

UTILISATION OF WASTE – A NOVEL APPROACH TOWARDS CLEANER ENVIRONMENT

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ABSTRACT

Increasing concern for environmental protection, growing cost of waste disposal, depleting natural resources, growing economical constraints have put the metallurgical industries under tremendous pressure to find ways and means for waste utilization and also to reduce waste generation. As a result the emission level and waste discharge are lower today than what was a few years ago. Still vast scope exists for improvements. This paper deals with utilization of some of the wastes generated in iron and steel and non-ferrous industries. Utilization of steel making slag, blast furnace slag, lime fines, mill scale, fly ash from steel and red mud from non ferrous industries have been considered as examples.

INTRODUCTION

Iron and steel industries use various raw materials. During the process of production different types of wastes are generated adding cost to the products. Environment can be adversely affected during generation, storage, transportation and disposal of these wastes. Clean environment concept and recovery of mineral values from wastes have opened out areas to transform waste to wealth. Integrated steel plants of modern times have reduced the generation of wastes significantly and increased the utilization of wastes be they solid, liquid or gaseous in nature. This has been possible by adopting (1) pollution control methods (2) adopting latest technologies (3) better maintenance equipments and controls and (4) means to increase the awareness of waste utilization and pollution control at all levels

UTILIZATION OF STEEL PLANT WASTES

To produce 1 tonne of steel 6t of air, 3t of water and 2.8t of ore, coal and lime are required to be processed generating 9.7t of moist dust laden gases, 0.5t of effluent water and 0.4t of solid waste. Over the last three decades technologies have been either developed or modified to recycle the by-products within the plant or the by products are sold as raw materials for other down stream products However, many factors and techno-economic parameters must be considered before planning to utilize a particular waste. Some of steel plant wastes which are being utilized are as follows [2].

STEEL MAKING SLAG

Basic Oxygen Furnace (BOF) and open hearth furnace slag produced during refining low phosphorous pig iron can be used in the following applications provided free lime content is less than 4%.

- Local land filling and land reclamation
- Road building and railway ballast
- Construction of embankments, dams etc. provided slag is very coarse in size.

When the lime content is more than 4%, the slag can be used in the manufacture of fertilizer or it can be recycled for iron making and sintering. If low phosphorous pig iron has been refined, phosphorous in that form of P_2O_5 must be added to ground slag before it can be used as fertilizer. In case of high phosphorous entire slag can be ground and sold as fertilizer.

FERROUS STEEL FINES AND DUST

Large quantities of fines to the extent of 10% of steel produced are generated in iron and steel industries. These fines contain Iron-oxides, lime, carbon and silicates suitable for recycling and conversion into value added products. Steel fines are generated in raw material yard, sintering plant, blast furnace etc. Dust and slag from raw materials yard and crushing plant contain fine particles of iron ore, coal and lime stone. These materials can be utilized in sintering plant for making sinters or palletizing plants after adjusting moisture for making pellets. Sinters and pellets are used as raw materials for iron making in the blast furnace. Dust and sludge from the sintering plant can be used in iron making provided the alkali content is low. Dust from gas cleaning plant can be recycled to sintering plant or palletizing plant for making sinter and pellets.

MILL SCALE

The iron oxide arising out of continuous casting soaking, reheating and rolling operations are known as mill scale. This is relatively pure iron oxide with little contamination. This dust can easily be recycled in iron making in sintering plant. 90% of mill scale is directly recycled in the steel plant through out the world, the rest is used for land filling due to oil contamination.

BLAST FURNACE SLAG

Blast Furnace slag is another waste generated in the steel plants. The slag rate of Indian blast furnace is 250-300 kg/t of iron produced. This slag can be used for the following purposes.

- a) Air cooled slag – Bases and shoulders of highways, bituminous road construction, rail road ballast, aggregate for building construction etc.
- b) Granulated slag – Portland slag cement, super sulphated cement, road making, etc.
- c) Method controlled cooled slag – Light weight or foamed slag, wool, slag cream tiles etc.

LIME FINES

L.D. steel making uses only lump lime (+10 mm size) to avoid loss of lime fines in out going gases and subsequent deposition in the gas cleaning system. The consumption of lime in L.D. Steel making is about 100-130 kg/t of steel. This leads to generation of lot of lime fines. These fines can be utilized with in LD and OH steel making after briquetting. These fines can also be used in sintering mix, since the use of lime helps in better preballing of sinter mix leading to improved productivity of a sinter plant.

FLY ASH

Fly ash is the end product of thermal break down of coal associated minerals at the operating temperatures of combustion. Minerologically fly ash contains magnetite, hematite and glass contaminated with different amounts of unburnt carbon. The amount of glassy phase and unburnt carbon influences the property of fly ash.

In general, fly ash is a pozzolana and this pozzolanic activity has opened up areas of its utilization particularly in building industry and in civil construction. The common areas of utilization of fly ash are

- Portland-pozzolana cement
- Cement fly ash concrete
- Pre cast fly ash blocks
- Fly ash bricks
- Lightweight aggregates
- Portland cement clinker
- Road and artificial pavement construction
- Insulating cement.

Since the chemical composition of fly ash does not differ much from clay, large amount of fly ash can be used in the manufacture of burnt clay bricks. However, mixing of fly ash lowers the plasticity of clay.

UTILISATION OF WASTES OF NON-FERROUS IN INDUSTRIES

Nonferrous industries also generate waste, which can be converted into wealth. Utilisation of wastes generation by Aluminium industries is discussed below.

RED MUD

Red mud is a waste from alumina plants where crushed bauxite ore is digested in caustic soda at elevated temperature in an autoclave. It is washed to recover caustic soda, then pumped in the form of slurry into the residual disposal area. For production of 1 ton of aluminum 3.5 tons of bauxite is needed resulting in 2 tons of residue. Attempts have been made to utilize red mud in producing bricks and acoustic tiles by mixing with suitable Shali [3].

The quantity of red mud generated throughout the world are far in excess of any potential use. Due to presence of high iron-oxide and high density of red mud, this is not very attractive in manufacturing any building materials. However the materials can be considered for roads.

INDIAN SCENARIO

India generates about 70 Mt of fly ash by 65 Thermal Power Sectors. At present most of the fly ash is dumped in the vicinity of thermal power stations or thrown into rivers. India has large reserves of bauxite and large quantities of red mud are generated. No concrete step has been taken to utilize the huge quantity of red mud generated in these plants. Similarly blast furnace of steel plants generate huge quantity of slag part of which is used for the manufacture of cement and road construction materials.

CONCLUSIONS

Industrial wastes can be converted to wealth. Waste utilization should be an integral part of any industrial manufacturing system. It is necessary to characterize waste to fully exploit its potential and develop viable technologies.

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