PILOT STUDY ON TREATMENT OF PLASTIC BY PYROLYSIS PROCESS FOR PRODUCTION OF OIL

M.kalaiyarasan[1] *,R.Arun kumar*[2]*,M.K.Mohamed Irfan*[3]*,M.Bala krishnan*[4]*,A.Vijay*[5]

Student scholar, Department of Civil Engineering Panimalar Engineering college Chennai, India [1]

Student scholar, Department of Civil Engineering Panimalar Engineering College Chennai, India[2]

Student scholar, Department of Civil Engineering Panimalar Engineering College Chennai, India[3]

Student scholar, Department of Civil Engineering Panimalar Engineering College Chennai, India[4]

Asst.professor, Department of Civil Engineering Panimalar Engineering College Chennai, India[5]

Abstract - *There is an increase in the production and consumption of plastics as the day goes by. All plastics need to be disposed after their usefulness, as waste. The needs to manage this waste from plastic become more apparent. This leads to pyrolysis, which is a way of making to become very useful to us by recycling them to produce fuel oil. In this study, plastic wastes (polyethylene) were used for the pyrolysis to get fuel oil that has the same physical properties as the fuel used in aviation industry. The experiment was carried out in such a way on, thermal pyrolysis (without the aid of a catalyst). Some of the plastics wastes that are suitable for pyrolysis are: HDPF (high density polyethylene).*
Thus the problems faced by the increasing in plastic waste and the increasing fuel crisis can be eliminated by making a system which can decrease the pollution due to plastic and increasing the availability of the alternative fuel. This was created by changing the waste plastic into helpful different oil by means that of shift method.

Key Words: pyrolysis method, waste plastic, condensation ,KOH, copper tubes

1.INTRODUCTION

The use of plastics has been associated with significant environmental problems due to their continuous accumulation in landfills, as plastic waste does not degrade or degrades at a very low pace. On average, 50% of the waste plastic generated in Europe is recovered, while the rest is sent to landfills. In 2015, global plastic production reached 322 million tones, a dramatic increase compared to the 279 million tons produced in 2011 According to the World Bank, plastic waste accounts for 8–12% of the total municipal solid waste (MSW) worldwide, while it is estimated to increase to 9–13% of the MSW by 2025. The increasing availability of such waste material in local communities, coupled with the high energy density, render waste plastics one of the most promising resources for fuel production. The pyrolysis of plastics and other MSW (end-of-life tires, organic wastes, etc.) for fuel production is practiced by several small-size companies worldwide, especially those of emerging economies, where industries such as cement, glass, and other energy-intensive sectors represent the reference market for this type of fuel (diesel-range hydrocarbons produced via the pyrolysis of plastics and MSW). The pyrolysis of plastics yields on average 45–50% of oil, 35–40% of gases, and 10-20% of tar, depending on the pyrolysis technology.

According to previous analysis, there are some cases where a high amount of liquid yield, more than 80 wt %, could be produced in the pyrolysis of individual plastic ,which is higher than the pyrolysis of wood-based biomass in general. The pyrolysis oil can be valorized better if separated into separate fractions with different boiling point ranges. This compendium of technologies aims to gift an outline of the technologies on the market for changing waste plastics into a resource. It emphasizes the standard ways for changing waste plastics into solid, liquid and vaporized fuels furthermore because the direct combustion of waste plastics for specific applications.

