WASTE TO ELECTRICITY CONVERSION

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ABSTRACT

One of the fastest growing materials in Municipal Solid Waste (MSW) is that of waste plastics .In the India alone, 11.1% of the waste produced is plastic. With an annual amount in 2001 of over 229 million tons of waste, 25.4 million tons was plastic. Waste plastic when buried in landfills requires 50 plus years to decompose. When burned, waste plastics also emit toxic and foul smelling odours into the atmosphere but in present day the abundant waste plastic can be turn into the electricity.

The various tests and analysis done, the fuel oil and gases derived from waste plastics will be a very suitable fuel for the use of power generation in producing electricity. The fuel oil i.e. ETHANOL is mixed with 4% to 5% of that diesel oil. The dry gas consisting mainly methane, ethane, propane, butane, it is then used as a fuel to run an internal combustion engine and generator. and produce large quantity of fuel. The fuel oil is also suitable for mixing as component parts for gasoline and diesel fuel usage

Keywords: Reacting principle, Technical flow, Far Infrared Heating, chemical reaction, Reactor.

I. INTRODUCTION

Biodegradable plastics are plastic that will decompose in natural aerobic (composting) and anaerobic (landfill)environments .Biodegradation of plastics can be achieved by enabling microorganisms in the environment to metabolize the molecular structure of plastic film to produce an inert humus like material that is less harmful to the environment. They may be composed of either bio plastic which are plastics whose components are derived from renewable raw materials, or petroleum-based plastics which utilize an additive. The use of bio-active compounds compounded with swelling agents ensures that, when combined with heat and moisture, they expand the plastic's molecular structure and allow the bio-active compounds to metabolize and neutralize the plastic.Biodegradable plastics typically are produced in two forms: injection melded (solid, 3D shapes), typically in the form of disposable food service items, and films, typically organic fruit packaging and collection bags for leaves and grass trimmings, and agricultural mulch One of the fastest growing materials in Municipal Solid Waste (MSW) is that of waste plastics .In the India alone, 11.1% of the waste produced is plastic. With an annual amount in 2001 of over 229 million tons of waste, 25.4 million tons was plastic..

II. REACTING PRINCIPLES

PP, PE and PS are made from their respective monomer, such as propylene, ethylene and styrene. Their molecular weight is about 100000Kg/K mol. In the high temperature with the help of thermal cracking in the absence of air, their molecular, a long chain, is first broken into shorter chain molecular, then broken into smaller molecules. Their final products are gas, fuel oil, etc.

III. COLLECTION SCREENING AND STORAGE OF PLASTIC UNIT

This unit collects the waste plastic from the various sources such as domestic, industrial, commercial, etc. The waste plastic materials are also purchased by this unit from various industries and commercial sectors. The various plastic or polyethylene materials are also collected from the municipal areas by making the contact with municipal department.

After the collection of this bulk amount of plastic waste it is stored by the storage unit. In the storage unit the plastic materials are stored according to their types as tough plastic materials (bottles, toys, etc), polyethylene materials (thin plastic bags, etc) and chemical or soil mixed plastic materials .The storage unit also posses the screening of the plastic before their storage. These plastic materials are stored in the large steel containers.

Fig 1: Collection Screening And Storage Of Plastic Unit

IV. TECHNOLOGICAL FLOW DIAGRAM OF THE PROCESS

The technological flow diagram of the process is shown in Figure given below. The waste plastic from the Storage unit is fed into a plastic crusher unit where it is rendered into small pieces of about 20mm x 20mm in size. These small pieces are then transported into the auto-sealed 2screw feeder system and then pushed into the reactor where they are turned into a liquid state by the temperature of the heating system .The sediments like sand, mud, sludge and etc. are discharged out of the bottom of the reactor while the plant is running.

