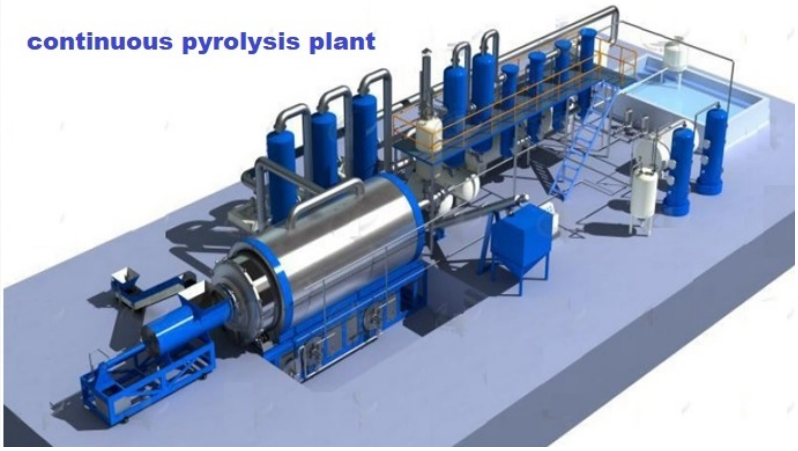

PYROLYSIS is the thermal degradation of both organic and inorganic matter, diminishing huge hydrocarbon chains, releasing carbon atoms that react with each other and in the absence of oxygen, form carbon monomers in the form of methane gas (CH4) and hydrogen atoms in excesses released in the process come together to form stabilized hydrogen (H2).

The more anaerobic (sealed air free) the reaction system is, the more purified will be the emissions of CO2, CO, dioxins and furans. (toxic greenhouse gases). The reactions are endothermic because they need high temperatures to break the molecules, but in the energy balance they produce more energy than they consume in the process.

The system is self-sustaining because it is powered by a small part of the energy it produces. All material contaminated by pathogenic microorganisms are inertized and their decomposition state is fully stabilized. Substances that would take more than 400 years to decompose in nature, polluting the environment every day to stabilize, in Pyrolysis in just a few hours reach this stage, exchanging lasting problems for quick and efficient energy solutions.

Why the worldwide race for urban waste’ s PYROLYSIS and other industrial wastes?

Existing technology: GASIFICATION that bears the (misguided) name of Pyrolysis. Pyrolysis and Gasification are similar in the operating system, both work with the thermal degradation of matter at high temperatures; Both produce syngás and pyrolytic oil and manage to dispose of landfills; So why are first world countries so interested in pyrolysis? For example, currently, environmental certification in Europe, is already denied on any waste treatment process or machine that does not have zero greenhouse gas emissions. Failed gasification! ok pyrolysis!

This is a worldwide trend and the United States is already investing heavily in PYROLYSIS.

Thinking about energy solutions for the near future in 5 years: What do we have?

- Hydroelectric: flooded areas produce more methane and CO2 than an electric term;

- Electric term: fossil fuels are running out and this type of generation is destined for total ban;

- Photovoltaic: Solar plates with low energy conversion in less than 20%, occupies a lot of installation area, difficult logistics, assembly and periodic cleaning;

- Wind: low yield, difficult and costly installation, environmental impact for bats and birds in general, few geographical places with sufficient wind;

- Nuclear: high hazard and no place for disposal of highly radioactive waste;

MOTIVATION: In addition to urban waste , hospital waste (now going to incineration, producing CO2, CO and biopathological contaminated water vapors, providing costly collection and transportation, poor disposal with high danger of handler contamination) and slurry (contaminated liquid (bad odor and heavy metal accumulator that seep into the groundwater), many industries have tons of waste, trimmings and leftovers from plastic, rubber, EVA, natural and synthetic leather, textiles, chips, mdf, plywood, cardboard ... of wood, disposable packaging (cups, bags, including tetrapack), resins, polymers, tires, shoes and used fabrics, agriculture: cane bagasse, twigs, corn husk, rice, wheat, soybeans, grass, tallow , feathers, waste, etc .... that sell very cheap for recycling. All this a pyrolysis machine transforms into zero greenhouse gas energy ... on one side there is polluting waste on the other side lacking energy supply ... perfect combination for PYROLYSIS.

Noteworthy: The process produces its own energy that the machine spends to work: 18% of its own consumption; 82% energy income; 0% external source consumption; 0% greenhouse emissions; 0% for landfills; 100% ok!!! what is the power source of the future without greenhouse gas emissions?

PYROLYSIS: END OF SANITARY EARTHS AND BEGINS A NEW ERA OF ENERGY MATRIX

Waste Pyrolysis can exchange expenses for gains.

