July 2012

The Environmental Pollution and Control- Solution in Sponge Iron Industries

Himanshu S. Moharana

Raajdhani Engineering College, Bhubaneswar, Odisha, India, himanshu.smoharana@gmail.com

Follow this and additional works at: <https://www.interscience.in/ijarme>

Part of the [Aerospace Engineering Commons](#), and the [Mechanical Engineering Commons](#)

Recommended Citation

Moharana, Himanshu S. (2012) "The Environmental Pollution and Control- Solution in Sponge Iron Industries," *International Journal of Applied Research in Mechanical Engineering*. Vol. 2: Iss. 1, Article 8.

DOI: 10.47893/IJARME.2012.1059

Available at: <https://www.interscience.in/ijarme/vol2/iss1/8>

This Article is brought to you for free and open access by the Interscience Journals at Interscience Research Network. It has been accepted for inclusion in International Journal of Applied Research in Mechanical Engineering by an authorized editor of Interscience Research Network. For more information, please contact sritampatnaik@gmail.com.

The Environmental Pollution and Control- Solution in Sponge Iron Industries

Himanshu S. Moharana & Bipin B. Mohanty

Raajdhani Engineering College, Bhubaneswar, Odisha, India

Abstract – It is normally assessed that a Country's economy is directly proportional to the use of steel that the country is having. This is true and at the same time, some adverse situations are also caused due to such industrialization. In an Indian economy, it is advisable to open more and more industry sectors rather to seize them down. Motivation from governmental as well as non-governmental agencies would be more effective to keep a sound mind towards the environmental assessments which is the call of the day the whole globe around. We have got much concern and responsibility to combat the climate change which has become a drastic phenomenon for rest of our lives as well as our ancestors. The paper discusses about the sponge iron industries and various methods to help support the environmental issues. It focuses how the environmental system related to the sponge iron industries in the country would help to build a green globe around in near future without affecting the economy of the country.

Keywords - *Sponge Iron Industries, Environmental issues, Problems, Solutions.*

I. INTRODUCTION

The Indian Sponge Iron Industry has witnessed remarkable growth in the last few years in India. Even a few years back our country was ranked 3rd and today we stand as the largest producers of DRI in the world. The credit of this transformation should be given to all the consulting and technology companies, who contributed to the indignation of DRI technology through their vision and prudent inputs and ideas. But having attended this mark one has to be extra vigilant and careful in terms of the environmental scenario in the whole world around as whenever the growth in term of environmental support is unplanned, unmeasured and by all the accounts exceeding expectation, there is always a possibility that this growth may be followed by setbacks and problems. Although the Industry has performed exceedingly well, it is not devoid of areas which it can work and improve on. It should be our endeavour to put in place a mechanism which could in some regard guarantee sustainable and long term development for the industry in term of environmental setups and there by the people involved in it.

II. MAJOR PROBLEM FACED BY SPONGE IRON MANUFACTURER

- Iron Ore with with 63% Fe content if available fluctuates highly in terms of cost, irrespective of its product cost.

- Availability of Coal from the Govt. controlled Mines contains high level of ash or else FC content is low which creates environmental hazards.
- Low metallization of DRI is available in the market, resulting from POOR QUALITY of Iron Ore, which ends up affecting the yield of liquid steel Production and creates environmental hazards.
- High Ash content in coal and contamination in Iron ore results in accretion and low campaign life of the kiln.
- The quality of fines generated in the product during the processing (25% to 45%) affects the profit margins especially in the south.
- High volume of Ash and Coal Char generated every day is becoming a THREAT to the ENVIRONMENT and cost of waste disposal remains high.

III. AIR POLLUTION MITIGATION MEASURES

In most of the Plants where Popuri technology is involved, there is no pollution control equipment provided to clean the waste gas. Some of the plants are adding pollution control facilities to clean the gas at present to comply with statutory requirements.

In some of the bigger size plant, the heat content of hot gases is utilized to generate steam through Waste

Heat Recovery Boiler (WHRB). The steam is used to operate small size turbines to produce electricity.

The exhaust gases coming out of WHRB, having temperature around 150-170°C is taken to pollution control equipment for particle separation. Different industries using different types of pollution control equipment like Bag filter, scrubber and some also have Electrostatic Precipitators. The clean gas is let out through stacks.

The old rotary kiln DRI Plants have used Gas Cleaning Plant (GCP) based on Venturi Scrubbers (wet cleaning) for the treatment of DRI gases. This system generates dust bearing sludge that needs separate handling and disposal. However, this system cares of particulate matter as well as gaseous pollutants.

IV. FUGITIVE DUST GENERATION

The sources of fugitive dust generation in rotary kiln based DRI plants are the raw material handling yard (unloading, stacking, reclaiming operations) and product discharge system (cooler discharge conveyors, transfer points, junction house, screens magnetic separators, storage silos, truck lading and packing operations). The dust at the yard is controlled using water sprinklers in bigger sized plants. Covered product house further reduces the wind blown dust. skirt boards and covered conveyor belts also generate less fugitive dust.

V. RAW MATERIAL PREPARATION

The production of sponge iron requires sized raw materials i.e iron ore and coal. the sizing of raw materials involve the crushing, screening and conveying operation. During the crushing and screening operation fines are generated along with which the micron size dust flies in the air. coal is mostly received in higher size (100-250 mm depending upon mines) which need to be crushed in a crusher to get the required size of 0-20 mm, thus all most all the plants are provided with coal crusher of required capacity. Iron ore is generally available in sized condition after a number of crushing units was set up in Orissa. Thus crushing of iron ore by and large is not required at plant site. Dolomite is available in required size, thus crushing is not required. Without any pollution control unit, it is very difficult to arrest dust in crusher area. Most of the plants are devoid of any pollution control equipment.

