

**ENVIRONMENTAL AND WASTE MANAGEMENT IN IRON AND STEEL INDUSTRY
IN THE KALINGA NAGAR INDUSTRIAL CLUSTER IN JAJPUR DISTRICT OF
ODISHA**

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ABSTRACT

The rapid progress of iron and steel Industry is associated with the generation of solid waste materials like slag, dust, sludge, etc. Significant quantities of wastes are generated from steelmaking process has aggravated environmental and waste management problems. The production of steel in steel plant involves several operations from primary and secondary steelmaking to ingot and continuous casting of steel. At each of these stages of steelmaking process, substantial amounts of wastes are generated. This has led to an increase pressure from Government as well as public to speed up the necessary action plan for industrial waste management. This paper summarizes and analyzes the generation, composition, characteristics and present status of the utilization of the most of the wastes generated from the steelmaking processes.

KEYWORDS: Economic, environment, iron, steel making, steel slag.

INTRODUCTION

The minimization and utilization of waste through integrated waste management has gained special significance in the present scenario, as these wastes have a wide ranging impact on the environment. In steel production, India is also expected to leave behind USA and Japan in couple of years according to given data. In 2019-20, as per expectation the production of steel will be 150MT and the production of mill scale will be 3MT.^[1] The need of steel in India is expected to rise by 7% in the coming financial year and expected to going 200 million tons by 2020 as compared to 83.36 MT in the current year.^[2] The solid waste generation, presently in Indian steel industry is in the range of 450 - 550 kg/t of crude steel and recycling rate varies between 40 - 70 % which lead to higher production costs, lower productivity and further environmental degradation. It is very essential not only for recycling of the valuable metals and mineral resources but also to protect the environment. In advance countries, the solid waste generation has been brought down below 200 kg/t and the recycling and reuse rates are above 90% approaching almost to 100% level. The waste management system needs to be further strengthened for making successful and economically viable efforts for 100 % utilization of all wastes.

The progress on technological aspects, process options for enrichment of input materials and solid waste management in Indian steel industry are moving at much slower pace than desired. In order to sustain the present competitive market and for further growth in future, it is required to use technological innovations and putting R & D efforts in order to reduce waste generation and its recycling to steel plants.

Development of steel industry has brought with it environmental degradation. Environmental conservation has become an increasingly more important aspect of our daily lives. With the rapid and extensive industrialization and urbanization in many parts of India, there is a dawning realisation that ultimate prerequisite for man's survival could well be the preservation of environment. We live under horns of dilemma. However, our expectations and our perceptions of what constitutes a minimum standard of living have put increasing pressure on both the public and private industrialists to ensure clean and healthy environment.

The aim of the paper is to explore the various developments for total recycling of solid waste generated from steel industry in our study area which is Kalinga Nagar Industrial Cluster (KNIC) at Duburi, Jajpur district of odisha state, India (figure 1), so that the vision

for making “*clean & green steel with zero waste*” can be achieved for survival and growth of steel business in future. Kalinga Nagar is a major industrial area located at 20°57'N- 21°03'N latitude and 85°05'N-86°05' E longitude near Duburi, a renowned mining area of Jajpur District, Odisha, India. The abundance of raw-materials such as iron ore, chromite, coal, dolomite, limestone, manganese and quartzite etc. at close proximity and adequate availability of infrastructure facilities have encouraged establishment of several mineral based industries (especially (especially steel plants) steel plants) in Kalinga Nagar area. Kalinga Nagar Industrial Cluster (KNIC) is in the process of becoming a major global hub in steel and ancillary products. It has been envisaged that by 2020, about 16 million tonnes crude steel will be

produced per annum by different steel industries i.e Mega, Large and Medium industries in the area. At present eight number of Large and Medium industries have already started production and one Mega Plant named M/S Tata Steel with a capacity of 6 million tonnes per annum is in pipe-line. Operation of industries in such a large scale in a cluster will have definite load on the physical, chemical and biological characteristics of the natural environment as iron and steel production involves usage of huge raw materials (approximately 3 tonne of raw materials per 1 tonne production of steel) and the manufacturing process generates a lot of waste materials.^[3] Consequently, there will be considerable water pollution in pace with industrial advancement.^[4]

