ENVIS

MANAGEMENT OF PLASTICS, POLYMER WASTES AND BIO-POLYMERS AND IMPACT OF PLASTICS ON THE ECO-SYSTEM

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INDIAN CENTRE FOR PLASTICS IN THE ENVIRONMENT

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Use of Plastics Waste in Blast Furnace

Due to its multifacet benefits, use of plastics in variety of applications has been increasing at a galloping rate all round the world, including in India.

Plastics contribute various benefits to the modern world from providing safe and hygienic packaging materials for food and food products, to conserving Land, Water, Forests and Energy resources and to practically in all areas of our daily life. However, the management of the waste created by discarded used plastic items, especially the ones used for packaging applications has become a challenging task in developing countries. Developed countries have established effective infrastructure for the management of plastics waste of all kinds by adopting proper collection system and different recycling technologies. Out of the different recycling technologies, recovery of fuel and energy from plastics waste is a very important and effective option.

Use of plastics waste in blast furnaces as an alternative raw material for generating energy has been developed in some countries.

Use of Plastics Waste as Reducing Agent in Blast Furnace

For the smelting of Iron ore for producing pig iron, traditionally coke is used in the blast furnace to generate carbon monoxide (CO) and heat. Many steel companies use pulverized coal, to reduce the cost of raw material. Waste Plastics have replaced a part of coke or pulverized coal for producing pig iron from iron ore. Plastics, when burnt in the absence of sufficient oxygen, produces CO apart from generating the heat energy. This property of plastics has been utilized in blast furnace.

