The Catalytic Low Temperature Thermolysis Process Of Pragmatec & Pyro-Kat

<u>Pyro-Kat plants are suitable for all types of waste and hazardous waste</u>, such as household waste, industrial waste, hospital waste, plastics, used tires, manure, waste from slaughterhouses, sewage sludge, oil sludge, shredder light fraction from the auto industry, waste oils, contaminated wood, etc., whereby several different types of waste can be mixed together before introduction into the system. Only restriction: The moisture level of garbage must not exceed 85%.

Example for Solid Waste (e.g. MSW) – Diagram 1 and Picture 1

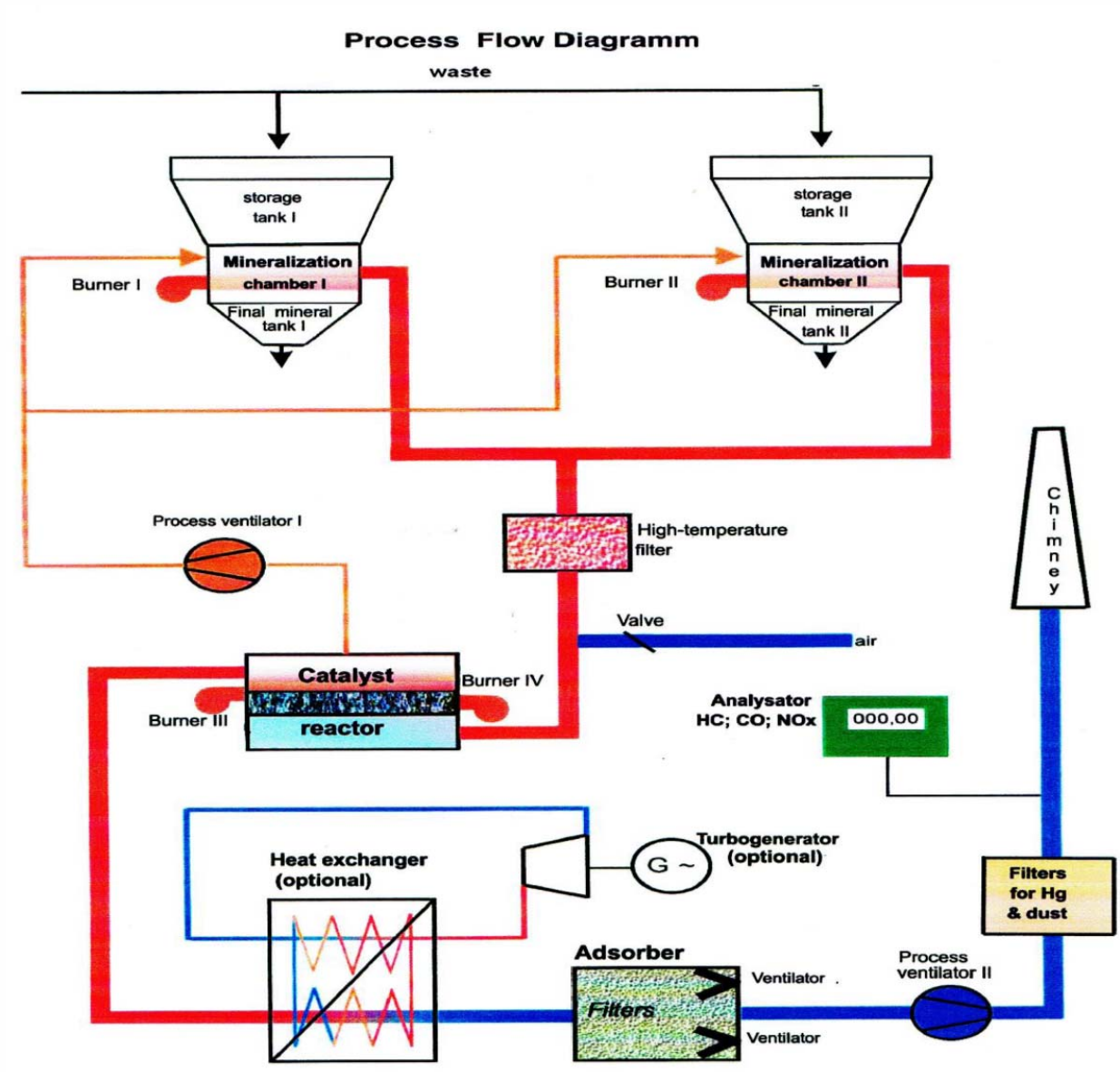

Diagram 1

The Catalytic Low Temperature Thermolysis Process Of Pragmatec & Pyro-Kat

Process Description

In a two-stage process, the waste is first dried under oxygen deficiency (negative pressure) and degassed or mineralized (= 1st stage).

The 1st stage works on the basis of a two-chamber system. While the first chamber initially heats up its containing waste in the starting phase and then over one part of the exhaust gas of the entire system to temperatures from 250 °C up to 450 °C (depending on the input material) and mineralizes the material; the 2nd chamber is at rest or in dry mode. In the second chamber, the process is repeated as in the first chamber, the first chamber is now refilled and goes into dry mode, and so on. So the two chambers work continuously alternating. Subsequently, the syngas produced in the first stage is then fed to a catalytic combustion (= 2nd stage).

