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Iron ore fines and their impact on environment in Sandur-Hospet region, Bellary district, Karnataka, India

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ABSTRACT

Sandur-Hospet region has abundant reserves of Iron ores from which large amount of fines are generated during mining, crushing and screening processes. Nearly 50-60% of the total burden removed is below 10 mm size and these fines are dumped at mine sites as waste. There is no systematic plan in preserving these fines. As demand for economic minerals increases, the mining activity will also increase resulting in generation of more fines. During the rainy seasons, these fines, carried by run off water, spread to the surrounding agricultural land there by reduce the fertility of the soil and productivity of the pedosphere and lead to deforestation. Ultimately the silt and suspended matter are transported and deposited into the near by tanks and reservoirs. The dissolved constituents from mining process pollute the surface and ground water of the region. In the present study, the utility of iron ore fines have been discussed in the light of many industries coming up in Sandur-Hospet sector. Various environmental impacts on land, air, water, ecological disturbances and impact on socioeconomic fabric have been discussed. In order to combat the environmental problems due to the dumping of fines as waste, several environmental control measures have been suggested.

INTRODUCTION

Iron plays an important and versatile role in the service of man. India is endowed with vast reserves of iron ore, and in the year 1993-94 the total production was around 57 million tonnes. Out of this, domestic consumption in the iron and steel industry was about 22 million tonnes, the rest was exported to different countries. Karnataka is one of the leading producers of iron ore and its production of about 12 million tonnes of iron ore is mostly exported. In Karnataka the

important deposits are located in the districts of Bellary, Chikkamagalur, Shivamogga and Uttar Kannada with minor occurrences in different places. The iron ore deposits of Sandur-Hospet region are most important for export and internal demands. The mines are operated by both private and public sector. As the demand for iron ore increases, the exploitation of low grade ores by mechanised mining is inevitable. During mining, crushing and sizing lot of fines are generated and the specifications imposed by the buyers have resulted in rejecting these fines as waste. In view of the many steel plants like, Vijaynagar-Zindal, Mukund, Kalyani and Kirloskar coming up in this region, the utilisation of iron ore fines has become all the more important. Fast depletion of the high grade ores and the increasing demand of the above said industries,make it imperative to use the low grade ores as well as the huge quantity of fines generated during mining. The occurrence, distribution and mineralogy of iron ore deposits of Sandur-Hospet region has been discussed by Mishra, 1970; Murthy 1994; and Radhakrishna, 1995. In the present paper the effective utilisation of iron ore fines of Sandur-Hospet region and its impact on environment have been discussed.

IRON ORE FINES

In the Sandur–Hospet–Bellary sector there are 67 iron ore mines and the total reserve is estimated to be 1253 million tonnes. Among the total reserves of this region 65 to 75% consists of fines. The recovery of lump ore is 25 to 35%. In addition to these fines there are large deposits of blue dust which is unused because of its fine size. The softness of ore at depths has also resulted in the generation of fines while mining. If we look into the demand of iron ore lumps for the steel plants, it will be around 16.3 million tonnes during 1996-97 and 41.3 million tonnes by 2012 AD. The demand for iron ore fines will be 33.3 million tonnes for 1996-97 and 84.2 million tonnes during 2012 AD (Table -1). Thus, there will be

Table 1 : Projected demand for iron ore in India (in million tonnes)

Iron ore	Process route	1996-97	2001-02	2006-07	2011-12
Lump	BF	8.1	11.0	15.0	20.5
	DRI (Coal based)	3.0	6.0	7.0	8.0
	DRI (Gas based)	4.5	5.2	7.8	11.1
	OH/BOF	0.7	0.9	1.3	1.7
	Sub Total	16.3	23.1	31.1	41.3
Fines	BF	31.5	43.1	58.4	79.9
	DRI (Pellet)	1.8	2.0	3.1	4.3
	Sub Total	33.3	45.1	61.5	84.2
	Total	49.6	68.2	92.6	125.2

Source : 20 Year Action Plant

good market for iron ore fines in the coming years. In this respect Sandur-Hospet region has an important role to play in the growth of iron and steel industry. The size of lumps and fines in integrated steel plants in India is +10 –40 mm and +100 mesh to –10 mm respectively. The sieve and chemical analyses of iron ore fines of Sandur area are given in Tables - 2 and 3. The results shows that the fines can be either sintered or pelletised for their effective utilisation in the steel making process. Jindal-Vijayanagar steel plant is going to employ the Corex Process using pellets instead of lumps or sinters.

It has been observed that 6 lakh tonnes of hot metal can be produced by feeding lump ore where as production of hot metal is around 8 lakh tonnes per annum if pellets are the fed. This route of steel making is not only more economical than the BF–route, it also reduces ecological in balance (Dewangan, 1996).

Table 2 : Sieve analysis of iron ore fines

Size	Weight fraction %
+10 mm	4.84
–10 mm + 1mm	37.14
– 1mm + 100 mesh	14.08
–100 + 300 mesh	35.46
–300 mesh	8.48

Utilisation of iron ore fines of this area helps in two ways. It meets the future demand of the industries and results in good ecological set up. Because of these advantages with pellets in Corex process, at present Jindal-Vijayanagar steels is going to establish a pelletisation plant with 3 million tonnes capacity per annum. These industries expected to provide employment to the people of this back ward area and would change the industrial scenario. In the study area, except NMDC, Donimalai, a public sector organisation and few private sector mines, none have taken care to stock pile the fines systematically. Fines have been dumped in many mining areas considering without consequences of environmental impact.