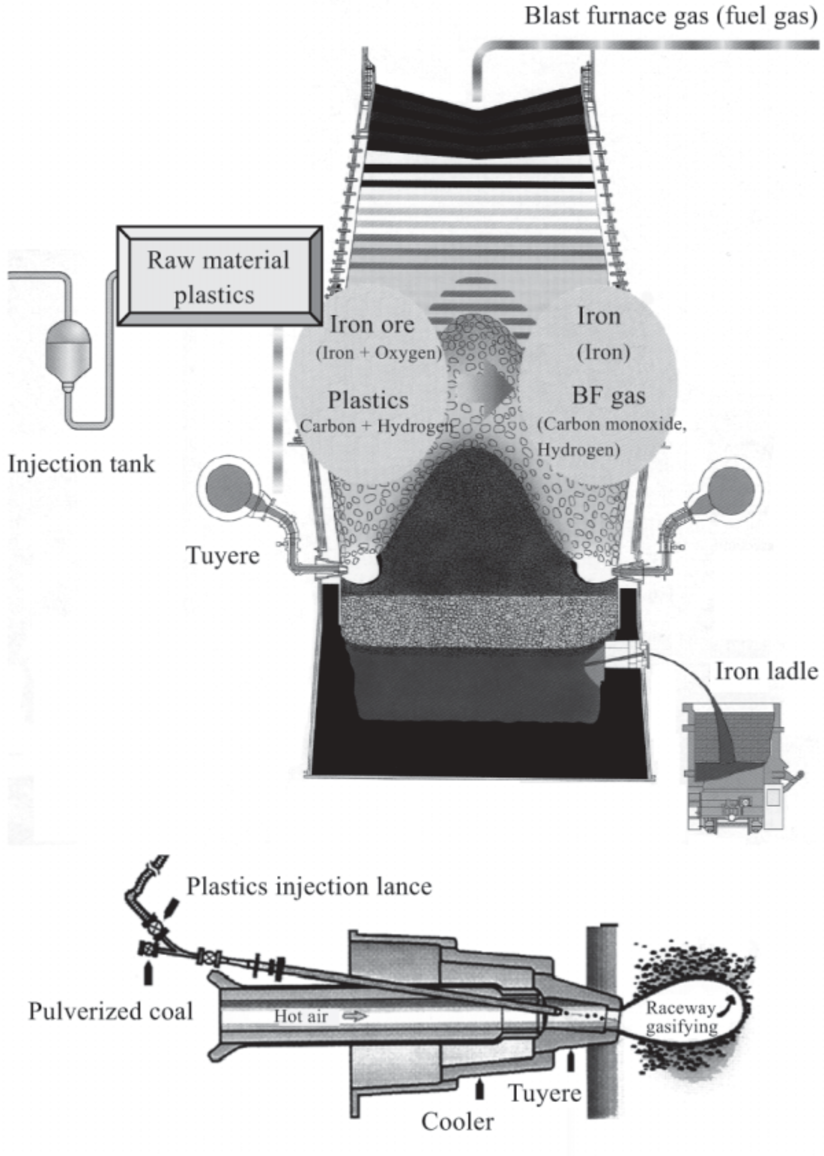
The Process

The plastics waste is first formed into suitable size either by crushing or pellatising as necessary, and subsequently injected into the blast furnace from the tuyeres at the base of the furnace with hot air. The injected plastic waste material is broken down to form reducer gas – Carbon Monoxide (CO) and Hydrogen (H_2). The reducer gas rises through the raw material layers in the blast furnace and reacts with iron ore. While reducer gas reacts with the iron ore to produce pig iron, the gas, after the reduction reaction, is recovered at the top of the blast furnace which has an energy content to the tune of 800 kcal/NM^3 and is reused as a fuel gas in heating furnaces and generators within the steel plant.

The reactions involved in the process

(A) In the presence of coke or pulverized coal only:

Coke or pulverised coal is burnt rapidly in the first stage of operation when, in the



Blast furnace process and tuyeres

presence of oxygen, carbon-dioxide is produced.

$C + O_2 = CO_2$

When the oxygen in the passage area is fully consumed, carbon monoxide is produced by the reaction of freshly produced carbondioxide with the coke.

(i) $C + CO_2 = 2\,CO$

The carbon monoxide reduces the iron ore into pig iron.

(ii) $Fe_2O_3 + 3CO = 2Fe + 3CO_2$

(B) In the presence of plastics waste along with coke:

Plastics materials break down to CO and Hydrogen. This presence of hydrogen, produced by burning of plastics, contributes to the reduction reaction thus reducing the amount of CO_2 generated by coke. (When the waste is polyethylene.)

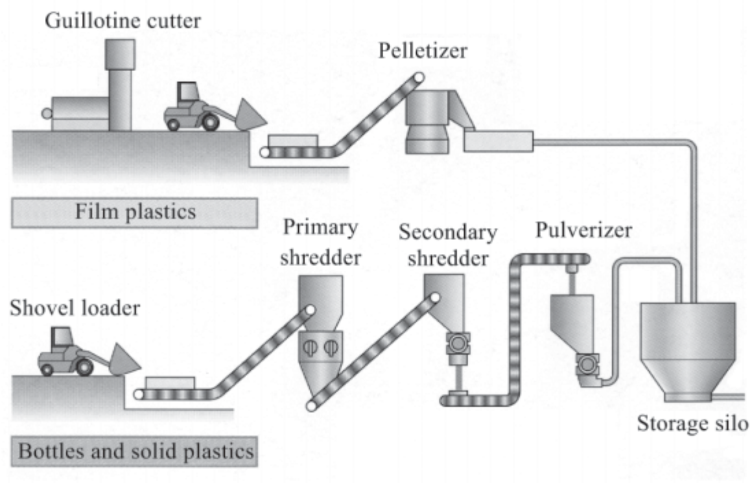
(i) $^{1}/_{2}C_2H_4 + CO_2 = 2CO + H_2$

