Plastic Waste Useful Alternative Fuel for Co-Processing in Cement Factory

Ruchi Singh Rajput¹, Archana Paranjpe²

¹M.Tech. Scholar, ²Asst. Prof. Dept. of EX, Takshshila Institute of Engineering & Tech.

I. PRESENT SCENARIO & CHALLENGES

About 6.2 tonnes of hazardous waste is generated by India annually, of which around 3.09 million tones is recyclable, 0.41 million tonnes is incinerable and 2.73 million tones is land-fillable. With increase in population and increase in per capita consumption, increasing quantum of hazardous waste is generated every year. The local administration, civic bodies and policy makers are posed with a serious concern of its effective & safe disposal.

The use of cement kilns have been utilized by all developed nations as an effective option for industrial, municipal and hazardous waste disposal. Spiraling fuel costs, uncertainty in fuel availability and goal to reduce CO₂ emissions has led few cement plants in India to use alternative fuels. However, the current thermal substitution rate (TSR) in Indian cement industry is less than 2% as compared to some European countries that have a thermal substitution rate as high as 40% (Perspectives and limits for cement kilns as a destination for RDF).

However, we must ignore what the environmentalists say on this extensive usage of plastic. The fact that plastics are too cheap and way too durable makes their use very extensive. Their durability and lack of bio-degradability makes them accumulate in the biosphere. We definitely do not want our descendants to remember us by the billions of Styrofoam cups tossed away each year. The widespread presence of and nuisance caused by plastic has encouraged its recycling, and now this process is gaining momentum. This process allows the use of plastic again and again.

With the advanced lifestyle the consumption and disposal has brought major problem of solid waste management. Plastic create threat to the environment in the form of long lasting waste. It is not biodegradable and hence, remains in Environmental cycle with its ill effects for a long time. Therefore in todays scenario plastic waste management is of great concern. Plastic carry bags made from the recycled plastic using substandard colors have been proven to be dangerous for the health.

Figure 1: Waste Generation [2012][1]

Figure 2: Hazardous Waste generation geographic split [%][2]

- Total estimated Incinerable Hazardous Waste in India 6, 50,000 tonnes per annum
II. TECHNIQUE OF CO-PROCESSING FOR PLASTIC WASTE MANAGEMENT

Proper disposal of plastic waste is of great concern in the prevailing time due to improper collection and segregation. In order to minimize its adverse effect some technologies have been developed. Today incineration is a worldwide accepted technique for plastic waste disposal, although due to release of toxic gases like chlorinated dioxins and furans it is not much preferred. Efforts are put to consolidate innovative technical options for safer disposal of plastic waste. Proper usage of waste as raw material or to replace natural mineral resources and fossil fuels such as coal, petroleum and gas is the process of Co-processing.

Today most of the energy recovery in industrial sector mostly in energy intensive industries (EII) is done through the process of co-incineration.

The harnessed Waste for Co-processing are referred to as alternative fuels and raw materials (AFR).

III. IDEA OF CO-PROCESSING

It is a proven sustainable development technique that reduces demand on natural resources, moreover it also contribute to reduce environmental footprint. The technique of Co-processing is based on the principles of industrial ecology, which considers the best features of the flow of information, materials, and energy of biological ecosystems.

IV. WASTE MANAGEMENT HIERARCHY

It’s extremely important and urgent to decide on waste hierarchy so waste streams that can’t be recycled or reused and those that are suitable for co-processing are not sent to incinerator, landfill or other processing industries[2]. At present, there are no clear guidelines categorizing the kind of waste and what is the most suitable strategy for its disposal- landfill, incinerator or co-processing. Different State Pollution Control Boards across the country maintain an inventory of hazardous waste that is categorized into landfill waste, recyclable waste, and incinerable waste. A new category “Co-processing” waste could be added.

V. POTENTIAL OF CO-PROCESSING

The global industrial demand for energy is roughly 45% of the total demand and the requirements of the energy intensive industries (EII) are more than half of the total industrial demand, at 27%.

Worldwide, wastes suitable for Co-processing have an energy potential equivalent to nearly 20% of the fossil fuel energy used by the EII and coal-fired power plants. By 2030, the thermal substitution rate of waste could rise to nearly 30%. In the EU-25 countries of Europe, the available energy potential in waste currently represents nearly 40% of this demand, and this is expected to rise to almost 50% by 2030.

