Experimental Investigation of Devdaru Seeds in Batch Type Pyrolysis

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ABSTRACT:
Now-days the degraded and non-degraded wastes were increasing rapidly and causes major problem in the disposal issues. There are several methods in disposing the waste like Biochemical and Thermo chemical process. Among these techniques Pyrolysis is one of the Thermo chemical process in which the waste biomass is converted into useful products like Pyrolytic oil, Gas and residue by means of heating the biomass in the absence of oxygen. In this paper pyrolysis of Polylthialong folia (devdaru seeds) were studied. Initially the thermo gravimetric analysis and ultimate analysis were carried out to find the maximum decomposition temperature and percentage of various components (Carbon, Hydrogen and oxygen) present in the biomass respectively. The devardu seeds are subjected into batch type pyrolysis setup and the maximum pyrolytic oil yield temperature was 550° C. The pyrolytic oil is characterized by using FTIR to find the various compositions present in oil.
KeyWords:Pyrolysis,TGA,Polylthialongfolia.

1.INTRODUCTION

Biomass has been recognized as a major renewable energy source to supplement declining fossil fuel sources of energy. It is the most popular form of renewable energy and currently bio fuel production is becoming very much promising. Transformation of energy into useful and sustainable forms that can full fill and suit the needs and a requirement of human beings in the best possible away is the common concern of the scientists, engineers and technologists[1,2]. From the view point of energy transformation, batch type pyrolysis is more attractive among various thermo chemical conversion processes because of its simplicity and higher conversion capability of biomass and useful products such as pyro lytic oil, Gas and Residue.

Pyrolysis is a thermal decomposition process that occurs at moderate temperature with a high heat transfer rate to the biomass particles and a short hot vapor residence time in the reaction zone. Pyrolysis of biomass produces a liquid product, pyrolysis oil or bio-oil that can be readily stored and transported.Pyrolysisoil is a renewable liquid fuel and can also be used for production of chemicals. Pyrolysis has now achieved a commercial success for production of chemicals and is being actively developed for producing liquid fuels. Pyrolysis oil has been successfully tested in engine, turbines and boilers, and been upgraded to high quality hydrocarbon fuels although at a presently unacceptable energetic and financial cost.

In this work, the pyolysis of Polylthialongifolia(Devardu seeds) is studied. The main objective of the work is to perform i) Conducting the experiments in batch type pyrolysis setup by obtaining the temperature from the TGA curve. ii) Analysis of the pyrolytic oil by using FTIR.

2.MATERIAL AND METHODS

Devdaru seeds were selected as the feed material for this study. PolylthiaLongifolia (Devdaru) in the genus Switenia, is extensively cultivated in India, It is a semi evergreen tree, about 30-35m tall. Fruit shape is oval, fruit length is 1 to 3 inches, fruit covering dry or hard, the fruit color is brown. The devdaru seeds are not utilized but it is considered as the renewable energy along with add value in the agricultural products[3,4].The devdaru seeds were collected and dried in sunlight for two days in order to moisture present in the seeds.

Fig 1.1 Devardu seeds

2.1CHARACTERIZATION OF RAW MATERIAL:

The devdaru seeds is subjected to ultimate analysis in order to find out the various components present in the raw material by using CHNS/O analyser with the initially sample weight of 5.109mg. (Make:Perkin Elmer, Model: 2400seriesII). The (CHNS/O analyser) result were shown in Table 1.1.The raw material is also characterised by using Thermo gravimetric analysis (TGA) to find the maximum temperature with the initially sample weight of 5.778mg (TA instruments, Model : Q600 SDT). The TGA results were shown in Figure 1.3.

2.2PYROLYSIS OF POLYLTHIALONGIFOLIA (DEVDARU) SEEDS.

The pyrolysis process of devdaru was carried out in a batch type pyrolysis apparatus shown in the Fig.1.2. It consists of a stainless steel, cylindrical reactor core which can be placed in a silica brick shell. The reactor core can be taken out from the shell to feed the raw material and remove the residue. A cover is provided to

close the reactor and seal it from the surrounding atmosphere [5]. Electrical windings are placed in the shell to heat the raw material. K-type thermocouple is mounted in the shell to indicate the reactor temperature. A stainless steel counter flow water cooled condenser is fitted at the top end of the reactor.

The devdaru seeds was fed into the stainless steel reactor and closed with the cover to avoid the entry of oxygen. For each experiment 100 gram of waste milk cover was kept into the reactor. The reactor was heated to final temperature of 250°C, 350°C, 450°C, 550°C, and 650°C. The time taken to attain the final temperature was noted. The volatile matter produced by the thermal degradation was cooled in the condenser. The pyrolytic liquid was collected in a vessel. The non-condensable gas was released out of the system. The residue was removed from the reactor core. The pyrolytic liquid and residue were weighed. The amount of non-condensable gas was calculated from mass balance.