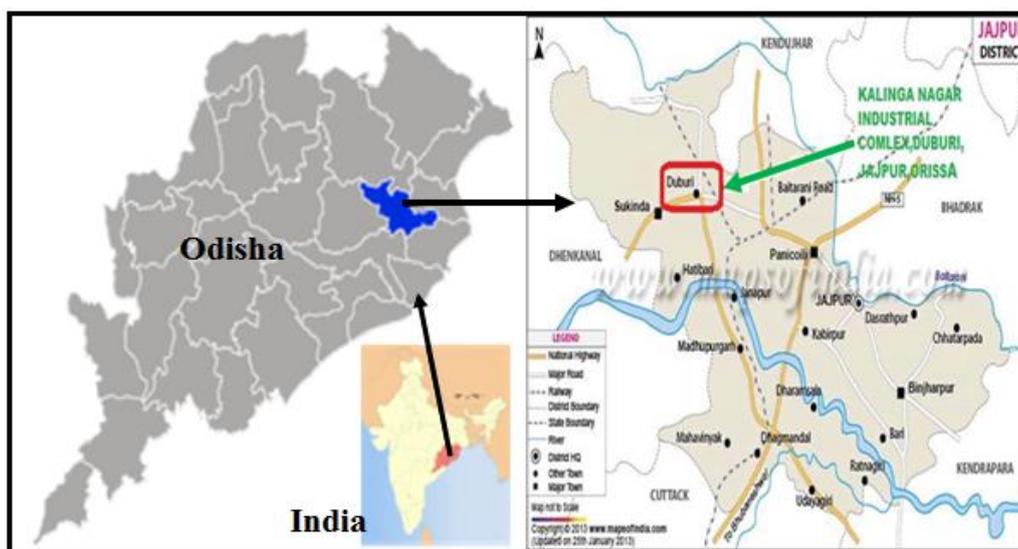


Figure 1: Map showing location of study area.

Source- http://en.wikipedia.org/wiki/Jajpur_district,
<http://www.mapsofindia.com/maps/orissa/districts/jajpur.htm>, accessed on 12th Feb. 2013

Environmental pollution in steel industry

Iron and steel industry which consists of mining of ores, preparation of raw materials, agglomeration of fines in sinter plant, feeding of burden to blast furnace and also manufacturing of coke in coke ovens, conversion of pig iron to steel, making and shaping of steel goods, granulation of slag for its use in cement plant, recovery of chemicals from Benzol and tar products etc. All the

above mentioned operations add to air, water, land and noise pollution. Steel production affects the environment.

Different types of wastes generated from steel plant

Steel industry creates waste materials in three states like solid, liquid & gaseous wastes. The generation of different types of wastes are differ from one steel plant to other depending upon the steelmaking processes adopted and pollution control equipments installed in the steel plant. The most common type of wastes generated in steel plants given bellow in figure 2 and figure 3.

