.68	6.76	61.36	1.07	3.78	43.2
		- do -	64.51	1.13	3.07	65.50	1.05	2.37	77.5
		- do -	66.13	1.32	1.52	66.44	1.23	1.35	81.3
		- do -	62.73	2.89	4.50	65.03	2.39	2.99	79.8
		- do -	63.18	2.27	4.14	65.52	1.82	2.98	40.1
Sample : Dumped fines (Study at RDCIS)									
9	Dalli	Scrubbing, Screening Classification, Jigging	58.09	4.76	7.05	63.7	2.1	2.65	66.7
10	Gua	Scrubbing, Screening, Classification, Jigging	61.78	3.7	3.0	63.44	2.76	2.17	79.2
Sample : Slime (Study at NML)									
11	Joda	Hydrocycloning	48.72	11.23	12.27	61.76	-	-	45.1
12	Noamundi	Hydrocycloning	58.50	6.22	5.90	62.10	-	-	66.4
13	Kiriburu	Hydrocycloning	60.40	2.96	4.96	64.80	-	-	69.7
14	Daitari	Hydrocycloning	59.82	2.30	4.52	63.02	-	-	74.1
15	Bailadila 14	Hydrocycloning	63.30	2.76	4.40	65.70	-	-	75.3
16	Bailadila 14	Tabling	63.30	2.76	4.40	66.58	-	-	44.7
17	Donimalai	Hydrocycloning	57.90	6.42	6.23	64.50	-	-	75.7
18	Noamundi	Hydrocycloning	57.65	4.38	5.95	63.52	-	-	54.7
19		Hydrocycloning	62.30	1.90	2.11	63.35	1.55	1.60	50.4
		Tabling	59.70	3.88	5.10	63.07	1.65	2.22	40.1
		Tabling	56.58	6.50	7.31	63.38	3.35	3.75	44.6
		Tabling	51.95	2.97	10.35	57.80	1.72	7.25	33.1
		Tabling	57.24	2.45	6.05	65.86	1.10	2.32	36.9
		Tabling	61.73	1.85	2.92	63.00	1.80	2.52	70.1
		Tabling	43.55	9.00	15.65	58.18	4.85	6.95	31.1
		Tabling	57.90	2.75	5.30	62.65	2.20	3.40	43.6
20	Noamundi	Multi Gravity Sepn.	55.50	4.24	7.45	65.90	1.50	2.00	42.0
21		Hydrocycloning,	57.85	3.22	5.99	67.00	0.85	1.50	33.7

Source: NML

Table 3. Projected demand for steel, iron ore lumps and fines up to 2011-12

		Years		
		2001-02	2006-07	2011-12
		million tonnes		
STEEL		31	42	57
IRON ORE	Process route			
LUMPS	BF	11.0	15.0	20.5
	DRI (coal based)	8.0	7.0	8.0
	DRI (gas based)	5.2	7.0	11.0
	OH/BDF	0.9	1.3	1.7
	Sub total	25.1	30.3	41.2
FINES	BF	43.1	58.4	79.9
	ORI (Pellets)	2.0	3.1	4.3
	Sub total	45.1	61.5	84.2
	Grand total	70.2	91.8	125.4

Source: Growth plan for steel and iron ore - 20 years action plan, Government of India.

Growth of Steel industry in Karnataka

Based on projected growth plan for steel, Government of Karnataka issued licences for steel plants to be located in various parts of the State. Particulars of the steel plants and requirement of raw materials are given in Table 4.

With the increase in demand for iron ore lumps to meet the internal and export commitment large quantity of fines is likely to be generated in the coming years which will add to the already accumulated dumps spread throughout the iron ore range in Bellary-Hospet sector. By non-utilisation of these dumped fines and slimes, not only we are losing our non-renewable natural resources but also have to face environmental problems due to accumulation of fines at the mine heads. Beneficiation of dumped fines will not only help to meet the growing demand for iron ore but also result in conservation of our resources and prevent pollution of our environment.

Mobile beneficiation plants

Keeping the benefits in view, under the Societal and Technological mission projects of Council of Scientific and Industrial Research (CSIR) a project proposal on "Mobile Beneficiation Plant" has been conceived by the Department of Science and Technology and major portion of the total estimated cost is expected from DST and the balance from user industries, i.e., iron ore producers/exporters. The mobile plant could be stationed at a chosen site for assessing the beneficiability of iron ore fines of that area. The concentrate produced has to be tested for pot sintering tests in R & D units of NML followed by actual plant trial. After successful campaign, the plant can be shifted to another location.

