



Experimental Comparison of Yield of Bio-Oil in Fixed Bed Pyrolyzer

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ABSTRACT

Generally all over world, the researchers are researching in the field of renewable energy and alternative fuels. Researchers are working in the manufacturing of bio fuel from the natural material and also scrutiny for the use as alternative energy source. In this work, the research is focused on the extraction of oil by means of fixed bed Pyrolyzer. Also in this paper provides the detailed information about the experimental comparison of yield of bio-oil from the coconut shell and the Indian almond shell with the help of fixed bed pyrolyzer.

Keywords - Coconut Shell, Indian Almond Shell, Pyrolysis, Bio-Oil

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 thermo-chemical 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

I. INTRODUCTION

Indian Almond tree is generally found in near coastal areas of the Indian Ocean, through tropical Asia, and into the Pacific Ocean. Indian Almond grow throughout the warmer regions of Indian including Maharashtra, Karnataka, Tamil Nadu, Andra Pradesh and Kerala. It bear fruits during the winter months in India.

Coconut is a popular plantation and is grown in more than 90 countries worldwide. The world production of coconut sums up to around 55 million tonnes annually. Coconut production plays an important role in India. India accounts for 22.34 per cent of the world's coconut production and is one of the major players in the world's coconut trade.

II. METHODOLOGY

The basis method which is adopted for the extraction of oil is Pyrolysis method. There are three types of Pyrolysis which are slow, flash & fast pyrolysis. In our work, the process of extraction of oil is done under the type of Flash Pyrolysis . figure 1 shows about the process involved in the extraction of oil.

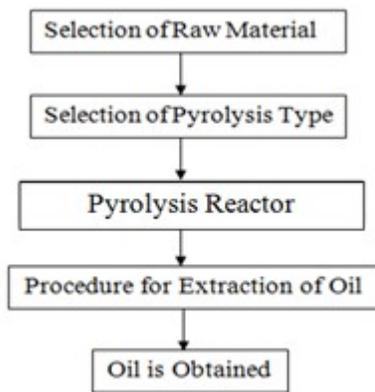


Fig 1: Process chart

2.1 Selection of Raw Materials

The raw material which is selected for our work is Coconut shell and Indian almond shell. It is cleaned and the residue of the seed should be removed finely. The nuts of this coconut shell and almond fruit should be removed. Then the coconut shell and Indian almond shell is get dried for more than a month for the removal of moisture nature in the shell. Then it is finely grained by means of crusher or mechanical power.

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 flash pyrolysis. By means of fast pyrolysis, the rapid heating rates and moderate temperature between 400 and 600°C.

2.2 Pyrolysis Reactor

The pyrolysis experiments were conducted in a tubular reactor. An electric heater along with temperature sensing device is fixed in the upper lid which is used to close the reactor. The temperature input is controlled by dimmer-stat. In this reactor water is used as condenser. The temperature which is given at the limit of 500°C to 550°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 input to the reactor.

2.3 Procedure:

The input material should be very small less than 5cm, that in this work selected. Then the material is poured into the fixed bed reactor. The input material quantity should 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 can leaves out through the condenser. The condensing medium is

water 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 550°C. So that, the yield of oil becomes high.

III. EXPERIMENTAL COMPARISON

3.1 Coconut Shell

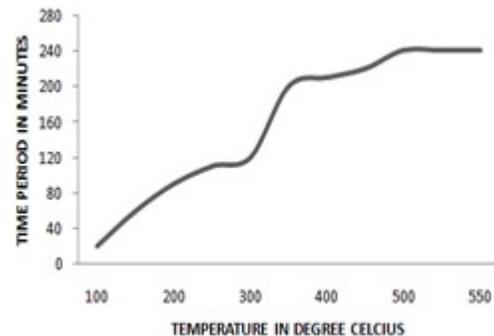


Fig 2: Graph coconut shell: temperature Vs time period for combustion

From the above graph 2, the information provides the time period taken for obtain the desired temperature for the production of oil. The graph is drawn between the temperature versus time period taken for the combustion taken within the reactor. From the graph 3, shows about the yield value of oil is obtained at certain temperature (i.e) 500 to 550°C. The graph is drawn versus temperature and yield value.