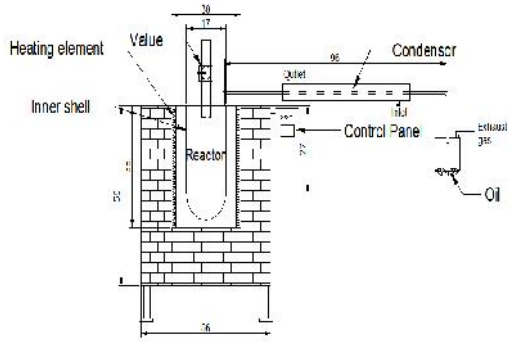

Fig 1.2 Pyrolysis Setup

3. RESULT AND DISCUSSION:

3.1THERMO-GRAVIMETRIC ANALYSIS

Thermo gravimetric analysis or thermal gravimetric analysis (TGA) is a method of thermal analysis in which changes in physical and chemical properties of materials are measured as a function of increasing temperature (with constant heating rate), or as a function of time (with constant temperature and/or constant mass loss. Likewise, TGA can provide information about chemical phenomena including dehydration, decomposition, and solid-gas reactions. The TGA[6,7] experiments were conducted with initially sample weight of 5.076gm.The maximum decomposition temperature of the devdaru seeds were shown in the figure1.3.

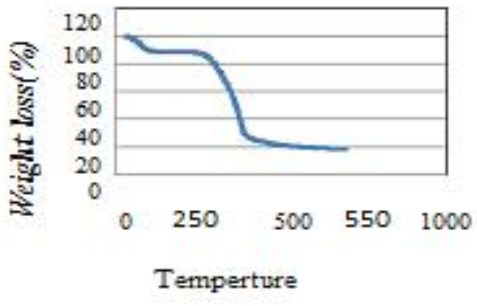

Fig 1.3 TGA

3.2ULTIMATE ANALYSIS

The ultimate analysis is used to determine the various elemental compositions present in the sample. The initially sample weight of Devdaru seed of 5.109mg is taken for CHN analyses. The result were shown in the table 1.1

ULTIMATE ANALYSIS	DEVDARU SEED
C (%)	42.83
H (%)	6.48
N (%)	0.49
O (%)	50.2

Table 1.1 ultimate Analysis of Devdaru.

3.3PYROLYSIS EXPERIMENTS IN BATCH TYPE:

The Devdaru seed is subjected into the batch type pyrolysis under different temperatures of 250°C, 350°C, 450°C, 550°C, and 650°C obtained from the TGA cure. From the graph, it is seen that the maximum oil yield take place at 550°C.Whereas char and gas yield is high at 250°C and 650°C respectively and their result were seen in the Fig 1.4

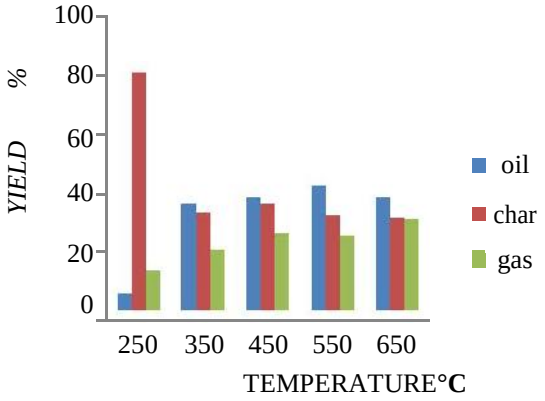

Fig 1.4Yield of the pyrolysis products at different Temperature

3.4FOURIER TRANSFORM INFRARED SPECTROSCOPY

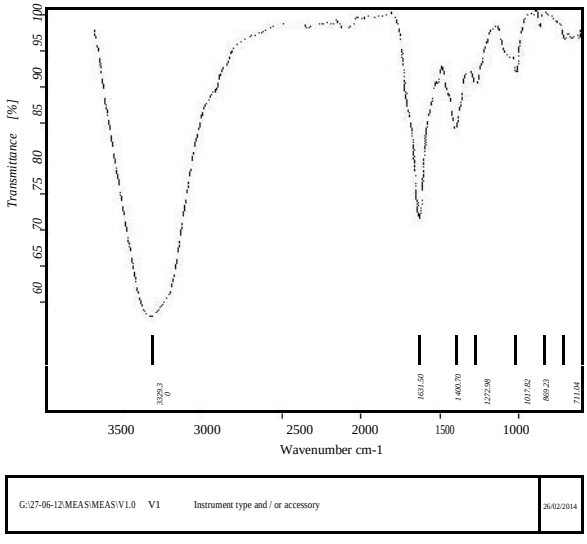

Fig1.5 FTIR of Devdaru Seeds

Table1.2 components present in Pyrolytic Oil.

Peak value	Group name	functions
3329.30	Alcohols	O-H stretch
1631.50	Ketones	C-C stretch
1400.70	Secondary Amines	N-H Bend
1272.98	Esters	C-O stretch
1017.62	Ethers	C-o stretch

4.CONCLUSIONS

The pyrolysis of Devdaru seeds were carried out in the batch type pyrolysis setup. From the experimentation process the maximum oil yield is obtained at the temperature of 550°C. The major components present in the pyrolytic oil is Esters and Ketones by using FTIR analyses. The pH value of the pyrolytic oil is 3.65 since it is acidic in nature.

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