1.2 PLASTICS:

Plastics are compound materials, a fabric designed up from long continuation chains of molecules.
Polymers such as rubber occur naturally, but it wasn't until the development of synthetic polymers around 1910 that the polymers tailored to the needs of the engineer first started to appear. One of the first commercial plastics developed was Bakelite and was used for the casting of early radios. Because the first plastics weren't utterly with chemicals stable, they gained a name for being low cost and unreliable. However, advances in plastic technology since then, mean that plastics are a really vital and reliable category of materials for product style. Plastic could be a marvel of compound chemistry, plastics became an essential a part of our everyday life. But continual reprocessing of plastic waste, and its disposal cause environmental issues, create health hazards, in addition to being a public nuisance. The biggest current threat to the standard industry is probably going to be environmental issues, as well as the discharge of harmful pollutants, gas and non-biodegrable lowland impact as a result of the production and disposal of petroleum based plastics. Plastics are cheap, lightweight, strong, durable, corrosion-resistant materials, with high thermal and electrical insulation properties. The diversity of polymers and also the skillfulness of their properties are wont to create a huge array of product that bring medical and technological advances, energy savings and various other societal benefits. As a consequence, the production of plastics has increased substantially over the last 60 years from 0.5 million tonnes in 1950 to over 260 million tones today. In Europe alone the plastics industry has a turnover in excess of 300 million euros and employs 1.6 million people. Almost all aspects of daily life involve plastics, in transport, telecommunications, clothing, footwear and as packaging materials that facilitate the transport of a wide range of food, drink and other goods. There is considerable potential for new applications of plastics that will bring benefits in the future, for example as novel medical applications, in the generation of renewable energy and by reducing energy used in transport. Some plastics wastes are suitable for pyrolysis such as: HDPE (high density polyethylene), LDPE (low density polyethylene), polypropylene' polystyrene' polyvinyl alcohol, polyoxy-methylene, polyamide, polyurethane, polyphenylene, polyvinyl chloride etc. But for tire purpose of this study low density polyethylene (LDPE) was used since it is.

1.3 TARGET WASTE PLASTICS:

Waste plastics area unit one among the foremost promising resources for fuel production attributable to its high heat of combustion and because of the increasing convenience in native communities. Unlike paper and wood, plastics do not absorb much moisture and the water content of plastics is far lower than the water content of biomass such as crops and kitchen wastes .The conversion ways of waste plastics into fuel depend upon the categories of plastics to be targeted and also the properties of different wastes which may be utilized in the method. Additionally the effective conversion needs applicable technologies to be designated in step with native economic, environmental, social and technical characteristics. In general, the conversion of waste plastic into fuel requires feed stocks which are non-hazardous and combustible. In particular every style of waste plastic conversion methodology has its own appropriate feedstock. The composition of the plastics used as feedstock is also terribly completely different and a few plastic articles would possibly contain undesirable substances (e.g. additives such as flame-retardants containing bromine and antimony compounds or plastics containing nitrogen, halogens, sulphur or Any other hazardous substances) which pose potential risks to humans and to the environment. The types of plastics and their composition can condition the conversion method and can verify the pre-treatment necessities, the combustion temperature for the conversion and thus the energy consumption required, the fuel quality output, the flue gas composition (e.g. Formation of risky flue gases like Roman deity and HCl), the ash and bottom ash composition and also the potential of chemical corrosion of the instrumentality, Therefore the major quality issues once changing waste plastics into fuel resources area unit as follows:

• Smooth feeding to conversion equipment: Prior to their conversion into fuel resources, waste plastics are subject to various methods of pre-treatment to facilitate the smooth and efficient treatment during the subsequent conversion process. Depending on their structures (e.g. rigid, films, sheets or expanded (foamed) material) the pre-treatment equipment used for each type of plastic (crushing or shredding) is often different.

• Effective conversion into fuel products: In solid fuel production, thermoplastics act as binders which form pellets or briquettes by melting and adhering to other non-melting substances such as paper, wood and thermosetting plastics. Although wood materials area unit shaped into pellets employing a pelletizer, mix plastics with wood or paper complicates the pellet preparation method. Suitable heating is required to produce pellets from thermoplastics and other combustible waste. In liquid fuel production, thermoplastics containing liquid organic compound may be used as Feedstock. The type of plastic getting used determines the process rate still because the product yield. Contamination by undesirable substances and also the presence of wetness will increase energy consumption and promotes the formation of by product within the fuel production method.

Well-controlled combustion and clean flue gas in fuel user facilities: it's vital to match the fuel sort and its quality to the burner so as to boost heat recovery potency .Contamination by N, chlorine, and inorganic species, for instance, can affect the flue gas composition and the amount of ash produced. When victimization fuel ready from waste plastics, it must be assured that the flue gas composition complies with local air pollution regulations.

In the same way, ash quality must also be in compliance with local regulations when disposed at the landfill. If there aren't any relevant laws, each the producers and customers of the recycled fuel ought to management the fuel quality and also the emissions at combustion so as to attenuate their environmental impact.