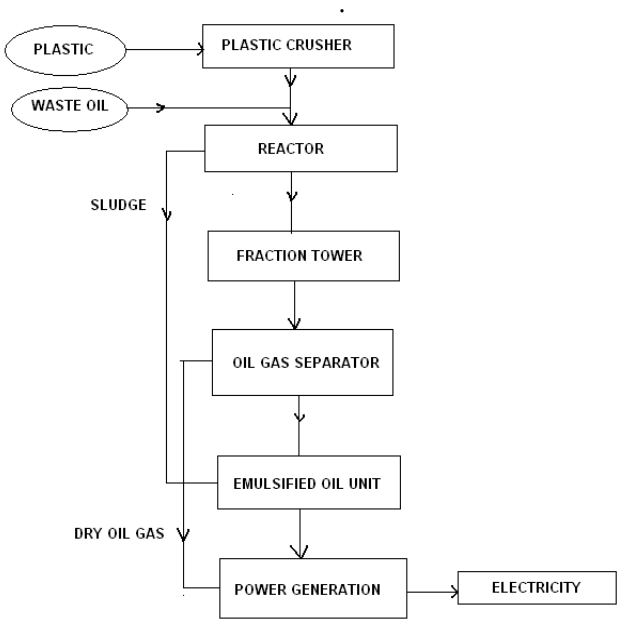

Fig 2: FLOW CHART

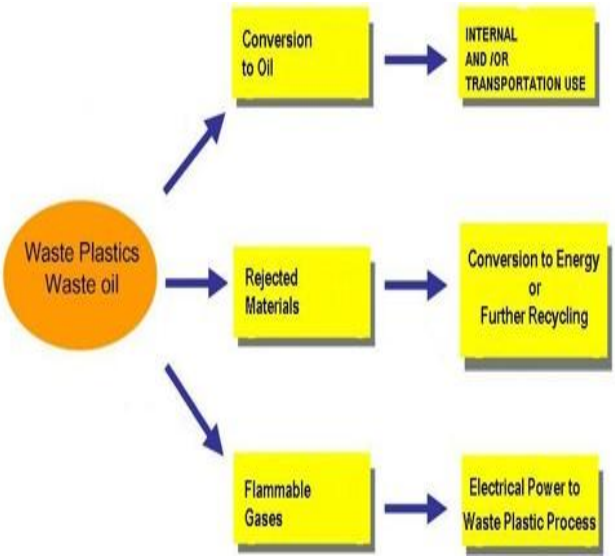

Fig 3: Technological Flow Diagram

V. FAR INFRARED HEATING FOR PLASTIC TO FUEL OIL CONVERSION

1) Far Infrared Heating

Conventional reactors for converting waste plastics into oil all use high temperature flue gas to supply the heat required to decompose the plastics into oil. But those reactors involve some disadvantages

First, their heating efficiency is not high. The high temperature flue gas transfers the heat to the outer surface of the reactor, and then the outer surface conducts the heat to the plastics in the reactor. Because the heat is not directly transferred to the plastics, the heating efficiency is lower. Because the heat-conducting coefficient of the plastic is low, it is difficult to conduct the heat into it from the heat source.

But the plastics, for example, PP (polypropylene), PE (polyethylene) and PS (polystyrene), absorb the far infrared ray easily, especially in the band of wavelength between 2.5 and 25 microns where the absorption is the strongest. When the wavelength of the infrared ray is in this range, it is called "far infrared ray". So when the waste plastics are heated by far infrared ray, the heating rate and heating efficiency will be increased.

The PP, PE, PS, and other plastics have their own special absorbing wavelength band. Various metal oxidants, nitride, carbide and boride, which are called far infrared radiator, emit the far infrared ray of different wavelengths when heated, and the wavelength is different

at different temperatures to similar material. Therefore, in order to get a high heating efficiency, the wavelength of the far infrared ray should be focused within this range by selecting the appropriate far infrared ray radiator and working temperature.

2) Plastic to fuel oil conversion

The waste plastic materials such as- waste plastic cement bags of polypropylene (thin-type PP), waste plastic from weaving bags made from polypropylene (PP),waste plastic food bags made from polyethylene (PE) , etc were cut into pieces and the sand sediment removed .They were then put into the cracking reactor. The pieces began to melt and were turning into a liquid state when the temperature of the bottom part of the reactor rose to 110°C and fuel oil appeared at the exit of the condenser behind the reactor when the temperature reached a specified range and the top temperature was 75°C.

After 20 minutes the oil flow increased when the temperature in the bottom increased and the top temperature reached 95°C. After 10 minutes at this stage, the oil flow accelerated and produced a great quantity of cracking gas, which was ignited after passing through a water-sealed tank. The bottom temperature was increased and the top temperature reached 242°C and cracking was carried on for 35 minutes. Ten minutes after this stage, the reaction phase finished with a top temperature of 147°C and thus we get the fuel oil.

The yield of fuel oil was 65.83% from the whole plastic materials bag and the heavy oil that contained wax at the bottom of the reactor was 20.93%. Total yield of high quality fuel oil was 86.76%. Cracking gas and loss amounted to 10.23% and coke was3.01%.

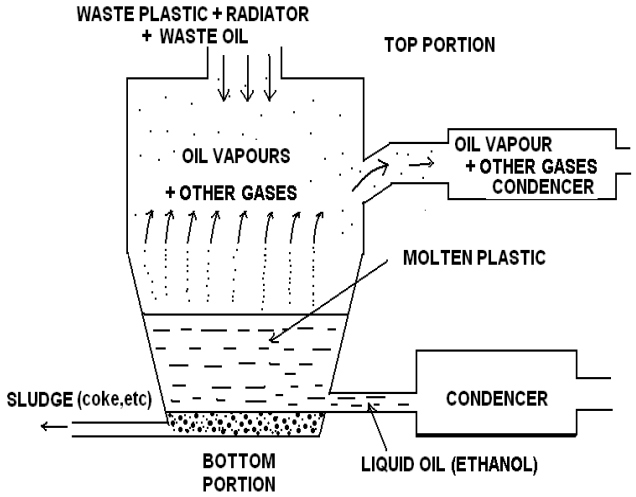

Fig 4: DETAILS OF REACTOR

VI. ELECTRICAL POWER GENERATION

From the results of the various tests and analysis done, the fuel oil and gases derived from waste plastics will be a very suitable fuel for the use of power generation in producing electricity. The fuel oil i.e. ETHANOL is mixed with 4% to 5% of that diesel oil.

The dry gas consisting mainly methane, ethane, propane, butane, it is then used as a fuel to run an internal combustion engine and generator. and produce large quantity of fuel. The fuel oil is also suitable for mixing as component parts for gasoline and diesel fuel usage.

The power generating set used for this system is shown in figure as given below. The generating capacity of this set is 100 KW and supply 120 KVA load.

The working and construction of this generating set is nearly similar to that of the diesel generating set as shown in figure.

Basically 800 Kg of waste plastic produce 100 KW power.

Fig 5:Power Generating Set

VII.CONCLUSIONS

The conclusion from the above topic is that WASTE TO ELECTRICITY CONVERTION SYSTEM converts the chemical energy stored in the waste plastic into electricity by producing the oil for the generation of electricity and the waste plastic also becomes a non conventional source of energy.

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