

Disposal of Plastics Waste through Co-processing in Cement Kilns

Cover Story **1**

Disposal of
Plastics Waste through
Co-processing
in Cement Kilns

Conference **7**

Municipal Solid Waste &
Plastics Waste:
Issues and Solutions

Awareness Programmes **8**

Data Sheet **Inside
Back Cover**



Disposal of Plastics Waste through Co-processing in Cement Kilns

Disposal of Plastics Waste through Co-processing in Cement Kiln is a known and accepted process of Municipal Solid Waste Management in many developed countries.

ICPE had brought out brief notes on this process in its earlier Issues. More details of the process have now been brought out along with test results of the trials conducted – for the first time in India, in an ICPE sponsored project at the cement plant of the leading cement manufacturer of the country – ACC Ltd.

– T. K. Bandopadhyay,
Sr. Technical Manager – ICPE



Due to its multifaceted benefits, use of plastics in a variety of applications has been increasing all around the world, including India. Though 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 practically in all areas of our daily life, 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. The increased use of plastics products, about 50% of which go for packaging applications alone and hence are discarded shortly after using the content has increased the quantity of plastics in the solid waste stream to a great extent. Recycling has now assumed great importance in the context of solid waste management.

The new technologies and economics have come to play an important role in plastics recycling. Recycling principally refers to Recovery, which is divided into Material Recycling and Energy Recovery. Material Recycling is again divided into Mechanical and Feedstock Recycling. The choice between Mechanical Recycling, Feedstock Recycling or Energy Recovery depends on the types of plastics waste and the relative ease / difficulty in total or partial segregation from other plastics and / or other waste materials.

Mechanical recycling includes a wide variety of processing techniques and a broad range of processing methods. Pure grade production scrap may only have to be reground and reprocessed, mixed plastics have to be mechanically separated and, if contaminated, also adequately washed and cleaned. All these steps increase the cost depending on the degree of contamination. To avoid the extra work involving extra cost and other numerous problems, proper segregation of wastes at



ACC & ICPE Team Members of the Project

instead of dumping them diffusely on landfills. This recovers their calorific values and at the same time disposes of the waste in a scientific manner without causing any environmental hazards.

Many developed / developing countries are disposing these otherwise unattended plastics waste in the Municipal solid waste stream through co-processing in Cement Kilns (Energy Recovery) and using in Blast Furnaces of Steel Industries (Feedstock Recycling) in a scientific and environmental friendly method. Conversion of all types of mixed plastics waste into Industrial Fuel (another example of Feedstock Recycling) is also a recent development. Though both processes (Co-processing in Cement Kiln and Conversion to Industrial Fuel) can handle all types of plastics including laminated / multilayer plastics, without any segregation and without thorough cleaning of the waste, fresh investment is required for the Fuel Conversion route

while some modifications in the Feed Section are required for the existing Cement Kilns in case of Co-processing.

However, in India the method of disposal of plastics waste in Cement Kilns (or in blast furnaces) are not practiced as yet. ICPE initiated a project along with the leading manufacturers of cement in the country, ACC Limited to find out the possibilities of disposing plastics waste through co-processing in the cement kilns in Indian

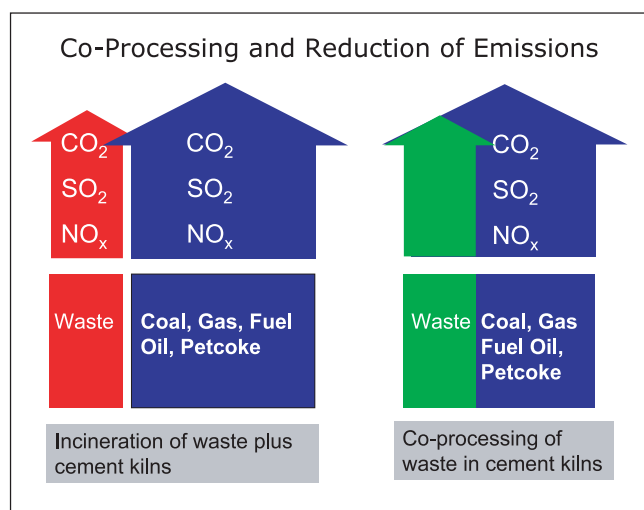


Mr. T. K. Bandopadhyay of ICPE, Mr. Vivek Chawla & Mr. U. Parlikar - both of ACC making presentation to MPPCB

conditions. The project had active support from Central Pollution Control Board (CPCB). With the active cooperation and formal clearance from Madhya Pradesh Pollution Control Board (MPPCB) to conduct a trial of co-processing plastics waste in the Kaymore Plant near Katni, MP of ACC, a systematic trial was conducted during 29th-31st March, 2008 to record any possible environmental implication associated with the process.

