The thermolysis of organic waste as the process THERMOLYSIS

Principles of Thermolysis:

All the molecules 'organic', which come from nature (biomass) or of a chemical reaction (carbon chemistry), can be progressively decomposed and reduced in single atoms by the combined effect of temperature and pressure. This is sufficient to prevent the formation of other chemical reactions. No need to add another type of atoms but the reaction has been elected a sufficient temperature and pressure small addition to give the matter the time necessary and sufficient for its disintegration.

The thermolysis reaction is easily explained: the long, thick organic molecules, arranged in chains, the thermal energy stored in termolizador as heat and begin to vibrate (the vibrations are translated into an increase in temperature) when the vibrational energy exceeds the binding energy of the weakest chains in their molecular structure, these chains are broken, and released into simpler molecules.

This phenomenon, known for over a century, has given birth to the process of refining crude oil (composed of organic molecules) known under the name "steam-cracking".

But the application to the waste of civilization, of variable composition and complex, is much more recent (15 years).

THERMOLYSIS Process (trademark TERMOLISIS®)

The experience proved that in the absence of oxygen, limiting the external pressure exerted on each molecule at atmospheric pressure, and if it maintains the temperature of the waste between 420º C and 450º C, all organic molecules are reduced to atoms (carbon the most part) and simple gas (gas called "oil" noncondensable under ordinary conditions of temperature and pressure.

Hence the choice made by the promoters of Thermolysis process: Making a thermolysis' heart in the midst strictly reductive. For this, the operation is performed in the absence of air supply, and reactor performing simultaneous disintegration termolizados waste.

- In the absence of oxygen, is created strictly reductive half.
- Termolizadas molecules are evacuated and released to the underlying molecules to allow their thermolysis, it is therefore a thermolysis 'heart' of the process leaves no residue without being termolizado.

The materials of the Thermolysis ® brand, are designed and constructed to allow the permanent realization of these conditions.

Factories THERMOLYSIS.

The main purpose of the factories of thermolysis of this trademark is to treat waste to recycle elements and extract as end products:
- No contaminants and, if raw materials, uncontaminated.
- Conforms to internationally accepted standards. It is therefore of commercial products.

The recoverable products are carbon (coke organic) and gas, they contain all of the internal energy of waste, specific calorific equivalent to commercial fossil fuel (gas or petroleum products).
The other products are recyclable, glass, iron and other metals, no fillers or polluted. Heavy metals are vitrified at high temperature, and leave in the form of non-convertible rocks contaminants.

Scheme of principle of the process THERMOLYSIS.

Legend:
1. The circuits of intermediates of waste defined by arrows.
2. Each color indicates a different product.
3. The central device of the process, termolizador, is intended to address not only crude residue (dry to 90%), but also those "intermediate", as polyunsaturated oils to the flash reactor outlet and the gas emitted the vitrification process for heavy metals and their compounds.
4. The dryers are rotary kilns to evaporate the moisture from the waste hot air circulating in closed-circuit extracted vapors are condensed and collected and purified water.
5. The termolizadores rotary kilns are heated with electricity.
Each line of thermolysis can work 8000 hours per year and treat from 1 to 5 tons / hour of raw waste. The best lines are designed to treat sized 1.0 - 1.5 - 2.0 - 2.5 - 3 tons / hour. The best sized factories treat 50,000, 200,000, 500,000 tonnes / year, ie 150, 600, 1,500 tons / day. They consist of 2 to 12 lines that run automatically identical. Every factory that is designed to treat more than 50,000 tons / year is at least one line booking to ensure continuous operation at rated power.
APPLICATIONS OF THERMOLYSIS

The Termorreducción can be applied to the transformation of certain raw materials for use as commercial products of great value.

It can also be applied to the transformation of natural products so that, once they have been removed from their primitive organic structures, they can be used directly.

The applications of TERMOLISIS® Technology are numerous and, among others, it can be used to treat:

Urban solid waste.
Sludge from sewage treatment plants. Urban or industrial.
The transformation of vegetable waste (pruning, plantations).

Treatment of agricultural waste:
- greenhouse plastics.
- mushroom residue.
- of the transformation of the olive, etc.

Organic industrial waste:
- solids and liquids.
- assimilable to urban.
- toxic.
- tires, plastics, oils, etc.

Cleaning of lands contaminated by oils, oils, lindane, etc.
Water polluted by oils, oils, etc.
The manufacture of charcoal.
Energy conversion of poor coal (peat, lignite) into gas.
Transformation of products and natural waste (shells of animals, vegetables, etc.) into fertilizer directly assimilated by the plants.

Hospital waste:
- Assimilables to urban.
- Clinicians.
- Toxic, cytostatic.
TECHNICAL ADVANTAGES - ENVIRONMENTAL

1.- Thermal cracking of the organic fraction of the waste by molecular division in the absence of air.
2.- Thermolysis to the heart of matter.
3.- Continuous process.
4.- Set of technologies with zero final residue.
5.- Operating flexibility below its nominal capacity.
6.- No formation or dispersion of nitrogen oxides, of dioxins, of furans, of PCBs, of hydrochloric and hydrofluoric acids, of sulfur dioxide, of dust, of slag, of soot.
7.- No dispersion of heavy metals, by concentration in vitrified mass.
8.- No need for final disposal.
9.- Possibility of energy production from the compounds resulting from the CRAQUIZACIÓN: coal and gas.
10.- Drying in closed circuit with air condensation and water purification.
11.- Drying by hot air with movement of the dough.
12.- Non-production of liquid hydrocarbons by recirculation in the reactor.
13.- Procedure that valorises the waste energetically, not directly, as in an incineration but by means of gas and coal resulting from the process of CRAQUIZACION, from which the heavy metals have been chemically cleaned.
14.- Low working temperature, around 400ºC, with adjustment degree to degree, of the operating temperature and millibar to millibar of the working pressure inside the reactors.
ADVANTAGES OF MODULAR DESIGN

1º This means that the plant will be formed by several independent treatment lines, to achieve the total capacity of the installation as a sum of the capacities of each line.