(ii) $Fe_2O_3 + 2CO + H_2 = 2Fe + 2CO_2 + H_2O$

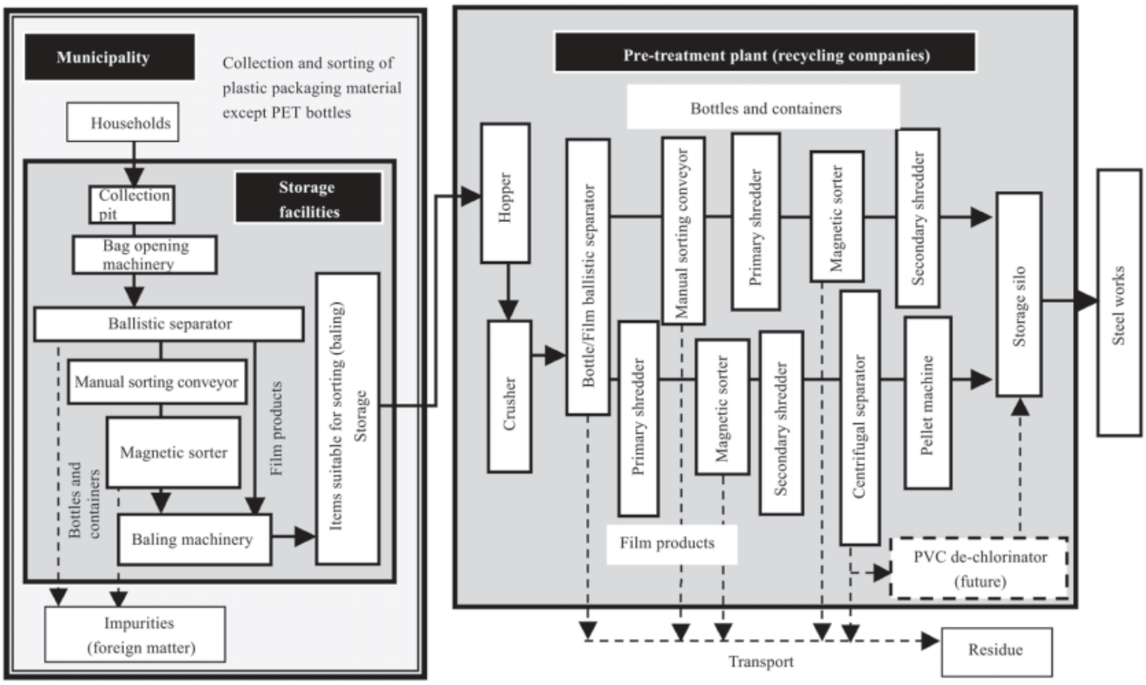
The Blast furnace temperature reaches up to around 2000 °C

Plastics may replace coke or coal for the reduction reaction. However, coke has a special function in the blast furnace in moving the gases, liquids and solids within the blast furnace. Plastics and pulverized coal cannot perform this specific function and hence the substitution of coke is possible only up to a certain limit, which has been established at approximately 40% (compared to coke).

As per this calculation, a steel manufacturing facility having production capacity of 3 million tonnes per annum, can consume 600,000 MTs plastics waste annually. When the



Equipment for conversion of industrial waste plastics to blast furnace material



Processing flow of recycling plastic packaging material except PET bottles for use as blast furnace material

cost of waste plastics is less than coke, use of plastics waste reduces the raw material cost. Use of plastics waste also reduce the ash generation, ensuring more cleaner operation. There are varieties of low-end plastics waste, whose cost is lower than coke. Basically, these low-end plastics waste create waste management problem as the waste pickers find it unviable to pick up those for normal mechanical recycling. With the utilization of all types of low-end plastics waste in the blast furnace, the waste management problems can be solved to a great extent.

Types of plastics waste which may be used in Blast Furnaces:

Normally hydrocarbon rich plastics are the preferred raw materials. There is no problem of using chlorine containing plastics, like PVC in the blast furnace. The hydrogen chloride generated during the burning process, is readily neutralized by the limestone used inside the blast furnace. The high temperature environment inside the blast furnace (around 2000°C) also ensures that there is no possibility of any dioxin formation even if PVC is processed. Furthermore, as the reducing atmosphere in the low-temperature region at the top of the furnace contains no oxygen, no dioxins are produced or re-synthesized in the lower temperature zone also. However as no counter measures are taken against hydrogen chloride corrosion of the equipments used in the treatment or utilization of blast furnace gas, use of chlorine containing plastics like PVC is avoided.

Precautions taken for preparing the plastics waste before injecting into the blast furnace:

1. Reasonable cleaning of the waste, especially from food waste and contamination of non-plastics materials, especially metals.
2. Uniform sizing of the waste.
3. Special measures are required for using expanded polystyrene (EPS/Styrofoam) articles.

Small amounts of paper, stones and sand included in the plastics waste pose no problem as these are discharged as slag.

Visualizing this prospect of utilizing plastics waste as the fuel and reducing agent in the blast furnace, Central Pollution Control Board is also encouraging such practice in India. This would ensure that plastics waste is used as an alternate raw material replacing fossile fuel and also ensuring environment friendly way of plastics waste management in the country.

ICPE Team has already undertaken this idea and initiated discussion with a leading Steel Manufacturer in the country.

Based on information received from published article of M/s. NKK Keihin Works, Japan and ICPE Team's discussion with leading Steel Manufacturers in India.

For more details:
http://www.jfe-steel.co.jp/archives/en/nkk_giho/84/pdf/84_01.pdf

Use of Plastics Waste in Cement Kilns

One of the most effective methods of recycling of plastics waste for recovery of energy is the use of plastics waste as an alternative to fossible fuel in Cement Kilns.

