International Journal for Research in Engineering Application & Management (IJREAM)
ISSN : 2454-9150 Vol-07, Issue-01, APR 2021

Preparation and Blending of Different Biomass to Produce Bio-Oil and Determine its Characterization by Pyrolysis

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Abstract:- **The energy produced by the Biomass are the renewable resource utilized to produce bio-energy. Scientist was working in the manufacturing of bio fuel from the natural material obtained from various resources. In this work, the research is focused on the extraction of Bio- oil by means of fixed bed Pyrolyzer. The production can be achieved along two alternative process, they include the Biomass thermochemical liquefaction process or by biomass pyrolysis process. It is found that the Study of Conversion of Bio-mass to Bio-oil has to overcome the challenges about the structure and size of the pyrolysis reactor, and the amount of feedstock given to the material. Pyrolysis oil can also called as the Bio-crude oil or Bio-oil is obtained by heating the dried Biomass at the absence of oxygen in the rector in the temperature of about 500°C with subsequent cooling operation. Also this paper provides the detailed information about the experimental comparison of yield of bio-oil from the Coconut Shell and tamarind shell with the help of fixed bed pyrolyzer reactor.**

Keywords – ***Coconut Shell, Tamarind Shell, Pyrolysis, Bio-Oil .***

I. INTRODUCTION

India is the fourth largest energy consumer and importer after USA, China, Russia in 2011.The energy composition in India mainly comprised of nuclear and other renewable sources (5%), petroleum (23%), coal (41%), natural gases(8%), solid biomass and waste(23%)(example firewood).

From the beginning of economic policy 1991 standard of living is increasing due to high rate of per capita income, because of the same geographical transition is happening from rural to urban because of better opportunity and and high standard of living in urban areas. The per capita energy consumption which is more than double after new economic policy.

Tamarind and Coconuts are generally found near Agricultural areas and coastal areas of India . Coconut tree grow throughout the warmer regions of India including Maharashtra, Karnataka, Tamil Nadu, Andrapradesh and Kerala. It bear fruits during the winter months in India. Tamil Nadu has accounted for the largest volume of tamarind production in India in fiscal year 2018. This figure stood at almost 45 thousand metric tons, making up nearly 45.4 percent of tamarind production share. Kerala followed with Maharashtra ranking third that same year. Total tamarind production in the country amounted to just over 98 thousand metric tons. Pyrolysis is the process of decomposing organic materials at elevated temperature in the absence of oxygen. The word pyrolysis is derived from the Greek Words “pyro” means fire and “lys” is means separating. It is commonly is used to convert organic material into a solid residue. Pyrolysis is a thermochemical decomposition of organic material at elevated temperatures in the absence of oxygen. It involves the simultaneous change of chemical composition and physical phase, and is irreversible. There are three types of pyrolysis differentiated by the processing time and temperature of the biomass. The types are (i) Slow Pyrolysis, (ii) Flash Pyrolysis, (iii) Fast Pyrolysis.

II. METHODOLOGY

Pyrolysis reaction play a major role in the production of Bio-oil.The Bio-oil produced by this process undergo the three types of Extraction using the techniques of Pyrolysation process.The process involved in the Extraction and the Oil obtained in this process are tabulated below :

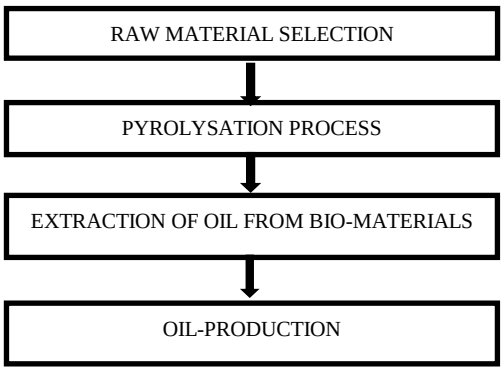

Fig. 1 Methodology

 DOI : 10.35291/2454-9150.2021.0141

III. RAW MATERIAL SELECTION

The raw material which is selected for our work is Coconut Shell and Tamarind Shell. These raw materials are cleaned well and then these raw materials are dried up for more than a month for the removal of moisture content in both the tamarind and coconut shell and then crushed well for the further process. There are three types of pyrolysis which are slow, flash and fast pyrolysis. In this work, separation of oil from the shell is done by fast pyrolysis. By means of fast pyrolysis, the rapid heating rates and moderate temperature lies between 350 and 550°C.