VI. COOLER DISCHARGE AND PRODUCT SEPARATION

The iron ore coal and dolomite/lime stone, which are fed into the rotary kiln are converted to sponge iron, char and burnt lime respectively. During the operation

the fines are generated due to tumbling action. Part of fines comes out of the cooler through the double pendulum valve and dust is generated at the transfer point. The cooler discharge material contains sponge iron & char and screened and then fed to the magnetic separator. Where sponge iron being magnetic, gets separated. The magnetic sponge iron and non magnetic char is taken to their respective bins and dust generated during these operations.

After cleaning the dust in bag filter, the clean gas is emitted through a small height stack in some cases the stack height is less than the nearby building height.

Greenbelt may be developed around plant premises and all other open spaces inside the plant covered with lawns and gardens. These systems are effective in ensuring dust free/aesthetic working environment. But most of the 50 TPD or 100 TPD plants do not have adequate space for green belts.

In gas based plants, the plant dedusting system is done using hydroclones, multiclones or bag filters. The system is quite effective in ensuring dust free environment in the product house.

VII. WATER POLLUTION MITIGATION MEASURES

In the closed based sponge iron plants, water is used mainly in three areas namely cooler, ABC and wet scrubber. The water requirement in rotary kiln DRI plants is mainly for cooling the discharge feed from 950-1050°C to below 100°C. Water is continuously sprinkled over the rotary cooler shell and is allowed to fall on a setting tank located below the rotary cooler/near the cooler. Make-up water is added in the tank to cool the hot water and compensate evaporation loss. The water from setting tank is re-circulated for sprinkling over the rotary cooler. The water requirement varies from 5-6kl/h 100 TPD DRI.

The domestic water consumption is for cooling, washing and sanitary purpose. About 50-100kl/ person/day water is used for domestic purpose. About 5-10% water is generated as sanitary waste water. The sanitary waste water is disposed into soak pits / septic tanks.

VIII. SOLID WASTE GENERATION AND DISPOSAL

Char contains moderate calorific value (1500 – 1600 kcal /kg) because of the presence of fixed Carbon content. Char does not have volatile matter and can not be independently used as fuel. It is washed to free the impurities, mixed with coal fines, pulverized and then used as fuel in Fluidised Bed Combustion Boiler (FBC). In India very few plants are using char to produce electricity. Flue dust and sludge collected

from air pollution control equipment are non- hazardous , non-toxic oxides that are mainly dumped in near by areas. These can be used for brick making and land filling.

IX. HAZARDOUS WASTES AND CHEMICALS

Coal based DRI plants do not handle any hazardous chemicals (as stipulated in manufacture, Import and Storage of Hazardous Chemicals Rules) nor generate any hazardous solid waste (as stipulated in Hazardous wastes Management & Handling Rules).

The occupational health envisaged in DRI plants are respiratory problems due to dust and CO poisoning due to accidental exposure to untreated DRI gases. Workers working in areas like RMH yard and product house that generates fugitive dust should wear nose masks /dust filters. CO probes with electrochemical sensors should be installed after the ABC, at stack and kiln discharge end. In case a person inhales CO, he should be removed to fresh air and given medicated oxygen through a mask for 30 minutes and if required cardiopulmonary resuscitation should be performed. Thereafter, supportive treatment if required should be given in the nearest hospital.

X. ENVIRONMENTAL IMPACT

With all pollution control measures the impacts due to the plant cannot be avoided. Suitable air pollution control system shall be installed to achieve the prescribed stack emission standards. Solid waste management program should be prepared with thrust on reuse and recycling. Solid waste disposal site should be earmarked within the plant premises. The storage site of solid waste should be scientifically designed keeping in view that the storage of solid waste should not have any adverse impact on the air quality or water regime in any way.

The various types of solid wastes generated should be stored separated as per CPCB guidelines so that it should not adversely affect the air quality, becoming air borne by wind or water regime during rainy season by flowing along with the storm water.

Since the sponge iron industries suffice to the guidelines laid down by the Pollution Control Board, they are said definitely to combat the GHG emission by which the whole world would see a better prospective ahead. Though India doesn't contribute much to such climatic change still then the pollution creating hazards should always be taken in to account to make a Green World on a long run.

REFERENCES

- [1] Lee J. Krajewski and Larry P. Ritzmann: Operations Management – Process and value chain, 7th Edition, PHI, 2005
- [2] Mary Samner: Enterprise Resource Planning, Pearson Edn., 2000
- [3] Plan4demand – Manufacturing Analysis 2008
- [4] Sunil Chopra and Peter Meindl: Supply Chain Management – Strategy, Planning & Operations, 2nd Edition. Pearson Edn., 2005
- [5] H.S. Moharana, J.S. Murty, S.K. Senapati: Information Technology and the Supply Chain, Presented at International Seminar for IT, HIT, West Bengal, December 2006.
- [6] H.S. Moharana, J.S. Murty, S.K. Senapati: Sponge Iron Industries and their responsibility For Combating Climate Change and the Supply Chain, Presented at National Seminar on Environment at NIT, Rourkela, 2010.