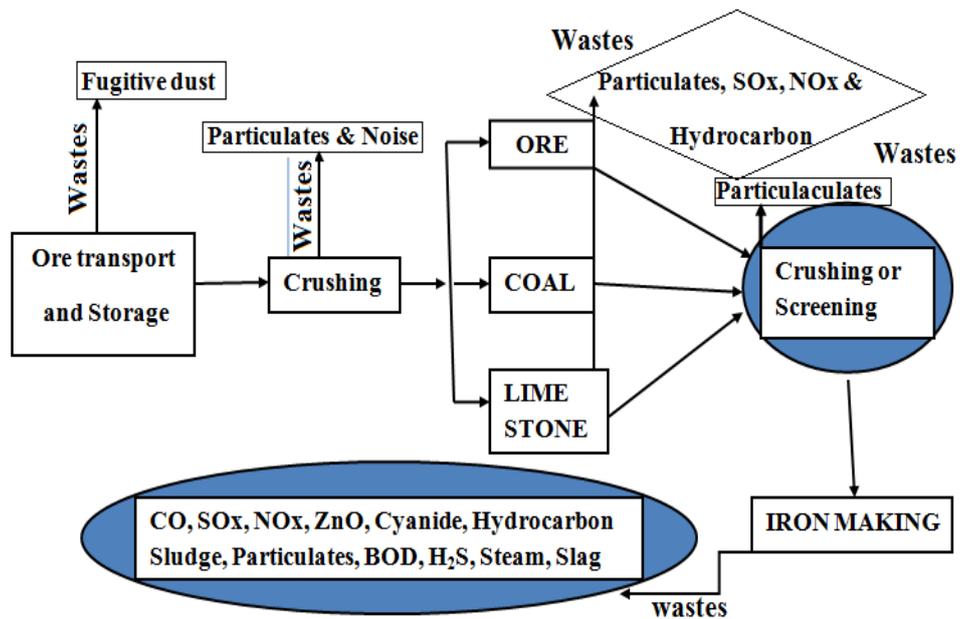


Figure 2: Wastes generated in steel industry till iron making process.

In iron making process we get liquid pig iron which undergo further for steel making process and different

types of wastes are obtained in this process which is given in figure 2.

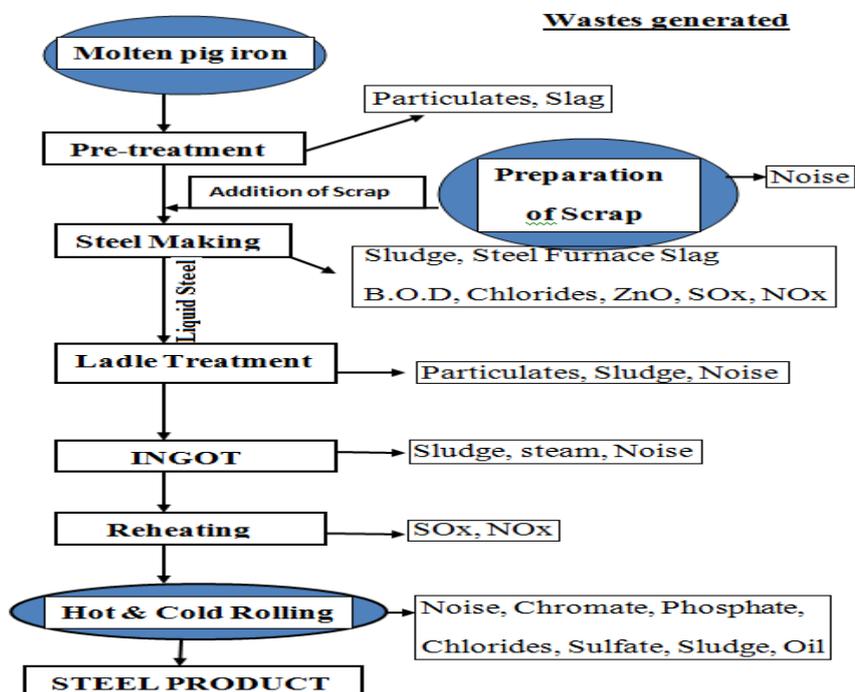


Figure 3: Flow Chart showing different operations after iron making and wastes formed in them.

Now waste disposal and dump are very big issue for environment and therefore, these wastes are being tried for reusing through recycling & utilization. These wastes are being used and recycled by various means but complete utilization of these waste are still challenges for steel industries. Various efforts and experiments are being carried out in order to make use of 100 % wastes into useful products without disposal of any type of wastes into the environment.

Advantages of recycling and utilization of wastes are as follows.

- Conservation of natural resources
- Better & cleaner environment
- Reduced cost of disposal
- Conservation of energy
- Economic development
- Less consumption of raw materials.

Environmental management

Environmental waste management may be as an Act, manner or practice of managing, handling or controlling something by which no effect takes place in the environment. Waste management is a problem susceptible to the application of classical engineering analysis and solution to solve the bad effect of waste. Hence by extension of the most fundamental planning and management techniques, the problem can be solved in a manner which will protect man and improve his environment. All waste materials are considered as an important economic assets, only when these are accidentally or intentionally dispersed at lower concentrations into a benign or otherwise beneficial matrix such as air, soil or water that the essential management element or control is lost and human may become exposed to their short or long term hazards.