Table 3 : Chemical analysis of iron ore fines of Sandur area

Size	Fe	SiO_2	Al_2O_3	P	S
+10 mm	67.02	1.45	1.32	0.036	0.006
–10 mm + 1 mm	67.13	1.48	1.06	0.037	0.006
–1mm + 100 #	66.46	1.67	1.41	0.036	0.007
–100 # + 300 #	66.57	1.54	1.45	0.035	0.006
–300 #	66.63	1.56	1.36	0.036	0.006

During rainy seasons the dumped ore washed down along the hill slopes results in the destruction of agricultural land.Beneficiation and agglomeration of these fines become inevitable from both mineral conservation and ecological points of view.

ENVIRONMENTAL IMPACTS OF FINES

The process of extraction of mineral resources and its use in various way generate a wide range of environmental changes. Though many national policies have been formulated for proper conservation and effective utilisation of mineral wealth, little has been achieved to ensure rehabilitation of the land affected by mining activities. Our aim should not only be to extract the economic aspects of the mining but also to ensure reinvestment of a part of the profit either to extend the life of the deposit or to protect the natural environment likely to be spoiled by mining activity.

The fines generated during mining has to be taken care, otherwise it would damage the environment and ecology considerably. It is the need of the hour to plan and control the various impacts of mining on environment. The impact of mining on environment has been discussed by Prabhakar and Nijagunappa, 1995 and others. In the present paper, the authors have discussed the problem of iron ore fines and its impact on environment. In some of the mining areas it has been observed that the fines have been dumped hapazardly. During the rainy seasons the dumped ore will washed down hill slopes destroying the agricultural land. The impact of which results in progressive degradation of soil cover, disfiguring of landscape, deterioration of vegetation, check in the ground water potentialities, pollution of surface and ground water, siltation of water reservoirs and impact on socioeconomic fabrics etc. The important impacts of fines on environment are discussed below :

Waste disposal

In the Sandur-Hospet area, NMDC, SMIORE, MSPL and a very few mines have taken care on the impact of fines on environment. Most of the private mine owners of the area have selected hill portions as spots for waste disposal and dumping of fines. During rainy seasons most of the fines and dumps are washed down by rain water and lead to deforestation in large areas. The total vegetation all along the hill slopes is ruined. In some cases this has resulted in encroachment onto agricultural land also.

The mining industry in Sandur region has no proper planning. Preparation of landscape plan before starting operation will help in minimising this visual impact in this region. Fine ore dumps can be avoided by making stock piles in proper

places. This is one of the important control not only from environmental aspects but also for future utilisation of fines. Stock piles are advisable as land losses and contamination are very less. Green belt development has to be planned which helps in afforestation of the mined area, prevention of soil erosion, silting and pollution of stream water.

Air Pollution

Air pollution creates lot of problems in mining areas. The source of air pollution is mainly from drilling, blasting and plant operations. In addition to this blowing of dust from the working areas, dumps and stock piles and transportation also creates air pollution. Only the public and few private sector mines have taken possible measures to suppress the dust by spraying water. Closed conveyer system or slurry system is advisable to reduce the air pollution as done in MSPL, Hospet. Transportation of ore is also one of the main source of dust. To avoid this the trucks and dumpers should be leak proof to prevent dust blowing up to air. Planting of trees on waste dumps has to be done to control dust.

Water Pollution

The source of water pollution is mainly from spent water from handling plants, pumping of mine water, effluents from beneficiation plants, during dust suppressing, wash off from waste and tailing dumps. The fines dumped in the hill portions during rainy seasons wash off from mining area and the run off water is loaded with silt and suspended particles transported and deposited all along the stream courses, tanks and reservoirs. The dissolved constituents in them pollute the surface and ground water of the region. Due to disposal of mine dumps the surface drainages are blocked and this results in decreasing the storage capacity of the adjoining area. Blocking of fines in drainage areas reduce the yield from the wells and also ground water quality.

It is advisable to take all possible steps to prevent the discharge of toxic effluents into surface water bodies and ground water aquifers, and to reuse the water. Waste water treatment methods like lime treatment followed by oxidation process to convert ferrous to ferric iron, neutralisation with soda ash, caustic soda and anhydrous ammonia, ion exchange, desulfating should be incorporated for neutralisation and removal of solids.

Mining in these areas results in changes in life style of the people. The health condition of the people engaged in mining and inhabitants in the surrounding area are affected by health hazards. The socioeconomic environment is undoubtedly improved as mining provides employment and upliftment of economic profile of the region.

CONCLUSIONS

In view of the major steel plants coming up in Sandur-Hospet region, it is necessary to stop the present practice of exporting large quantities of the richest grades of ores. To meet the decreasing trend of lumps, the mine owners should establish sinter plants to meet the domestic market. The fines dumped at mine sites as waste should be sintered or pellitised as the fines of this region suite both the purpose. New technology should be introduced for the effective utilisation of iron ore fines of this area. Care should be taken to preserve the fines in the mining area. The dumping of ores haphazardly has resulted in the erosion of fines during rainy season resulting in the degradation of agricultural land, deforestation, air pollution and water pollution. Effective plans have to be drawn to restore land affected due to mining by green belt development which would help in many ways to minimise the environmental impact.

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