Example: In the city of São Paulo (Brazil) in 2010 it spent $ 336,5 million to collect and transpose trash. This same amount of waste, 12 thousand tons / day, could have been transformed into 300 MW of electricity, enough to supply 1 million inhabitants.

It would also avoid throwing 10,000 tons / day of CO2 into the atmosphere that could be sold as carbon credits to highly polluting countries.

Finally, there is no doubt that the pyrolytic technology of waste processing by itself already pays for investments, where everyone wins, especially the environment and our own quality of life.

ADVANTAGES OF PYROLYSIS IN COMBATING THE CORONA VIRUS PANDEMIC

Unfortunately, this evil has spread throughout the world.
Pyrolysis has several technological advantages over other waste treatment methods, some of which are:

#1- In addition to eliminating any type of domestic, commercial, industrial, hospital, agricultural or livestock waste, at the other end of the process it produces electricity and liquid or gaseous fuels;
#2- end of landfills and chourume;
#3- destroys bacteria, viruses, germs and all pathogenic biological material;
#4- end of odors by biological decomposition of organic matter;
#5- zero greenhouse gas emissions;
#6- End of contamination of the environment by leftovers and empty pesticide packaging;
#7- Neutralization of the toxicity of medicines and pharmaceutical drugs with expired date;
#8- 100% separation of radioactive materials from others that were connected, allowing the total reuse of these in their original processes;
#9- Fights pollution of the atmosphere, soil, rivers, groundwater, seas and oceans;

The superiority of pyrolysis has also recently been discovered compared to the current method of incinerating hospital waste.

In the incineration the following exchange takes place: we are free of 70% of the volume of the waste ... this is great but .... we won on the other side of the process:

- Solid toxic pollutants (dust and soot with high irritability and allergic reactions);
- liquids (with bacterial contamination, lead, cadmium, mercury, chromium, arsenic, cobalt and other heavy metals);
and gaseous (dioxins, furans, sulfur dioxide, carbon dioxide, carbon monoxide, chlorobenzenes, chlorophenols and PCBs);
- water vapor contaminated by entrainment of microorganisms,
- odors: sulfur dioxide, hydrochloric acid, carcinogenic polycyclic aromatic hydrocarbons (PAH) and nitrogen oxides;
- polyolefins and nitrocellulose that can detonate;
- Difficult to control the residence time of the waste inside the burning chambers. There must be complete combustion to eliminate toxins, but as the composition of the inlet flows is variable, it is impossible to guarantee the ideal burning time for the mixture.
- Reduces landfills, but there will still be 30% of material destined for them, so environmental inconveniences and contamination of soil and groundwater will continue.

Worldwide, it is estimated that 1.3 billion tons of hospital waste are produced per year. (in 2019)
Due to the new global pandemic, this amount has been increasing day by day and the incineration methodology had already proved to be inefficient, especially now with the growing need for disinfection and destruction of hospital waste.

Pyrolysis can:

- kill 100% of the corona virus;
- there is no steam escape of water contaminated by viruses or bacteria;
- the pyrolytic oil produced leaves the machine 100% decontaminated;
- the residence time inside the pyrolytic reactor is automatically regulated, leaving nothing that has not undergone the thermal process;
- all solid material that came along with the one that was pyrolyzed, like: pieces of glass, metal, ... come out of the bottom of the machine 100% disinfected and ready to be sent for recycling of each one;

- as there is no combustion due to the lack of oxygen in the process, all heavy metal comes out in metallic form, without formation of oxides, facilitating their separation and forwarding for recycling of each one;
- most hospital waste is made of plastics and synthetic fabrics with high calorific value, therefore, suitable for the growing volume of contaminated hospital waste. The more of these materials, the more energy they produce under pyrolytic treatment;
- any solid particles suspended in the gases produced (hydrogen and methane) are washed and filtered. The washing water is in a closed circuit. Its residues go back to the pyrolysis reactor and even the saturated filters are also destined for the reactor, where they undergo the treatment and the solids are concentrated, leaving the bottom of the equipment and destined for recycling each one;
- the residual coal produced is highly energetic, completely decontaminated and destined for the steel industry;


LEGALIZATION

In any individual situation, major considerations of equipment selection and use must meet local conditions.

These considerations include climate, management, waste characteristics, available equipment sales and service, and the experience and desires of the decisionmaker. Small to medium family operations, for example, tend to use more daily labor and invest in equipment that can be multipurpose (e.g., tractor loader, elevator-conveyor, box spreader).

Large operations require more, but less versatile equipment (e.g., separator, high-capacity pump, long pipeline) for separate AWMS (Agricultural Waste Management System) function needs. They typically assign tasks to hired laborers to accomplish in a specified time (e.g., scraping, agitation, hauling).