Management of Air pollution

Steel plant operations are responsible for polluting the air, because of huge consumption of coal, iron or limestone, dolomite, sulfur etc. During the process large amounts of emission consisting of dust, gaseous pollutants like SO_x, NO_x etc. are generated. To have an effective control over the pollutants first step for environmental management consists of conducting an emission inventory or pollution survey by visiting the plant at various locations such as blast furnace, coke oven, sinter plant, refractory plant, etc. to get a first hand information on the process and practices and also to carry out stacks and ambient air quality monitoring to establish the nature, quality and quantity of pollutants, emitted by the source, evaluate the performance of pollution control equipments if any, and also to compare it with emission standards so as to assess the necessity of controlling the emissions either at source by suitably altering the process parameters or by improving the efficiency of pollution control measures. Air pollution control equipment available in Indian steel plants are like Raw material plant, Blast Furnance, Boilers, Sinter plant, Stock house and cast house, L.D Shop, Bag houses, Ventury scrubbers, Electro-state Precipitators (ESP) etc.

Management of noise pollution

Noise may be defined as an unwanted sound judged to be unpleasant, loud or disruptive to hearing. In steel plants noise is generated due to high speed rotating equipments like fans, blowers, exhauster; due to leakage of compressed air and steam, metal to metal contact, at rolling mills, forge shops, foundry etc. Though the effect of noise on the nearby township is minimal, its impact is very much felt in plants. In plant units like B.F., rolling mills, oxygen plant, power plant etc noise survey is required to be carried out in well identified areas i.e sound level and frequency analysis with the help of acoustic experts. Accousting absorbing system is used to control the noise pollution in steel plants.

Waste water management

In India almost 70% of the water has become polluted due to the discharge of domestic sewage and industrial effluents into natural water source, such as rivers, streams as well as lakes.^[5] The improper management of water systems may cause serious problems in availability and quality of water.^[6] Sewage contaminated storm water out-falls and the dumping of industrial waste pose a major health and environmental hazard. Since water quality and human health are closely related, water analysis before usage is of prime importance. The provision of potable water to the rural and urban population is necessary to prevent health hazards.^[7] Before water can be described as potable, it has to comply with certain physical, chemical and microbiological standards, which are designed to ensure that the water is potable and safe for drinking.^[8] Potable water is defined as water that is free from diseases producing microorganisms and chemical substances deleterious to health.^[9] Steel plant consumes huge quantities of water as high as 150-200 tonnes per ton of steel produced. Water pollution survey has to be conducted to determine the source, quality and quantity of pollutions viz. suspended solids, cyanides, phenols, oils, greases, fluoride, ammonia, BOD, COD etc.^[4] Waste water treatment options consists of cooling the stream, separation and disposal of oil and suspended solids, biological oxidation of soluble organics, neutralization with acids and crystallization and removal of inorganic soluble salts. In steel plants, in certain sections waste water is segregated and treated separately. Collective treatment by settling or coagulation is also practiced. Recycling and reuse of water is adopted in different units. The cooling water is in continuous circulation through cooling and recirculating pond. If the waste water contains high pollutants the same is subjected to biological treatment, in trickling filters, by activated sludge treatment, etc.

Solid Waste Management

Solid waste such as power plant fly ash, acid sludge from by product plant, tar sludge, coke breeze, granulated B.F. slag, steel slag (fig 4), calcined lime (fig 4) and dolomite dusts, steel scrap, etc., are generated in huge quantities causing environmental degradation. Like industrial waste waters, in this case also a preliminary survey is to be conducted to assess the source, quality, quantity, physical and chemical characteristics, pollution load, toxicity etc. before planning for dumping, selling or treatment.^[4] Environmental management by environmental impact assessment(EIA) EIA is a management tool comprising a systematic, documented periodic and objective evaluation of how well a steel plant will affect environment during planning phase before expansion/new operation. The EIA study is based on data collected by a team of environmental experts on the plant layout, human settlement, basic facilities provided, other industries around steel plant, analysis and monitoring with respect to air/pollution, water pollution, noise pollution, solid waste, impact on vegetation,

human health etc. Based on the findings of EIA report an environmental management plan (EMP) can be prepared and implemented by which Kaling Nagar Industrial Cluster remain as good as previously it was.