Plastics Waste can replace approximately 15% of normal fossil fuel in Cement Kilns. Successful trials have already been conducted in some cement kilns of India for using agricultural waste, like rice husk, as alternative fuel. In fact, any material having calorific value of at least 2,500 kcals are accepted as an alternative fuel in cement kilns, provided it is available at a cost less than the normal fossile fuel:coal. Plastics waste, which have quite high calorific values, some which having more than that of coal, offer a viable alternative fuel.

As Cement Kilns are operated at a very high temperature in the range of 1500 °C or more, there is no risk of generation of any toxic emission due to the burning of plastics waste. In fact, Cement Kilns can be utilized for burning of some hazardous waste also.

A 1 million ton capacity cement plant can consume about 10000 MTs to 30,000 MTs of plastics waste annually, creating an enormous opportunity for the proper management of plastics waste, while recovering precious energy out of it for production of cement – one of the basic materials of infrastructure development.

Central Pollution Control Board realized this opportunity of using cement kilns as an alternative incinerator and has allowed some cement plants for conducting operational trials under controlled conditions and supervision.

ICPE Team has discussed this prospect of using various plastics waste in cement kilns with National Council for Building Materials (NCB), Ballabgarh, Haryana. NCB and ICPE propose to work together to develop this application in India.

ICPE Website on NIC Server

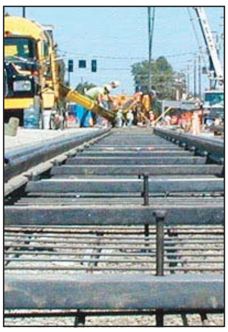
ICPE Website is now also hosted on NIC Server, which is under the Ministry of Environment and Forest.

The Website has been modified making it user-friendly with inclusion of more useful information, division into proper categories.

Log on to:
www.icpeenvis.nic.in

Railway Sleepers from Waste Plastics

These environmentally friendly and cost-effective products are finding ready acceptance in the marketplace. As an alternative to wood ties, these plastic sleeper have the potential of saving millions of trees and utilizing millions of pounds of waste plastics from landfills. The sleeper is not affected by chemicals, termites, fungus, rotting, or other problems usually associated with wood products. In addition, lab tests conservatively project a life cycle of at least fifty years, so maintenance costs are practically nonexistent.



http://www.envis-icpe.com
Website Hits in January 2006

Total Hits	63,848

Time of Browsing

Time	Hits
03.00 pm to 04.00 pm	5554
04.00 pm to 05.00 pm	4462
11.00 am to 12.00 am	4270
10.00 am to 11.00 am	4029
01.00 pm to 02.00 pm	3864
05.00 pm to 06.00 pm	3772
02.00 pm to 03.00 pm	3599
12.00 am to 01.00 pm	3373
07.00 pm to 08.00 pm	3275
09.00 pm to 10.00 pm	3274
10.00 pm to 11.00 pm	3075
08.00 pm to 09.00 pm	3070
06.00 pm to 07.00 pm	2890
11.00 pm to 12.00 pm	2267
09.00 am to 10.00 am	2250
12.00 pm to 01.00 am*	1794
08.00 am to 09.00 am	1690
06.00 am to 07.00 am	1274
07.00 am to 08.00 am	1225
02.00 am to 03.00 am*	1090
03.00 am to 04.00 am*	1038
05.00 am to 06.00 am*	964
04.00 am to 05.00 am*	919
01.00 am to 02.00 am*	830

* Indicate overseas Hits

Document	Views
/index.html	551
/newsbank.htm	253
/recyclingprojects.html	222
/biodegradable_plastics.htm	210
/mythsnrealities.html	155
/Overview_plastics.htm	140
/useful_links.html	135
faqs.html	128
/resourceconservation.html	121
/about.html	118

Type of Files Requests

Filename	Downloads
/images/icon_top.gif	2081
/images/but_bg_norm.gif	1982
/style.css	1938
/images/but_bg_over.gif	1671
/images/bg_lhs.gif	1611
/images/spacer.gif	1583
/images/top_logo.gif	1549
/images/bg_top.gif	1532
/images/bg_rhs.gif	1505
/menu_array.js	1436
/images/top_rhs.gif	1425
/mmenu.js	1402
/images/bg_tablemid.gif	1395