Trial details

Different types of plastics waste were used in the trial including – Polyethylene (LDPE / HDPE / LLDPE), Polypropylene (Homo and Copolymer), Polystyrene (GPPS and HIPS), Polyethylene Terephthalate (PET), Acrylonitrile Butadiene Styrene (ABS), Nylon, Polyacetal, Polybutylene Terephthalate (PBT), etc. PVC was excluded from the initial



trial stage as the cement kiln was not equipped to handle the situation which may arise due to the possible formation of HCl or chlorine. The emission samples prior to co-processing, during co-processing and post co-processing were collected by SGS Laboratories – who are approved by CPCB for conducting such tests. The samples were tested as per the international testing protocol on the subject matter in the SGS Laboratory facilities at India and Belgium.

Parameters monitored during each phase of the co-processing trial:

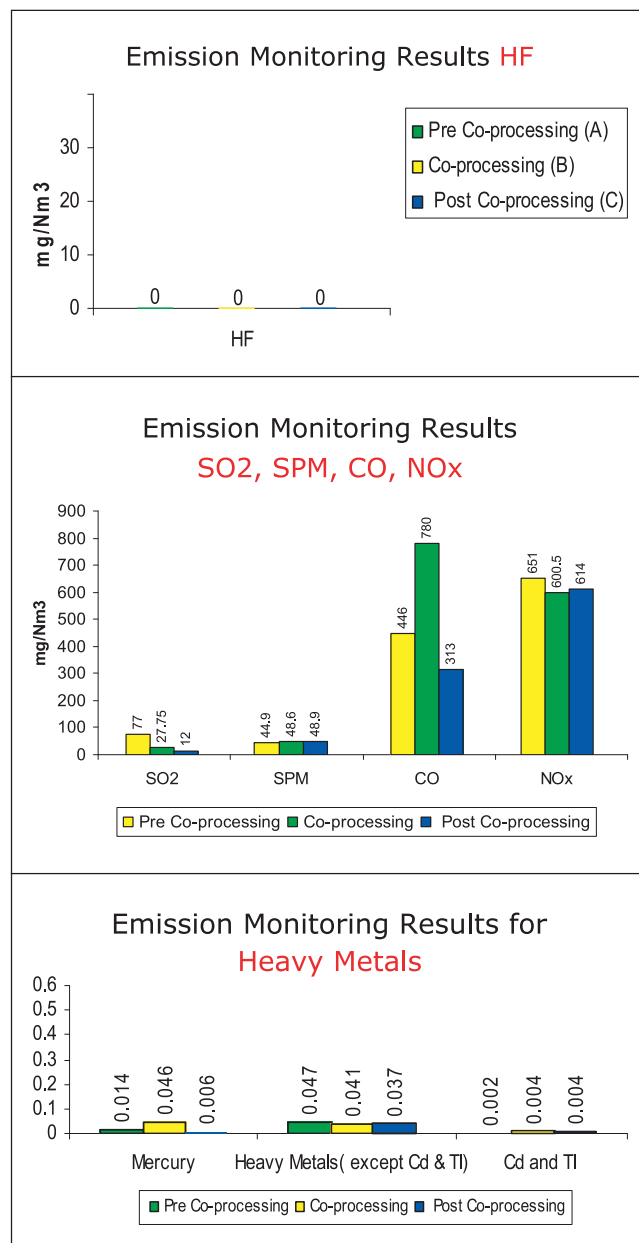
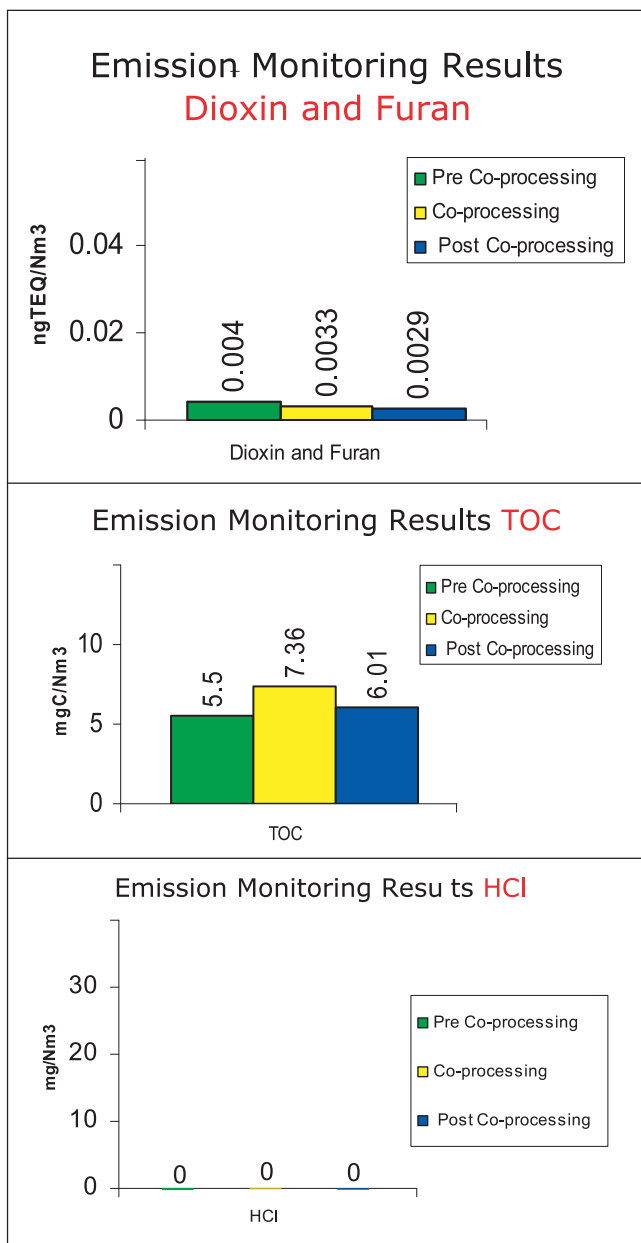
- Dioxins & Furans
- HCl
- Hg and other Heavy Metals
- CO₂
- NO_x
- Oxygen and Moisture
- TOC
- HF
- Particulate
- CO
- SO₂