Safety must be considered in addition to the cost, correct type, size, and practicality of the selected equipment. In an AWMS, relatively complex, pressurized equipment is often used by one person alone. It may be used in a noisy, remote location that is in semidarkness and a long way from help or medical service. Suppliers, owners, and others involved must correctly instruct family and hired help about safe operation of the equipment, hazards involved, and emergency procedures.

Also, uninterrupted electric power is essential for operating some equipment (e.g., compost aerator, flushing pump, biogas production), so a system failure alarm and emergency power system may need to be a part of the AWMS.

In the American legislation, we find few details about pyrolysis because it is a relatively new waste treatment procedure.

Observe what exists in USDA (United States Department of Agriculture)/ NRCS (Natural Resources Conservation Service)/ about the burning and thermal degradation equipment (210–VI–AWMFH, Amend. 44, July 2011):

Incinerators

Incineration equipment is used for destroying dead animals and poultry. This equipment is useful for animal disposal and disease control with confined livestock production and animal health care operations. Incinerators are fueled by liquefied petroleum (LP), natural gas, or fuel oil (#2 diesel oil). They utilize an electric blower to reach temperatures of 1,700 degrees Fahrenheit or higher. Some have second burners on the exhaust for more complete combustion. Most now have automatic ignition and timers to save fuel. Incinerators are available for a 100- to more than 850-pound animal load capacity. Suggested incinerator size is that needed to handle one day of animal loss. Burner capacity and door size affect actual use. CPS Code 316, Animal Mortality Facility provides criteria for mortality incinerators. An air-pollution approved incinerator has high investment and operation costs. These incinerators use 3 to 7.2 gallons of LP, 275 to 660 cubic feet of natural gas, or 2.5 to 3.5 gallons. Regular maintenance, cleaning, and ash disposal are required.

Gasifies

Gasifies are also being used in some locations for animal mortality management. A gasifies looks similar to an incinerator, but the process is different in that it takes place in an oxygen starved environment that converts biomass (animal mortalities) to biogas. An outside fuel such as LP or natural gas is used to begin the process. Gasifies have two chambers: a primary chamber where the biomass is loaded; and a secondary chamber where the supplemental fuel and recycle biogas is used to create temperatures of 1,470 to 1,830 degrees Fahrenheit. Mortalities are placed in the primary chamber. Heat is transferred from the secondary chamber to the primary chamber through the hearth plate. Biogas is produced as the biomass (animal carcasses) break down in a low oxygen environment. The biogas is used to supplement the outside fuel which reduces the volume of outside fuel required for the process. Since it is more efficient to process larger amounts of biomass at one time, a complete system would include the gasifies as well as a refrigeration unit to store mortalities, and a roofed structure to protect the equipment.

A gasifies has a higher initial cost than an incinerator, but offers the following advantages:

• particulate matter emissions reduced by nearly 90 percent

• other emissions reduced by approximately 50 percent

• fuel consumption reduced by at least 50 percent The ash produced by the process is inert and contains no bacteria, viruses, pathogens or antibiotics. It contains concentrated nutrients including phosphorus, potassium, and calcium and can be used as a fertilizer. Most of the carbon and nitrogen are discharged through the emissions of the process.

Pyrolysis

Pyrolysis and gasification are related processes of heating with limited oxygen. In fact, pyrolysis is the first step in the gasification process and ideally would take place in total absence of oxygen. In reality, it is not possible to create an environment totally free of oxygen so the process normally occurs in conditions of extremely limited oxygen availability, lower than that of gasification. As a result pyrolysis produces not only syngas, bio-oil, and ash, but also biochar which is similar to charcoal. The process has been used to make charcoal since ancient times. Recently, fast pyrolysis, which reduces the production of syngas and increased bio-oil, has been used to process poultry litter. Pyrolysis equipment used for treatment of agricultural waste is similar to that used for gasification and is generally based on one of the following processes:

• Augers—hot sand and biomass particles are fed at one end of the auger which mixes the sand and biomass and moves them along.

• Rotating cone—pre-heated hot sand and biomass particles are introduced into a rotating cone.

• Fluidized bed—biomass particles are introduced into a bed of hot sand fluidized by a gas, usually a recycled product gas (syngas).

• Circulating fluidized bed—biomass particles are introduced into a circulating fluidized bed of hot sand. For agricultural waste, the process typically operates in a temperature range of 840 to 1,000 degrees Fahrenheit.

There have been a number of demonstration and full scale projects implemented in the United States and around the world. To date, the projects have met with limited success, but the process is worth mentioning here since it is likely to become a more common practice as energy prices increase, equipment is further refined, and environmental regulations related to land application of untreated animal waste become more stringent.

So we can rest assured about legalizing pyrolysis machines, because in fact what the legal bodies demand and verify are emissions of greenhouse and toxic gases. As the pyrolysis work environment is anaerobic, there is no formation of co and co2. Other lethal are also not produced as is the case with incineration and gasification.