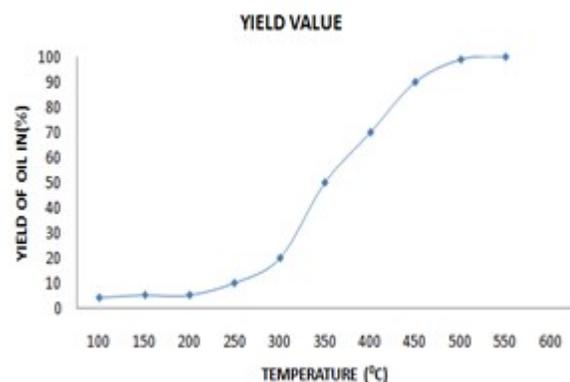


Fig 3: Graph coconut shell: Temperature Vs Yield value Indian almond shell

3.2 Indian Almond Shell

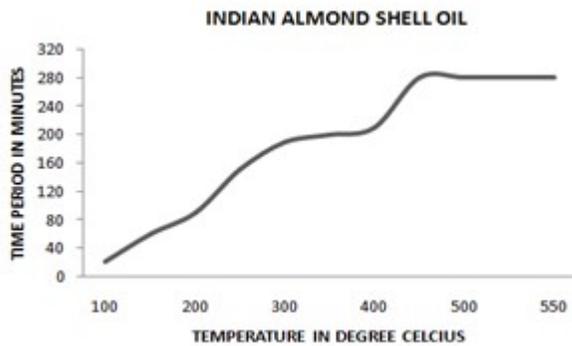


Fig 4: Graph Indian Almond Shell: temperature Vs time period for combustion

The above graph shows about the details of temperature which is maintained in the certain time period for the highest yield of oil. The maximum time period for the extraction of oil is 4hrs 40min.

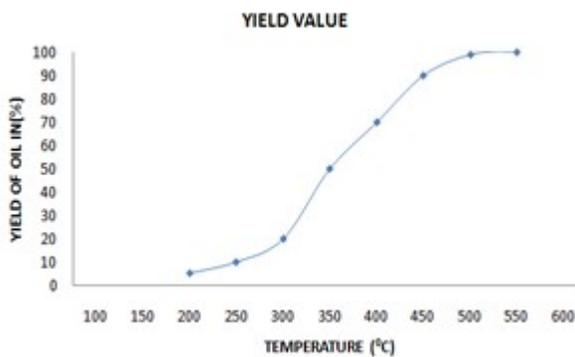


Fig 5: Graph Indian Almond shell: Temperature Vs Yield value Indian almond shell

The above graph shows about the yield point of oil versus the temperature. It shows at which the yield point increases with reference to the temperature.

The comparison table is shown below

Table 1: Comparison Table

Parameters	CSO	IASO
Yield point (°C)	200	100
Maximum yield (°C)	500- 550	500- 550
Raw material input (kg)	2.2	2.5
Oil obtained(ml)	1000	800

IV. CALCULATION

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

4.1 For Coconut Shell

Mass of raw material = 2.2kg

Mass of oil obtained= 1litre

Mass of ash = 0.5 kg

Vapour leaves out = remained

4.2 For Indian Almond Shell

Mass of raw material = 2.5 kg

Oil obtained = 800ml

Mass of ash obtained = 0.8 kg

Vapour leaves out = remained

V. RESULTS

From the experimental comparison the yield of oil from coconut shell is higher than the Indian almond shell oil. The yield of oil is based on the factor of size, quantity and the tendency of material used. In this work the size and the quantity of material which is used is similar. But the nature of material is get varied.

In the future work it will discuss about the nature of material for high and low yield of oil for the Coconut shell and Indian Almond shell respectively.

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