Parameters	USEPA Method No.
Particulate	17
CO ₂ , CO, O ₂ , Moisture	3 B
NO _x	7 E
HCl	26
HF	26
Heavy Metals	29
SO ₂	6 B
Mercury	29/10 1 A
Dioxins / Furans	23 A
TOC	25 A

The summary of test results is given below:

Summary: Emission Monitoring Results

Parameters	Units	Stack emission during trial		
		Pre Co-processing	During Co-processing	Post Co-processing
Dioxins & Furans	ng/TEQ/Nm ³	0.004	0.0033	0.0029
TOC	mgC/ Nm ³	5.5	7.36	6.01
HCl	mg/ Nm ³	ND	ND	ND
HF	mg/ Nm ³	ND	ND	ND
SO ₂	mg/ Nm ³	77	27.75	12
SPM	mg/ Nm ³	44.9	48.6	48.9
CO	mg/ Nm ³	446	780	313
CO ₂	Vol - %	17.8	17.6	17.8
NO _x	mg/ Nm ³	651	600.5	614
Mercury	mg/ Nm ³	0.014	0.046	0.006
Metals (except Cd & Tl)	mg/ Nm ³	0.047	0.041	0.037
Cd & Tl	mg/ Nm ³	0.002	0.004	0.004



Discussion of the result

It is observed that the emission levels of various gaseous substances including Dioxins and Furans, TOC, Heavy Metals, SPM, CO₂, SO₂ and NO_x, etc., either came down or remained within the acceptable norms.