1.4 Types of plastic:

- TYPE1 (PETE)
- TYPE 2 (HDPE)
- TYPE 3 (V)
- TYPE 4 (LDPE)
- TYPE 5 (PP)
- TYPE 6(PS)
- TYPE 7 (OTHER)

2. COMPONENTS:

2.1 LOW DENSITY POLYTHYLENE:

This is prepared by high pressure of ethylene. It is made from petroleum. It has a density range of 0.910 - 0.940g1cm3. It is not reactive at room temperature, except by strong oxidizing agents and some solvents causing swelling. It can withstand temperatures of 80oC continuously and 95oC for a short time.
LDPE is employed for producing varied containers, dispensing bottles, wash bottles, tubing, plastic bags for computer, and its common use is in plastic bags.

2.2 REACTOR:

This is a stainless steel tube of length 145mm, internal diameter 37mm, outer diameter 4lmm sealed at one end and an outlet tube at the other end. The reactor is to be placed inside the furnace for external heating with the raw material .Inside for internal heating. The reactor is heated by electrical heating to temperature of about〖500〗^0C and more.

2.3 FURNACE:

The furnace provides the heat the reactor needs for pyrolysis to take place, it has a thermocouple to control the temperature. A chamber could be a device used for high-temperature heating. The name derives from Greek word Fornix, which means oven.

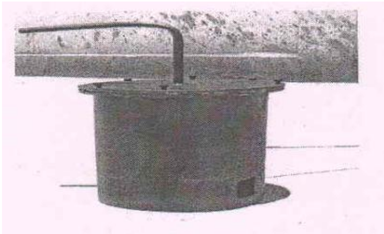

Fig : Furnace

Fig : STEEL REACTOR

Fig : CONDENSER

2.4 CONDENSER:

It cools all the heated vapour coming out of the reactor. It has an inlet and outlet for cold water to run through its outer area. This is used for cooling the vapour. The gaseous hydrocarbons at a temperature of about

〚350〛^0C are condensed to about 30-〚35〛^0C.In systems involving heat transfer, a condenser is a device or unit used to condense a substance from its aerosolized to its liquid state, by cooling it. In therefore doing, the latent heat is given up by the substance ,and will transfer to the condenser coolant. Condensers square measure generally heat exchangers that have varied styles and are available in several sizes starting from rather tiny (hand-held)to terribly giant industrial-scale units utilized in plant processes.

2.5 HEATING ELEMENT:

A element converts electricity into heat through the method of resistive or Joule heating.
Electric current passing through the part encounters resistance, resulting in heating of the element.
Unlike the Peltier result this method is freelance of the direction of current flow.

2.6 COPPER TUBES:

Copper conduit is most frequently used for offer of hot and cold H2O , and as refrigerant line in HVAC systems.
There square measure 2 basic sorts of copper conduit, soft copper and rigid copper.
Copper conduit is joined exploitation flare association, compression association, or solder.
Copper offers a high level of corrosion resistance, however is turning into terribly pricey.

2.7 SOFT COPPER:

Soft (or ductile) copper conduit are often bent simply to travel around obstacles within the path of the conduit.
While the work hardening of the drawing process used to size the tubing makes the copper hard or rigid, it is carefully annealed to make it soft again; it is thus costlier to supply than non-annealed, rigid copper conduit.
It are often joined by any of the 3 strategies used for rigid copper, and it's the sole sort of copper conduit appropriate for flare connections. Soft copper is that the most well-liked selection for refrigerant lines in split-system air conditioners and warmth pumps.

2.8 RIGID COPPER:

Rigid copper could be a well-liked selection for water lines. It is joined employing a sweat, roll grooved, compression or crimped/pressed connection. Rigid copper, rigid due to the work hardening of the drawing process, cannot be bent and must use elbow fittings to go around corners or around obstacles. If heated and allowed to cool down in an exceedingly method referred to as tempering, rigid copper can become soft and may be bent/formed while not cracking.

2.9 PYROLYSIS TECHNOLOGY:

Pyro: heat, lysis: breakdown into pafis. Pyrolysis is chemical reactions within which giant molecules are broken down into smaller molecules. Simplest example of pyrolysis is cooking in which complex food molecules are broken down into smaller & easy to digestible molecules. Waste plastic and tire are long chain molecules or polymer hydrocarbons. Pyrolysis technology is that the process of breaking down giant molecules of plastic/tire into smaller molecules of oil, gas and C. Pyrolysis of waste plastic or tire takes place in absence of oxygen, at about 350-550 degree C and reaction time is about 15-90 minute.