However, in the year 2004 in EU-25, less than 10% of the energy content of the waste that was not being reused or recycled was utilized by the EII and power plants. This figure indicates to which extend the high potential of waste as alternative fuel and a source of materials is being neglected.

The waste which can be used roughly for the process of co-processing is biomass. Therefore this concept of co-processing plays a vital role for the reduction of greenhouse gas emissions from fossil fuels. Moreover diverting industrial waste streams from incinerators and landfills without energy recovery contributes to reducing overall CO2 emissions (as illustrated in the figure below) [4].
VI. CEMENT PLANT CO-PROCESSING: A SUSTAINABLE APPROACH

- Waste fuel used in incineration plant for incineration, substitute fossil fuel for cement plant requirement [3].
- The co-combustion of waste fuel and fossil fuel does not increase any emission level with respect to CO₂, SO₂ & NOₓ.

Other factors that must be considered when Co-processing waste include product quality standards, permitting aspects, and transparent communication in order to gain public acceptance [5].

VII. CO-PROCESSING OF PLASTIC WASTE IN CEMENT KILNS AND POWER PLANTS

The use of waste materials in industry process such as power stations and cement industry is known as co-processing. It basically means the substitution of primary fuel and raw material. Waste material such as plastic waste used for co-processing are referred to as alternative fuels and raw material (AFR). The technique of co-processing offer advantages for cement industry and for municipal authorities. In other hand, cement producers or power plants can save fossil fuel and raw material consumption, contributing more eco-efficient production. In addition, one of the advantage recovery method used in existing facility, eliminating the need to invest on other plastic waste practices and to secure land filling. The schematic flow diagram of the process is shown at Figure.

VIII. A SOUND ALTERNATIVE - CO-PROCESSING

The process of Co-Processing we manage the waste materials in production process of lime, cement or steel production and power stations.

Figure 7: Temperature of Co processing [6]

Global environmental impacts, decreases the cost of waste management within the waste hierarchy. ACC Non recyclable plastic waste Management Rag Capacity: 4 MT per Hr.
IX. ENERGY RECOVERY THROUGH PLASTIC WASTE FROM JABALPUR CITY

In order to explore co-processing as an option for disposal of certain fractions of municipal solid waste an Exposure Visit was organised to Jabalpur and ACC Cement Plant at Kymore. Discussions were also held in Hotel Satya Ashok, Jabalpur to chart a way forward after the visit [4]. Given below are the objectives of the workshop, target group and expected outcome at the end of the program. Kymore (Katni) 2.2 million tons of cement per annum was produced here.

![Figure 6: ACC AFR Feeding System - Starter Kit [5]](image)

<table>
<thead>
<tr>
<th>Industry</th>
<th>No. of Klin</th>
<th>Cement Capacity, MTA</th>
<th>Clinker Capacity, MTA</th>
<th>Energy Consumed KWH</th>
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<tr>
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<tr>
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<td>Vikram Cement</td>
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<td>3.0</td>
<td>2.95</td>
<td>92</td>
</tr>
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X. ASSESSMENT OF PLASTIC WASTE GENERATION IN THE M.P.

Information regarding municipal solid waste generation was collected from the local bodies through the Regional Offices of the Board. It is estimated that around 4500 T/day municipal solid waste is generated from 342 local bodies of the state around 6% means 25.86 T/day plastic waste and after recycling 38.82T/day generate in M.P. . It is also estimated that plastic waste to the effect of 2-8% of the municipal solid waste according to the size and nature of local body. On an average plastic waste generation is 6% of the municipal solid waste [5].

XI. CONCLUSION

The co-incineration result shows that there is no unfavorable impact on the environment, clinker and cement properties. Hence co-incineration of plastic waste is one of the best alternatives for its disposal, saving of energy resource, in ecologidal sustainable and environmental friendly manner [6]. The co-incineration of coal and waste plastics reduces the overall CO2 emissions, after replacement of coal by plastic waste the total reduction of CO2. The cost of collection and treatment may limit the use of waste plastics’ Interactions between coal and waste plastics can improve combustion efficiency[7].

The plant is serving the twin purpose of keeping the city clean and to conserve the energy resources available in the form of plastic waste the final product of the plant, is being disposed off commercially as a good substitute of conventional fuel in the industries and Power plants located around Madhya Pradesh. In India, ACC has been the pioneer in this. An efficient cement kiln can provide an environmentally sound and cost-effective treatment/recovery option for a number of wastes.

REFERENCES