The plastics waste used for the trial consisted of both Commodity Plastics like PE, PP, PS and Performance / Engineering Plastics like PET, ABS, Nylon, PBT, Polyacetal etc. These plastic materials represent about 99% of the plastics end products used for daily routine or special applications (PVC was not included in the study due to the reason as stated earlier). All packaging applications including laminated / multilayer pouches contain combination of

some of the plastic materials used in the trial.

The result indicates that disposal / co-processing of all types of plastics waste in cement kiln in Indian condition is an environmentally safe operation.

The volume of Plastics Waste used for the trial

The volume used for the trial could replace only about 1.5% of the fossil fuel (coal) normally used in the cement kiln. For increasing this volume to a level of 5-10%, the Cement Plant has to modify its input material conveying system by introducing Air Ducts instead of Open Belt Conveyor. However at the trial volume rate, the 170 odd cement kilns of India can co-process about 2.4 million tons of plastics waste in a year – much above the total plastics waste

generated in the country. Hence it is sufficient enough for the Indian cement kilns to co-process the plastics waste at trial volume to begin with. In the future when Indian plastics consumption will increase, the Indian Cement Plants can replace even 50% of its coal consumption by co-processing plastics waste, like developed country Germany does it in its cement kilns.

Implementation

Madhya Pradesh Pollution Control Board has already accorded its consent to all the cement plants in the State to co-process plastics waste in their plants. It is learnt that



MADHYA PRADESH POLLUTION CONTROL BOARD

Roadmap for the Final Disposal of Plastics Waste adopted in the State of Madhya Pradesh

It is recommended by the committee that the plastics waste can be used as partial fuel in the Cement Kilns. The matter discussed on the 54th Conference of the Member Secretaries and Chairmen of the State Pollution Control Boards/Pollution Control Committees of the country in length. After discussion in the apex conference, the Board identified rotary Cement Kilns for incineration of non re-recyclable plastics waste as co-fuel, as a roadmap for its final disposal. One of the major cement industries in the State took lead in this regard. The trial carried out successfully from 29th-31st March, 2008 by ACC Ltd. and ICPE in presence of the officials of the State Board. The monitoring of stack Emission was carried out by SGS India.

The analysis results of the monitoring revealed that the emission values are found well below the standards set by regulatory authority for the Common Hazardous Waste Incinerators. On the basis of the study, the major cement industries of the State applied for permission for the trial run to utilise plastics waste in cement kiln as co-fuel. The work is being done with the co-ordination of local kabadis and cement industries. Permission accorded to the following cement industries in this regard:



Presentation of Results of ICPE - ACC Project.

Mr. Jayant Maliya, Hon'ble Minister of Housing & Environment, M.P. and Dr. S. P. Gautam, Chairman - MPPCB (now Chairman - CPCB) are seen in the chair.

- ACC Ltd., Kaymore, Katni for incineration of 7 to 15 MT/day plastics waste.
- Vikram Cement, Khere, Neemuch for incineration of 9125 MT/year (approx. 30 MT/day) plastics waste.
- Satna Cement Works, Satna, for incineration of 10 MT/day plastics waste.
- Maihar Cement, Maihar, Satna, for incineration of 10 MT/day plastics waste.
- Prism Cement, Manakhari, Satna, for incineration of 10 MT/day plastics waste.
- Diamond, Maihar, Narsinggarh, Damoh, for incineration of 0.5 MT/day plastics waste.
- J. P. Rewa Cement, Rewa, for incineration of 25 MT/day plastics waste.

CALORIFIC VALUES OF DIFFERENT PLASTICS

	MJ/Kg
Polyethylene	46
Polypropylene	44
Polyamide	32
PET	22
CA	16
CALORIFIC VALUE OF COAL:	29

CPCB has also asked all the Pollution Control Boards in the country to implement the system in their respective States.

This will pave way for civic authorities in various cities and towns in the country to find an effective alternative and scientific method of disposal of low end plastics waste in more than 170 cement kilns in the country in an environment friendly way and thus be able to solve the plastics waste management problem in a real big way. ICPE, in cooperation with ACC Ltd. has been able to demonstrate that plastics waste in India can be scientifically disposed off by co-processing in Cement Kiln in an environmentally safe method. The issue of collection and delivery of the plastics waste to the cement kilns has to be resolved by the Civic and State Government Authorities. This is expected to benefit the cement industries also as