A. Pyrolysis Reactor

The experiments of pyrolysis are carried out in a tubular reactor. An electric heater along with the temperature sensing device is fixed in the upper lid which is used to close the reactor. The input of the temperature is controlled by the dimmer-stat. In this reactor water is used as the cooling agent to reduce the high amount of heat produced during the operation of pyrolysis. The temperature which is given at the limit of 500°C to 650°C. The time period which is taken for the combustion of raw material is based on the size and quantity of the material which is provided as the input material to the reactor.

B. Procedure

The Biomass input material of coconut shell and the tamarind shell should be very small less in size of 1cm is selected. Then the crushed raw material is poured into the fluid bed reactor. The input material quantity should be more than the half or three-quarters of the capacity of the reactor. So that, the gas which is coming out from the heating shell releases out through the condenser. The water is the condensing medium which is allowed to flow over the gas. So that gas is converted into liquid form (i.e) oil and waste gases. The oil is collected in the beaker and the waste gas is removed gradually. In this work, the temperature should gradually increase and maintain the temperature 500 to 650^{0}C. So that, the yield of the Bio- oil becomes high.

IV. EXPERIMENTAL PERFORMANCE

A. Tamarind Shell Oil

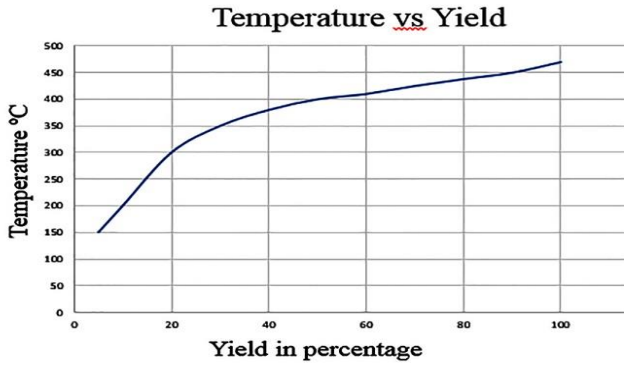

Fig 2. Temperature vs Yield

The information given above provides the difference of time period taken for obtain the desired temperature for the production of both thebio-oil. The graph is drawn between the temperatures versus time period taken for the combustion taken within the reactor. The graph shows about the yield value of oil that is obtained at a certain temperature (i.e) 500°C to 650°C.

B. Coconut Shell Oil

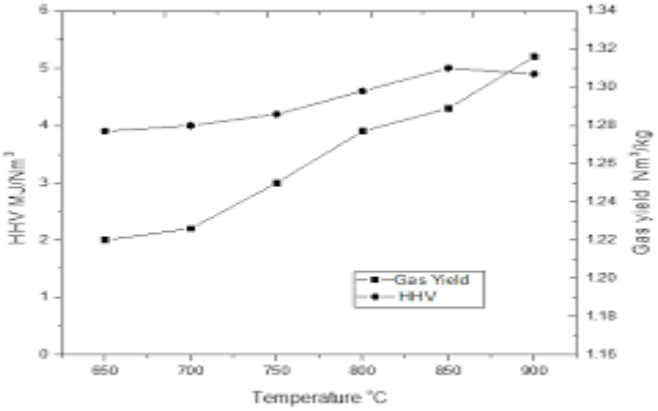

Fig 3. Performance Curve

Data were observed based on the coconut shell oil as a fuel in this experimentation. Based on that observed data to draw the performance curve.

PROCESS TABLE 1:

Parameters	Tamarind Shell
Yield Point	250°C
Maximum Yield	450 to 600°C
Raw material input(kg)	6
Oil obtained(ml)	2500

CALCULATION:

Mass of raw material = Mass of oil + Mass of vapour leaves out + Mass of ash formed.

Mass of raw material =6kg

Mass of oil obtained=1.3litre

Mass of ash = 0.7 kg

Vapour leaves out = remained

PROCESS TABLE 2:

Parameters	Coconut Shell
Yield Point	200°C
Maximum Yield	250 to 500°C
Raw material input(kg)	7
Oil obtained(ml)	1500

CALCULATION:

Mass of raw material = mass of oil + mass of vapour leaves out + mass of ash formed

Mass of raw material =7kg

Mass of oil obtained=1litre

Mass of ash = 0.5 kg

Vapour leaves out = remained

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V. CONCLUSION

The yield of oil from the experimental comparison provides the yield of oil from the tamarind Shell is higher than that of the Coconut Shell. The yield of oil is based on the factor of size, quantity and the amount of material used. In this work the size and the quantity of material which is used is similar. But the nature of material will get varied.

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