Filename	Downloads
/index.html	551
/images/tb_bg.gif	376
/Envis-Aug-04.pdf	372
/Envis-Apr-04.pdf	271
/newsbank.htm	253
/images/pic_recyclingprojects.jpg	246
/recyclingprojects.html	222
/biodegradable_plastics.htm	210
/images/hd_recyclingprojects.gif	203
/images/pic_bio.jpg	196
/cons-zone-address.xls	193
/images/hd_biodegradable.gif	178

Biodegradable Plastics

Brief Report of MoEF Meeting held on 12th May, 2006

MoEF had invited ICPE, along with other institutes, Govt. Dept. and other organisations for a discussion on 12th May, 2006 on matters relating to Degradable Plastics, allocation of specific Exim code for biodegradable thermoplastic materials, sorting out the anomalies between PFA and RMPU rules regarding use of coloured plastic containers for packaging and storing of food and food products. ICPE delegation led by Mr. Sujit Banerji, submitted ICPE comments on the points of discussion.

A brief is given below:

Definitions of Biodegradable Plastics:

MoEF desired to finalise the definition of Biodegradable Plastics. However, it was brought to the notice of MoEF that the matter is under consideration (draft stage) at BIS and this can be finalised at BIS Meeting only. A brief status on the Standardization process taken up at BIS was brought to the notice of the members. BIS Representative indicated that the shortest time that a BIS Specification took was 6 months for a reasonably easy subject matter (drinking water in pouches). However, as biodegradable plastics involve lot of scientific explanations, etc., it may take longer time. BIS indicated that in case of urgency BIS could adopt the ISO Specification on the subject immediately without any change.

On this, ICPE Representative indicated that there is a stipulation in the BIS protocol that unless the testing protocols are available in the country, no BIS Standard could be adopted for any product. BIS Representative also supported this. CIPET Representative indicated that the testing protocols could be implemented in many of the CIPET laboratories within the country, timeframe could not be ascertained though.

MoEF, CPCB and DCPC desired to become members in the BIS Committee for making biodegradable plastic standards. BIS Representative advised them to write to BIS officially for this purpose and they could be included in the Committee.

Specific Areas of Application:

ICPE strongly advocated that biodegradable plastics should by encouraged in specific applications like mulch films/nursery bags, etc., and not for general carry bags application. The representative from a supplier of Biodegradable plastic film maintained that the biodegradable plastics should be used for making carry bags also and they requested Government to offer subsidies for popularising biodegradable plastics. ICPE Members requested MoEF to amend the Delhi Act on use of biodegradable plastics for the collection of hospital waste and food waste.

Hospital waste is considered hazardous and is required to be incinerated or treated separately. There is no sense in collecting hospital waste in biodegradable bags. Similarly, food waste, when dumped naturally, takes a few days to weeks to become compost or degrade naturally. Biodegradable bags take several months to degrade. Food waste collected in Biodegradable bags and dumped into the dump yard as such, would not be able to degrade naturally, rather it would generate harmful germs in the process.

Coloured Containers:

MoEF proposed to do away with any pigments for plastic containers which will be used for packaging of food or food products. This proposal was objected to by ICPE. On a pointed question by MoEF on ICPE's view on the subject, ICPE reiterated its stand on the subject saying that coloured containers are required for branding, codification and in some cases protection of the content also. The BIS specifications are available for pigments to be used for such coloured plastic containers. However, MoEF still maintained that it was facing problem to control the use of non-standard pigments for making containers which are used for packaging of food and food products. However, ICPE brought it to the notice of the members that coloured containers are used across the world for this purpose. Approved pigments should be allowed to continue to be used and strict action should be taken against those who use non-standard pigments for manufacturing containers to be used for packaging of food and food products.

MoEF decision would be known on a later date.