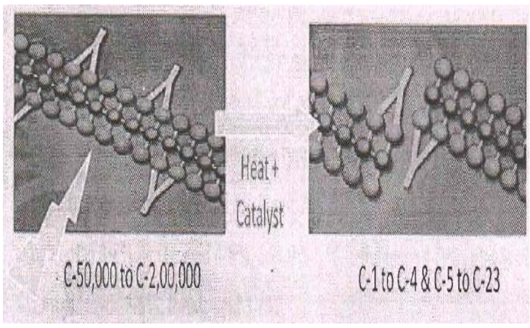

Fig : pyrolysis process

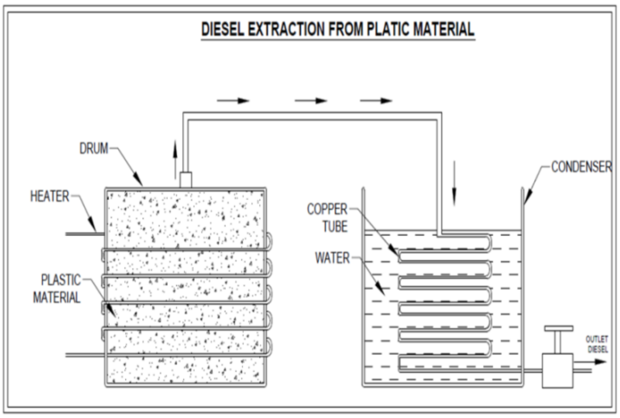

Fig: PROTO TYPE SETUP

Fig: PROTO TYPE MODEL

2.10 PYROLYSIS OIL:

Pyrolysis oil is sometimes known as bio crude oil or bio oil, is a synthetic fuel under investigation as substitute for petroleum. It is extracted by biornass to liquid technology of destructive distillation from dried biornass in a reactor at a temperature of about 500 degree Celsius with subsequent cooling. Pyrolysis oil (bio oil) may be a reasonably tar and usually contains too high level of O to be a hydro carbon. As such is distinctly different from similar petroleum product

2.11 PYROLYSIS OIL CHARACTERISTICS:

PH	1.5-3.8
Water	20-28%
Pyrolytic lignin	22-36%
Hydroxyl acetaldehyde	8-120
Levoglucosan	3-8%
Acetic acid	4-8%
Acetol	3-6%
Sellubiosonl	2%
Glycol	1-2%
Formic acid	3-6%

3. CONCLUSION:

We square measure proud that we've got completed the work with the restricted time with success.

The "FABRICATION OF EXTRACTION OF BIO-DIESEL FROM PLASTIC WASTE MATERIAL" is working with satisfactory conditions. We are able to understand the difficulties in maintaining the tolerances and also quality. We have done to our ability and talent creating most use of accessible facilities

REFERENCES:

[1] Kanika Mathur ,"EXTRACTION OF PYROLYSIS OIL FROM WASTE PLASTICS"(2016)

[2] M. Z. H. Khan, M. Sultana, M. R. Al-Mamun, and M. R. Hasan "PYROLYTIC WASTE PLASTIC OIL AND ITS DIESEL BLEND, FUEL CHARACTERIZATION"(2016)

[3] Vijaykumar B. Chanashetty ,"FUEL FROM PLASTIC WASTE" (2015)

[4] Athanasios Dimitriadis,Gian-Claudio Faussone, "ALTERNATIVE DIESEL FROM WASTE PLASTICS"(2017)

[5] G.K.Vijayaraghavan,"Manufacturing technology (Machine Processes & Types)"

[6] S.Senthil, L.Madan, N.Rabindro Singh, "Engineering economics & cost analysis (Cost of Material)"

[7] PSG college of technology ,"Design data book"

[8] Jackquelinevaughn,"Municipal waste management"

[9] G.M. Savage, "Composting and Recycling Municipal Waste"

[10] Morwood,.R,"Urban Solid Waste Management"