The exhaust gas of the total process after the 2nd stage consists exclusively of pure CO_2 and water vapor, all pollutants (such as dioxins, furans) are decomposed during catalytic combustion into the molecular components and also converted into CO_2 and water vapor. The Hg contained in the waste is converted into a harmless Hg compound, eliminated from the process and sent for recycling. What remains is a solid inorganic residue (less than 1% of the original waste volume), which is also completely free of pollutants and can be used as aggregate for concrete or in road construction.

The 650 °C to 700 °C hot exhaust gas (CO_2 and water vapor) resulting after the second stage (Catalytic Reactor) is approximately 5% recycled to the first stage, where it takes over the heat, the gas burner is now switched off. The mineralization process in the 2nd chamber is activated, subsequently the heat supply to the two chambers of the first stage takes place only via the above-mentioned 5% of the exhaust gas of the 2nd stage. A natural gas supply from the outside is no longer necessary. Only when starting up the system it is necessary to supply natural gas for a very short time from the outside, then the process is maintained by itself without external energy supply, including the catalytic combustion in the second stage.

If one chamber fails, the system can still operate at half speed. A total failure is thus avoided.

The heat which results from the catalytic combustion can generate electrical energy via a heat exchanger and a downstream steam turbine including generator. In addition reusable residual heat energy is available; the usable amount of heat energy is about half as large as the amount of electric energy generated.

In case of interest please contact the following partners:

C. E. Ballnath, CEO Syngas Solutions (ceballnath@syngas-solutions.com) , or
Dr. W. Partsch, Advisory Board of Pragmatec (wmp@drpartsch-partner.com)

The Catalytic Low Temperature Thermolysis Process Of Pragmatec & Pyro-Kat

Picture 1: Installation for mineralization of MSW (10t/24h)

Data from measurements on existing plants:

Temperature in the 1st stage: Depending on the type and moisture content of the waste from 250 °C to 450 °C.

Gas composition after the 1st stage:
Syn-gas (mainly CO, CH_4, H, various pollutants).

Temperature in the 2nd stage (catalytic combustion of the syngas):
Depending on the composition of the syngas 650 °C to 700 °C.

Gas composition after the 2nd stage (i.e. after the catalyst):
Purest CO_2, purest water vapor, all pollutants well below the limit allowed by EU directive efficiency of the Pyro-Kat process (i.e. available heat energy after the catalyst relative to the energy content of the supplied waste): approx. 85% to 95%.

Efficiency of electricity generation: (heat exchanger + steam turbine + Generator): approx. 42%

The overall efficiency of the whole system (i.e. generated electrical energy relative to the energy content of the waste introduced) **is approximately 36% to 40%**.

The overall efficiency of the system is practically independent of the size of the system. Example: An installation for 120 t/day mixed waste paper and plastics (energy content 15.9 MJ/kg) produces an available electric power of 8 MW, plus a usable heat output of 4 MW (for example for district heating).

The Catalytic Low Temperature Thermolysis Process Of Pragmatec & Pyro-Kat

Example for Gas Purification (e.g. exhausts of industry or coal power plants) – Diagram 2 and Picture 2

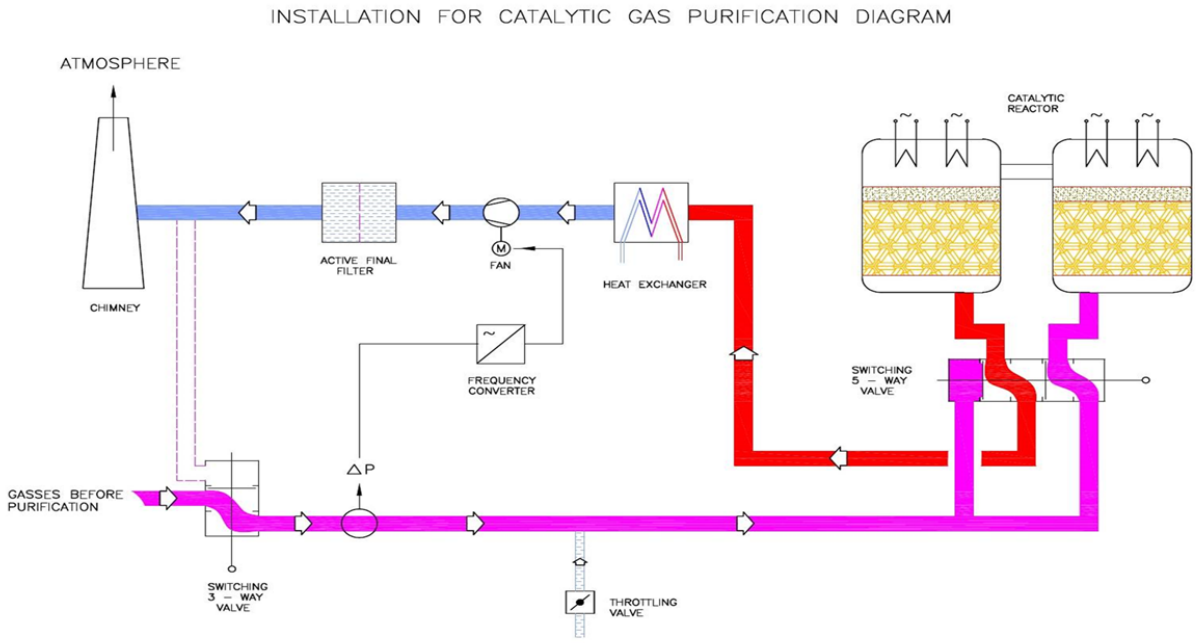

Diagram 2

Picture 2: Catalytic gas purification system (capacity of 40.000 m³/h)

pragmatec innovation driven