

CASE STUDY ON ENERGY GENERATION FROM HOSPITAL WASTE

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Abstract

In this paper we have calculated the pyrolysis oil generated from the hospital MSM Institute of Ayurveda, BPS Mahila Vishwavidyalaya Khanpur Kalan, Sonapat. The waste is collected from the hospital in total of 4 days to have an efficient pyrolysis plant. Calculation of energy generation from the fuel is done. And the recurring cost of the plant is calculated.

1. INTRODUCTION

Pyrolysis is a process which converts plastic waste into flammable oil with high calorific value.

This fuel can further be used to generate electricity in a hospital by burning it. Waste used for generation of electricity is taken from hospitals itself. Temperature plays an important role in pyrolysis process along with very high pressure. The reactors in which waste is pyrolyzed are of different types. Differentiation of pyrolysis is also done on the basis of time taken by the plastic to convert into fuel. Catalyst are also added in the reactor to enhance the process.

PYROLYSIS IN A HOSPITAL

Pyrolysis plant in a hospital is so set-up which generates electricity from the waste generated by the hospital itself. And that generated electricity can be used as a backup during load shedding. In general hospitals use incineration process to dispose the waste in which waste is burned but pyrolysis is more efficient and effective way to dispose hospital waste.

PYROLYSIS PROCESS

In this process plastic waste is initially shredded to small granules then heating of plastic waste is done in the absence of oxygen. Hydrocarbon chain of plastic is thermally cracked as it is a polymer chain with large molecular weight.

There are many processes which affect the pyrolysis. One of the important factor is

temperature. Since cracking of polymer chain is dominated by temperature. The temperature should remain constant for thermal breaking of C-C bond for a particular type of plastic.

Heating rate another thermal parameter is also a factor which is controlled in pyrolysis process. In this domain heating rate means the increase of temperature per unit time. For smaller quantity of waste slow process is preferred. For temperature indicator in this type of slow process heating rate is preferred. Rate of pyrolysis reactions is promoted by higher heating rate.

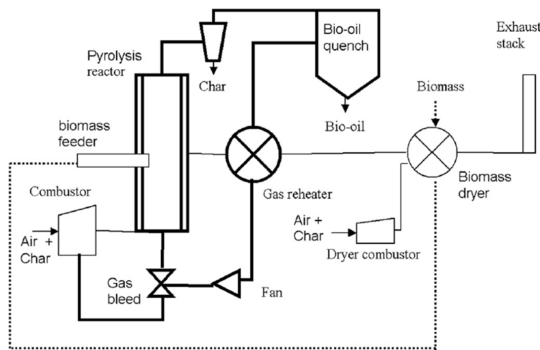
In pyrolysis process reactors are the significant stage. There are three types of reactors:- Batch, Semi-batch and continuous reactors. These reactors are categorized on the basis of feeding process. In the hospitals which generate less waste batch reactors are used. In this type of reactors materials are fed in small batches when the process starts. Reactors are further classified on the basis flow pattern of material that is fed in the reactor.

These reactors are of three types: fixed bed, fluidized bed and screw kiln reactor.

For small scale plants fixed bed is generally used, although being a slow process it is the most efficient process for the plants in which less amount of waste is fed. Fixed bed reactors are easy to operate.

In this pyrolysis plant all the plastic hospital waste is fed to the plant in a single batch in the fixed bed reactor in which under high temperature and pressure it is treated with the help of the catalysts. Residence time or the time required by pyrolysis

plant to convert into is monitored accordingly. And this residence time is divided into three categories, slow process, fast process, flash process. Residence time cannot be directly manipulated but it can be adjusted by altering various parameters like feeding rate, etc. basic catalysts used in pyrolysis plants include $AlCl_3$, zeolite, etc. These are some factors and points that are to be considered while designing a pyrolysis plant.



MATHEMATICAL CALCULATION FOR HOSPITAL

For economic production of pyrolysis oil, waste of four days is collected and the pyrolysis process is performed.

Waste generated per day = 20 kilograms

Waste collected for 4 days = 80 kilograms

Pyrolysis oil generated for 80 kgs of waste = 60 litres

Calorific value of Pyrolysis oil is 10,000 to 10,500 KCal/kg.

Production cost of pyrolysis oil (per liter) is Rs. 15.

Cost for 4 days = $60 \times 15 = 900$ Rs

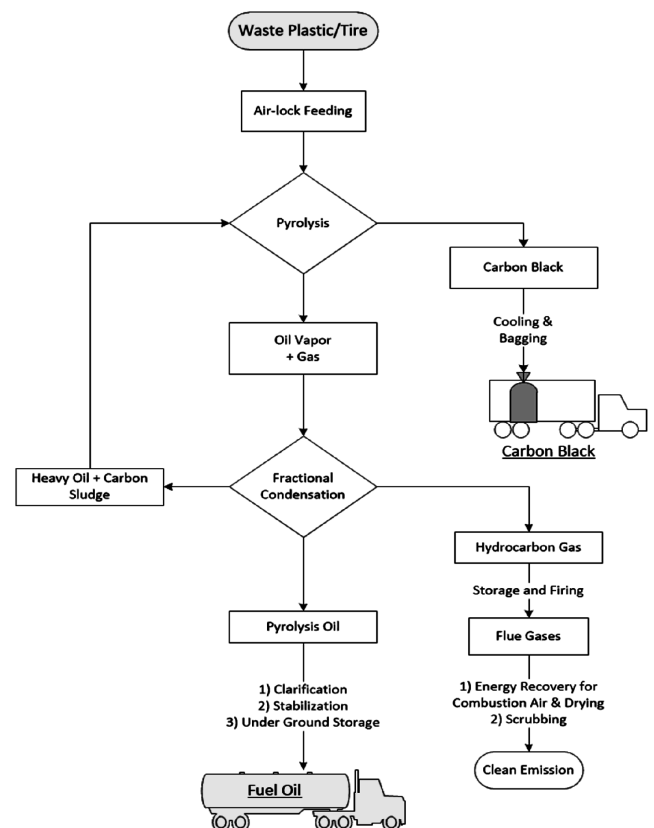
Density of pyrolysis oil is 0.87

Pyrolysis oil in kgs is $0.87 \times 60 = 52$ kgs

Calories in pyrolysis oil = $52 \times 10,000 = 5,20,000$ kcal

Energy in KWh = 605 KWh

That is 4 days of waste collected generates 605 units of electricity.



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