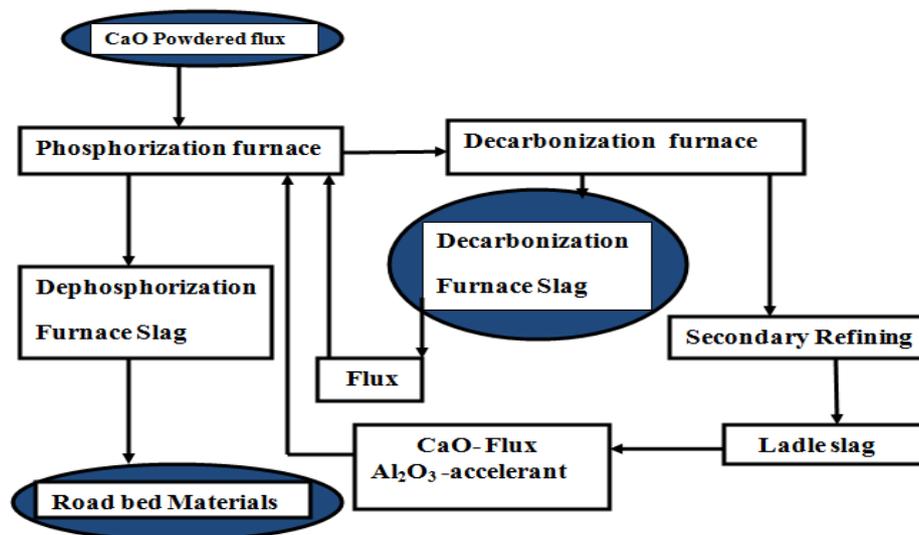


Figure 4: Recycling and application of Steel Slag obtained from steel making process.^[10]

Environmental management by environmental audit (EA)

Recently EA has been introduced for the first time by Ministry of Environment and Forests for continuation of NOC's for industries. The subject is still evolving and its importance and modalities are yet to be understood by many organizations. EA is a management tool that is valuable only if it is a part of overall management system. It is a self assessed management system and will cover all relevant information pertaining to steel production units/departments such as management of waste mate air, water, noise pollution levels, safety measures, etc. Basic functions of EA include: (i) Auditing of environmental management philosophy of steel plant, (ii) Technical audit of plant, equipment, facilities and operating practices for compliance. EA is a management tool to verify the adequacy of EMP prepared.

EA for pollution prevention/waste minimization (PP/WM)

A systematic audit of waste generating and handling of steel plant organization can help to ensure that all opportunities for PP/WM are identified and evaluated. The six important steps in waste minimization audit consisting of preparation of ground, selection of audit team, finding the facts, identify options, evaluate options and finally implementation. The final report will cover input analysis, analysis of waste generated, waste management recommendations, compliance of pollution levels with standards, impact analysis and economic analysis. Pollution prevention (PP) means not producing wastes and emission streams. PP not only offers an approach to reduce the risks associated with the most of environmental problems, it also makes good environment to save nature. PP programme includes option like source

reduction, recycle or treatment to prevent pollution. To sum up, WM/PP audit programme will not only reduce production cost, raw material cost, energy cost but also improve income through the sale of reusable waste and safety of employees. Reduction on the impact of industrial activity on the environment also makes commercial sense.

CONCLUSION

Compared to the developed steel industries, the utilization rate of wastes obtained from steel industries of Kaling Nagar Industrial Complex is still very low as compared with other steel industries in our country. Therefore, large-scale utilization is a substantial resolution to the environmental problems arisen by wastes of steel industries. The author believes that there are two important routs for utilizing wastes from steel industries in large-scale: one is to produce cement and concrete using the steel slag fine powder after reclaiming waste steel; the second is direct application in road and hydraulic construction. When the technology of CO₂ capture and flue gas desulfurization become reliable in future and two technologies will be selective before utilization in other ways. In addition, the database establishment of wastes from steel industries of Kaling Nagar Industrial Complex characteristics and applications is a substantial task for steel utilization.

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