2º This design guarantees the constant operation of the plant. Maintenance stops are programmed in such a way that there is always adequate treatment capacity.

3º The treatment capacity can be extended, adding lines to the installation. In a hypothetical need you can remove a line and dedicate it to other uses, without detriment to the economy. The flexibility is total.

4º This design allows to build plants of small capacity (from 10,000 tons / year) or large capacity, (millions of tons) according to the waste production of the towns and cities. Small capacity plants must be interconnected as a single company, so that the economic balance is profitable.

5º This design facilitates the transport logistics by reducing the routes.

6º If the plant is built next to the old urban waste landfill, the biogas that will produce the landfill, as an additional fuel, can be used in the combined cycle generation plant.

7º The consumption of natural gas, as a mixture with the Thermolysis gas is necessary, due to the variability in the composition of the input residues. A small amount is necessary to ensure stable conditions.

However, the proportion of natural gas in the mixture has no limits; it can be as high as determined, in each plant. For example, it can support a policy of diversification of energy sources, by establishing stable consumption points, which would make a gas pipeline network economically viable, from which the population and the industries would benefit.
### Principales tipos de tratamiento de residuos con aprovechamiento energético:

<table>
<thead>
<tr>
<th>THERMOLYSIS</th>
<th>INCINERACIÓN / PIROLISIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>It does not smell.</td>
<td>Yes it smells.</td>
</tr>
<tr>
<td>There is no combustion.</td>
<td>By combustion of polyunsaturated hydrocarbons, contained in the residue.</td>
</tr>
<tr>
<td>No environmental impact</td>
<td>If environmental impact.</td>
</tr>
<tr>
<td>Treatment temperature if uniform.</td>
<td>Non-uniform treatment temperature.</td>
</tr>
<tr>
<td>No ash.</td>
<td>Yes, ashes.</td>
</tr>
<tr>
<td>There is no possibility of unburned</td>
<td>The combustion produces unburned.</td>
</tr>
<tr>
<td>Zero residue. It does not need a later landfill.</td>
<td>Residue 20%.</td>
</tr>
<tr>
<td>In process outputs there are no complex compounds of organic nature.</td>
<td>Presence of complex organic compounds in ashes due to incomplete combustion. Even if it is done with an excess of oxygen, it is not guaranteed.</td>
</tr>
<tr>
<td>The atmosphere of the treatment is reductive, that is to say in the absence of oxygen.</td>
<td>The atmosphere of the treatment is oxidant, that is to say with an extraordinary contribution of oxygen, to avoid as much as possible the unburned ones.</td>
</tr>
<tr>
<td>Organochlorines are not produced and destroyed.</td>
<td>Organochlorines are produced in the combustion process.</td>
</tr>
<tr>
<td>The gas and coal are analyzed before combustion. The fumes are produced by burning the gas and coal in a combined cycle plant. Compliance with excess of the regulations.</td>
<td>Smoke can not be controlled by the procedure itself. Need for expensive smoke treatment facilities to be able to comply with the regulations.</td>
</tr>
<tr>
<td>The fuels do not have water. Its combustion does not produce water vapor.</td>
<td>Water vapor is produced in the direct combustion that comes out with the fumes and it must be captured in filters.</td>
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THE PROBLEM OF WASTE

Waste not usable is a problem for many societies, especially for large cities as well as for the entire population of the planet, because overpopulation, modern human activities and consumerism have greatly increased the amount of waste that is generate; the above, together with the inefficient management of such waste (burning in the open, disposal in landfills or inefficient landfills) causes problems such as pollution, which summarizes health problems and damage to the environment, as well as causing social and political conflicts.

Before becoming garbage, waste has been raw materials that in their extraction process, are usually from developing countries. In the production and consumption, energy and water have been used, and only 7 countries, which are only 21% of the world population, consume more than 50% of the natural and energy resources of our planet.

Overexploitation of natural resources and increased pollution threaten the regenerative capacity of natural systems.

Homemade solid waste classified:

1. Glass containers.
2. Fine plastic.
3. Thick plastic.
5. Miscellaneous
6. Compacted cans.
7. Paper.
8. Polystyrene.
9. Glassware
11. Different metals.
13. Tetrapak.
14. Fabrics.
15. Sanitary.

Ideally, garbage - as such - should not exist; nature teaches that everything produced and created is reintegrated into the environment and the garbage should look the same, that is, that everything be reused in one way or another. The above points to an integral solution in which the garbage concept would disappear.

Several initiatives exist to reduce or solve the problem, depend mainly on governments, industries, people or society as a whole.

Some general solutions to the garbage problem would be:
• Reduce the amount of waste generated.
• Reintegration of waste into the productive cycle.
• Proper channeling of final waste.
• Decrease with the degradation of the organic part
• Problem of the growth of consumerism.

On the other hand, if the increase in consumption does not stop, the amount of recycled garbage would never reach the level of the garbage produced. Since the implementation of recycling systems, the amount of waste has not decreased, but has increased, due to the constant increase in consumerism.

In this way, the supposed solution would become only a palliative and a way to organize the waste to lower the costs of raw materials. In any case, recycling has become a theory that although it does not work at present, it is presented as a possibility in the future.

We want to contribute our grain of sand and help as much as possible with the knowledge we have at this time and use them at the disposal of citizens, governments and especially the planet in which we live.

We know that we are not going to give an integral solution to the problem, but if we can help improve and take care of our way of life, we must act as much as we can and we are prepared to assume our responsibility in this.