Coproducting for a Zero Waste Future

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About Geocycle

Geocycle is the waste management brand of Holcim. In Geocycle, the service of waste co-processing in cement manufacturing process is provided. Holcim is the promoter of both ACC Limited and Ambuja Cements Limited (ACL).

• Brand was created in 2007 as the dedicated identity used to brand waste management solutions in the Holcim Group
• We apply the highest health, environment and safety standards in all our operation complying to relevant regulation

For a zero-waste future
Technical Characteristics of Cement Kiln

Preheater cyclones
Act like a dry scrubber for acid gases and metals

Precalciner
Gases: > 900 °C
Retention time > 3 s
Raw meal: 700 °C
(Non)-hazardous waste: liquid, solid, coarse particles

Kiln main burner
Flame: 1800 - 2000 °C
Combustion gases: >1100 °C
Retention time > 10 s
Material: 1450°C > 15 min.
(Non)-hazardous waste: liquid, fine solid particles, readily combustible

Mineral wastes: CaO, SiO$_2$, Al$_2$O$_3$, Fe$_2$O$_3$

Clinker: Thermal, macro-molecular immobilization of metals

Mineral by-products

(Non)-hazardous waste: lump fuel
What is Co-processing?

- **Co-processing** is…
  - …based on the principles of industrial ecology and stands for the **usage/disposal** of waste material (as raw materials, as a source of energy or both) in energy intensive industries to…
  - …replace natural mineral resources (material recycling) and fossil fuels such as coal, petroleum and gas (energy recovery) by ‘processed waste’

- **Benefit of co-processing** to the industry & community are………
  - Provides a [permanent](#) solution to waste management problems
  - [Reduces](#) emissions and greenhouse gases
  - [Lessens](#) reliance on fossil fuels
  - **Preserves** natural resources

- **Benefit of co-processing** to the cement industry are……
  - Service charges towards co-processing/tipping fees
  - Reduces cost of Fuel and Raw material

*In short, co-processing is the environmentally-friendly alternative business model for responsible industries*
Coprocessing and Sustainability

- In a world of diverse industries, a range of waste material is resulted in the process of manufacturing goods and services.

- Waste generation is an inadvertent outcome of economic growth and it becomes necessary to deal with its resulting.

- Landfill and incineration are considered as necessary disposal options in some cases, but are less preferable in the waste management hierarchy.

Co-processing recovers energy, recycles and conserves materials and contributes to reduced environmental footprint. It represents a sustainable solution for many waste streams which can’t be recycled and shouldn’t be land filled. It offers significant potential for reducing pollution and landfill space caused by the waste disposal. Co-processing is thus a preferred solution in the waste management hierarchy.
What happens to the waste in the Cement Kiln?

- Organic constituents are completely destroyed due to the high temperatures, long residence time and oxidizing conditions in the kiln. Combustion of an organic compound composed only of carbon and hydrogen produces CO2 and water.

- If the organic compound (coal or waste materials), contains chlorine or sulphur, then acid gases such as HCL and SO2 are produced. These gases are absorbed and neutralized by the freshly formed lime and other alkaline materials within the kiln.

- The inorganic constituents including heavy metals reacts with the raw materials in the kiln and are included in the clinker matrix leaving the process as part of the cement.
Zero Impact of Co-processing On Emissions

Output products
Cement Quality

On emissions

On final products

Output products
Cement Quality

On emissions

On final products

Output products
Cement Quality

On emissions

On final products

Output products
Cement Quality

On emissions

On final products
Zero Impact On PCDD/PCDF Emissions

Source VDZ
No Leaching of Pollutants from Concrete

Trough tests on mortars (Rechenberg, Sprung, Bachmann)

Lime-dissolving carbonic acid

Doped mixing water

Concentrations in the eluate are significantly below the limit values
The Geosycle Approach

1. Waste assessment
   We can provide a complete survey of your waste and a full assessment of its suitability for co-processing.

2. Waste analysis
   We offer dedicated laboratory testing to analyze your waste to ensure it is suitable. We at Geosycle are able to manage waste such as solids, sludge and liquids.

3. Waste transportation
   We provide a seamless service – ensuring the waste is transported in appropriate packaging with required labelling and documentation. The waste is carried by operators with required skills, qualifications and permits.

4. Pre-processing
   Further analysis of waste is conducted in our laboratories if required. We have extensive facilities to blend liquids, shred solid materials and homogenise waste prior to its usage in kilns.

5. Co-processing
   Waste is then safely co-processed in cement kilns. Our cement kilns operate at temperatures of up to 2000°C – which leaves no residue or waste after co-processing is complete.
Examples of Waste Pre-Processed and Co-Processed

• Diaper trimmings
• Expired corn seed
• Damaged beans
• Plastics
• Expired products
• Packaging materials
• Rubber wastes
• Textile waste
• Refinery wastes
• Bleaching earth
• Lime sludge
• Fly ash & bottom ash
• Mill scale
• Blasting grit
• Diatomaceous earth
• Paint wastes
• Used oil & grease
• Scrap tires
• Wood chips
• Solvents
• Carbon fines
• Oil filter fluffs
• Coking wastes
• Shipping wastes
• RDF fluff & pellets
• Sorted MSW
• Filter cake
• Refinery catalyst
• Calcium fluoride
• Foundry sand
• Contaminated soil
• Aluminium production waste
Large scale coprocessing - Pre-Processing Activities
Geocycle India has setup international standard Waste co-processing and Pre-processing facilities (PCPFs) at Wadi, Kymore, Bhatapara, Rabriayas, Maratha Ambujanagar and Madukkarai to manage the wastes from the respective states.