The National Metallurgical Laboratory (NML), Jamshedpur, the operating agency of this "Mission Project" conducted one day interactive meeting on 20-8-1999 at the Lecture Hall of the Geological Society of India. O.P. Rao (CSIR, H.Q.) and I.G. Reddy, consultant, explained the project concepts. M. Basappa Reddy, Director, Department of Mines and Geology, Karnataka, explained the growth of iron ore mining in Karnataka which started on small scale in 1952 with a production of only 10,000 tonnes per annum for export, has steadily increased to 4 to 5 million tonnes per annum with production coming from mines at NEB, Timmappanagudi, Ettinhatti,

Table 4

Sl. No.	Particulars	Capacity		Requirement of raw-materials (lakh tonnes)				
		Pig iron (mta)	Steel & Steel-Products (mta)	Iron ore	Lime-stone	Dolomite	Quartzite	Manganese ore
1	Canara Steels, South Kanara	-	0.25	3.75	0.375	0.33	0.13	0.052
2	J.P. Industries, South Kanara	-	1.00	15.00	1.50	1.30	0.50	0.20
3	Elkay Steels Co. Ltd., Bellary	0.25	-	3.75	0.375	0.33	0.13	0.052
4	J V S L., Bellary	-	1.25	18.75	1.875	1.62	0.62	0.25
5	Kudremukh, South Kanara	0.20	0.05	3.75	0.375	0.33	0.13	0.052
6	Kalyani Steels, Raichur	0.225	0.22	6.75	0.675	0.58	0.22	0.09
7	ARM Ltd., Raichur	0.40	-	6.00	0.60	0.52	0.20	0.08
8	Dalton Steels Ltd., Bellary	0.21	-	3.15	0.315	0.27	0.10	0.04
9	Bellary Steels and Alloys Ltd., Bellary	-	0.38	5.70	0.57	0.49	0.19	0.08
10	Sathvahana Ispat Ltd., Raichur	-	0.60	9.00	0.90	0.78	0.30	0.12
11	Bhuwalka Ispat Inds. Ltd, Hospet/Bellary	-	0.25	3.75	0.375	0.33	0.13	0.05
12	Usha Iron and Ferro Metals, South Kanara	-	2.00	30.00	3.00	2.60	1.00	0.40
13	Mittal Steel Ltd., Bellary	-	0.70	10.50	1.05	0.91	0.35	0.14
14	Kap Steel Ltd., Bellary	0.25	0.25	7.50	0.75	0.65	0.25	0.10
15	Raunag Inds. Corpn. Ltd., Hassan	-	1.00	15.00	1.50	1.30	0.50	0.20
16	Kanishka Steel, Raichur	-	0.30	4.50	0.45	0.39	0.15	0.06
17	Mukund Vijayanagar Steel, Bellary	-	2.50	37.50	3.75	3.30	1.27	0.51
18	National Engg. Co. Ltd., Raichur	-	0.14	2.10	0.21	0.18	0.07	0.03
19	Dalmia Cement (Bharat Ltd.), Bellary	0.18	-	2.70	0.27	0.23	0.09	0.04
20	Kirloskar Steel Ltd., Uttara Kannada	-	1.00	15.00	1.50	1.30	0.50	0.20
	Total	1.72	11.89	204.15	20.42	17.74	6.83	2.75

mta = million tonnes per annum.

Source: Department of Commerce and Industries, Government of Karnataka

Donimalai, Davadar Gudda, Kumaraswamy, Ramandurg and Copper Mountain range. Mining and export of lumps and calibrated ore has left large dumps of fines spread over all these hill ranges. The Director of Mines and Geology explained that there is not much processing of mined ore except for breaking the boulders into lumps and removal of dust through screening. He stressed on the need to have the whole Sandur iron ore dumps sampled and beneficiated.

K.K. Bhattacharya, S.C. Manik and J.P. Srivastava explained the facilities available at NML, Jamshedpur. They explained the scheme of sampling the dumps and testing of the samples at NML to draw the flow sheet for beneficiation of iron ore fines. Based on the flow sheet, budgetary estimates for mobile plant and scale-up operations will be ascertained from local fabricators. Prefeasibility report based on bulk testing of iron ores from different ranges would be prepared by NML with input from I.G. Reddy before submitting the final proposal to DST. Contribution by participating entrepreneurs will be ascertained before submitting the final proposal to DST.

Representatives of NMDC, KIOCL, and private mine owners, while welcoming the proposal of the project to conduct beneficiation tests suggested to explore the market potential of different beneficiated products.

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