ISO Standards on Degradable Plastics

1.	ISO 14851:1999 ISO 14851:1999/ Cor 1:2005	Determination of the ultimate aerobic biodegradability of plastic materials in an aqueous medium – Method by measuring the oxygen demand in a closed respirometer
2.	ISO 14852:1999 ISO 14852:1999/ Cor 1:2005	Determination of the ultimate aerobic biodegradability of plastic materials in an aqueous medium – Method by analysis of evolved carbon dioxide
3.	ISO 14853:2005	Plastics – Determination of the ultimate anaerobic biodegradation of plastic materials in an aqueous system – Method by measurement of biogas production
4.	ISO 14855-1:2005	Determination of the ultimate aerobic biodegradability of plastic materials under controlled composting conditions – Method by analysis of evolved carbon dioxide – Part 1: General method
5.	ISO 15985:2004	Plastics – Determination of the ultimate anaerobic biodegradation and disintegration under high-solids anaerobic-digestion conditions – Method by analysis of released biogas
6.	ISO 16929:2002	Plastics – Determination of the degree of disintegration of plastic materials under defined composting conditions in a pilot-scale test
7.	ISO 17556:2003	Plastics – Determination of the ultimate aerobic biodegradability in soil by measuring the oxygen demand in a respirometer or the amount of carbon dioxide evolved
8.	ISO 20200:2004	Plastics – Determination of the degree of disintegration of plastic materials under simulated composting conditions in a laboratory-scale test
9.	ISO/DIS 14855-2	Determination of the ultimate aerobic biodegradability of plastic materials under controlled composting conditions – Method by analysis of evolved carbon dioxide – Part 2 Gravimetric measurement of carbon dioxide evolved in a laboratory-scale test
10.	ISO/DIS 17088	Specifications for compostable plastics

American Standards for Testing Material on Degradable Plastics

ASTM D5951-96 (2002)	Standard Practice for Preparing Residual Solids Obtained After Biodegradability Standard Methods for Plastics in Solid Waste for Toxicity and Compost Quality Testing
ASTM D5210-92 (2000)	Standard Test Method for Determining the Anaerobic Biodegradation of Plastic Materials in the Presence of Municipal Sewage Sludge
ASTM D5271-02	Standard Test Method for Determining the Aerobic Biodegradation of Plastic Materials in an Activated-Sludge-Wastewater-Treatment System
ASTM D5988-03	Standard Test Method for Determining Aerobic Biodegradation in Soil of Plastic Materials or Residual Plastic Materials After Composting
ASTM D6340-98	Standard Test Methods for Determining Aerobic Biodegradation of Radiolabeled Plastic Materials in an Aqueous or Compost Environment
ASTM D6691-01	Standard Test Method for Determining Aerobic Biodegradation of Plastic Materials in the Marine Environment by a Defined Microbial Consortium
ASTM D6776-02	Standard Test Method for Determining Anaerobic Biodegradability of Radiolabeled Plastic Materials in a Laboratory-Scale Simulated Landfill Environment
ASTM D6692-01	Standard Test Method for Determining the Biodegradability of Radiolabeled Polymeric Plastic Materials in Seawater
ASTM D6954-04	Standard Guide for Exposing and Testing Plastics that Degrade in the Environment by a Combination of Oxidation and Biodegradation
ASTM D6400-99	Specification for Compostable plastics

Technical Meet on Waste Incineration Technologies

18th-19th April, 2006 – New Delhi

FICCI had organised a Technical Meet on Waste Incineration Technologies during 18th-19th April at New Delhi.

This two-day meet was designed to provide various techno-managerial aspects relating to identification and segregation of incinerable waste generated, their handing and storage, various technological options available for thermal destruction of these waste, the regulatory/legal aspects relating to management of incinerable wastes, selection of appropriate technology/equipment as per specific waste characteristics operational issues, measurement & analysis of pollutants from incineration of waste, etc.

The Salient Points of the presentation and discussions are given below:

- Successful incineration of hazardous waste depends on the incinerator design and operation technique of the incinerator depending upon the type of waste to be incinerated. Non-adherence to these two basic principles caused failures of various incineration activities in the 80's raising doubt about the effectiveness of this process itself. However, subsequent adoption of proper design and appropriate operation after careful analysis of the waste, have again brought back the reliability of incineration as one of the best options of hazardous waste treatment.
- The primary objective of incineration is hazardous waste treatment. Energy recovery and obtaining any other benefit, should not hinder this primary objective.
- Cement kilns are considered as very good option for acting as an incinerator for certain types of hazardous waste. CPCB encourage use of cement kilns for such activity.
- Plastics are part of municipal waste goes for incineration in a facility near Chandigarh. It has been acknowledged by the facility that without plastics, the calorific value is very low and cost of operation is higher.
- CPCB have given permission to 4 cement plants on experimental basis for using various hazardous waste as fuel. Results are encouraging. There are about 170 cement plants (kilns) in the country, which can use hazardous waste as fuel. This would help the national economy also, as the requirement of dedicated incinerators for treating specific types of hazardous waste could come down.

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Website hits for Jan.-Jun. 2006

Months		Hits	Months		Hits
January	:	63,848	April	:	NA
February	:	58,070	May	:	44,488
March	:	NA			

Indian Centre for Plastics in the Environment

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Indian Centre for Plastics in the Environment

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