Pre-processing is done by techniques such as size reduction, screening, impregnation, blending etc.

In the PCPFs, different kinds of wastes from industrial, biological and municipal sources are converted into uniform quality materials for using them as Alternative Fuel and Raw Materials (AFRs) in cement plant.
Awards

Golden Peacock Award for Eco-Innovation was awarded this year to ACC Geocycle Department for “Disposal of Industrial Wastes through Co-processing them in cement kiln”. 2008 and 2011

GreenTech Environment Excellence Award (2008 and 2011)

“Most innovative Environmental Project for use of Waste materials from different industrial sources” at CII Environmental Best Practices Award, 2011 at Hyderabad

ACC’s Geocycle Initiative was awarded the 2013 Parivartan Sustainability Innovation Challenge Award at the Annual Summit of the Sustainable Business Leadership Forum in October 2013
Clean India Drive - How cement plants can contribute

• Coprocessing can manage Industrial Hazardous wastes, Industrial Non-hazardous wastes, Segregated MSW, agro wastes, POPs etc. in large quantities and an environmentally sound manner.

• The infrastructure available to manage all the waste generated in the country by land filling and incineration is highly inadequate and inappropriate.

• Cement plants already exist and are well spread out through out the country to provide coprocessing solutions locally to the local waste problems.

• There is no need to set up additional landfill and incineration facilities.

• Coprocessing is environmentally a superior technology than incineration and land filling.

• All cement plants are developing necessary coprocessing capability and capacity in the country to extend the environmental solution in the “Clean India” drive.
Incineration v/s Co-processing

- The higher temperature in co-processing results in efficient thermal destruction
- Residence time is 2 times higher in co-processing which helps in complete destruction of the waste
- Turbulence when induced in cement kiln helps in complete combustion
- The Alkaline environment in kiln acts as natural gas cleaning
- Co-processing leaves no residue to be land-filled

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Incineration</th>
<th>Co-processing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>850°C – 1200°C</td>
<td>1400°C – 2000°C</td>
</tr>
<tr>
<td>Residence Time</td>
<td>&gt; 2 sec @ &gt;1200°C</td>
<td>4-6 sec @ &gt;1800°C</td>
</tr>
<tr>
<td>Turbulence</td>
<td>Induced in SCC</td>
<td>Induced in kiln</td>
</tr>
<tr>
<td>Gas cleaning</td>
<td>Alkaline scrubbing</td>
<td>Alkaline Environment in kiln</td>
</tr>
<tr>
<td>Residues</td>
<td>Ash / fly ash</td>
<td>In clinker product</td>
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</tbody>
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Reduction of Green House Gases

Co-processing and Incineration
Reduction in GHG Emissions

Co-processing and Landfill
Prevention of Methane*
Emissions

* Methane has 21 times more global warming potential than CO2

The same argument is valid for all other emissions too.
Proposed international guidelines for the co-processing of waste materials in the cement production
Secured the public acceptance of these guidelines
Finalized them in July 2006

From those guidelines, specific legal frames on co-processing are under implementation in around 15 countries.
Global regulatory framework – Basal Convention

Basal Convention has reviewed and approved technical guidelines on coprocessing

• To offer objective information about co-processing of waste in the cement industry

• To offer objective information about co-processing of waste in the cement industry

• To offer links to organizations, institutions, and companies active in the field of co-processing and to propose ways and means for capacity building.

For facilitating governmental authorities globally in formulating guidelines for co-processing of wastes
Global regulatory framework – Indian Scenario

The HWM rules recognized co-processing under chapter III, Rule 11. It states the following: “The Utilization of Hazardous Wastes as a Supplementary Resource or for Energy Recovery, or after processing shall be carried out by the units only after obtaining approval from the Central Pollution Control Board”

Current Framework for Hazardous Waste Co-processing in Cement Kilns

- Trial Run for new HW stream
- Approval from CPCB for regular co-processing
- Authorization from SPCB for regular co-processing

- CPCB Guidelines on Co-processing in Energy Intensive Industries was published in February 2010
- On similar lines, Guidelines for Co-processing of Spent Wash generated from Distillery Units was also published
What needs to be done to ensure large scale use of environmentally friendly coprocessing technology in Clean India Drive.

• The regulatory framework in India provides generic permit to manage the waste through land fill and incineration process.

• Although coprocessing technology has superior environmental performance over incineration or landfill operations, cement plant has to obtain coprocessing permit per waste stream. That too after demonstrating the suitability of each one of them in the cement kiln through an elaborate coprocessing trial.

• This waste by waste permitting process is a very slow permitting process requiring about one year for each of the waste stream.

• There is need therefore to modify the existing waste management rules in favor of coprocessing so that cement kilns can have generic permit to coprocess all kinds of suitable wastes.

• Since coprocessing leaves zero waste for future concern, in the current “Clean India” drive in the country, cement kilns can contribute substantially in treating large amounts of hazardous and non-hazardous wastes in safe and environmentally sound manner.