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Combustion characteristic of *Albizia falcataria* using thermogravimetry

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Abstract

In this paper, combustion characteristic of *Albania falcataria* was investigated. The sample was sieved until passes 100 mesh and heated in air with heating rate 80 °C/min to 900 °C. three kinds of initial mass performed on this research that were 10 mg, 15 mg and 20 mg. Thermogravimetic (TG) analysis was used to study and compare the combustion among of initial masses. TG curves are in correspondence with the volatiles of the material studied. Non-Isothermal thermogravimetric data were used to access the kinetics of combustion of material. The results of TG analysis have shown that thermal decomposition of the initial mass 15 mg takes place at higher enthalpy as compared to the others initial mass samples because of the AFR effects of the chemicals in the samples

Keywords : Combustion; Thermogravimetric; *Albania falcataria* ; initial mass; enthalpy

1. Introduction

Biomass is a renewable energy source that refers to biological material derived from recently dead organisms. The sources of biomass fuel are wood sawdust, municipal solid waste and agricultural waste. Wood is the most widely used source for biomass. One highly productive tree is Sengon *(Albania falcataria)*. The use of biomass fuels provides substantial benefits as far as the environment is concerned. Biomass absorbs carbon dioxide during growth, and emits it during combustion. Therefore, biomass helps the atmospheric carbon dioxide recycling and does not contribute to the greenhouse effect. Biomass consumes the same amount of CO from the atmosphere during growth as is released during combustion.[1]

Nomenclature

dQ/dt	Heat flow
dH/dt	enthalpy change
dT	further nomenclature continues down the page inside the text box

2. Material and Methods

2.1. Material

Sawdust of Albazia Falcataria was collected from local sawmill business in Lumajang Regency, East Java Provincial, Indonesia. Albazia Falcataria was be planted because many demand on this product, beside that it has short life to felled. The samples was sieved until pass 100 mesh before take placed in Al_2O_3 crucible pan.

2.2. Methods

Investigation using DSC-TGA Linseis was held in Central Laboratorium, Physics Department, Mathematics and Natural Sciences Faculty, State University of Malang. Sawdust of *Albania falcataria* was sieved u10 pass 100 mesh. Analysis of biomass sample was heated in airflow rate 5 liter/ mi8 with heating rate 80 °C/min to 900 °C and held for 10 min to constant weight [2]. 10 mg, 15mg and 20 mg samples were spread uniformly on the bottom of the crucible made of alumina. Thermogravimetric analysis was performed using The LINSEIS STA Platinum Series (Simultaneous Thermal Analysis).

3. Result and Discussion

The result of 10 mg, 15 mg and 20 mg combustion experiment were plot in fig 1, 2 and 3 respectively

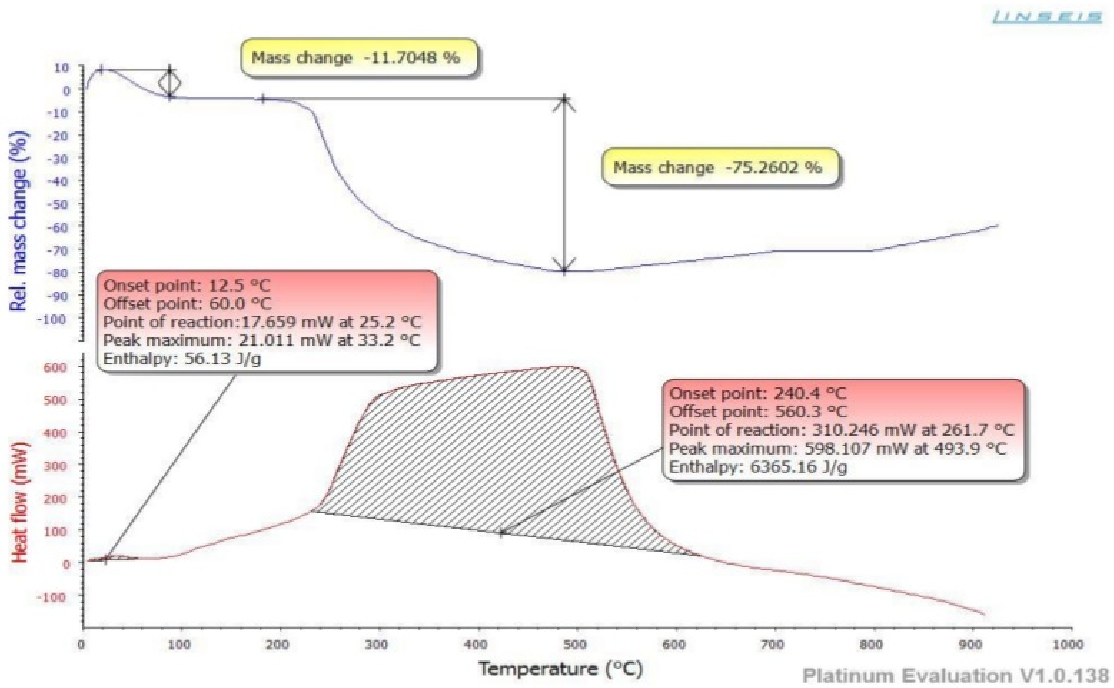

Fig.1. Combustion characteristic 10 mg

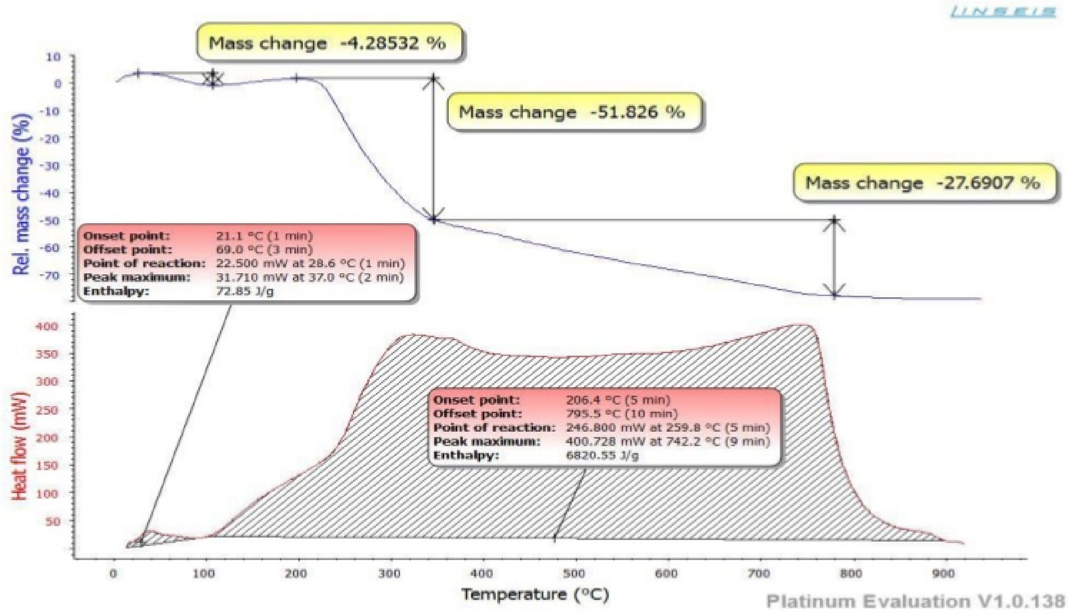

Fig.2. Combustion characteristic 15 mg

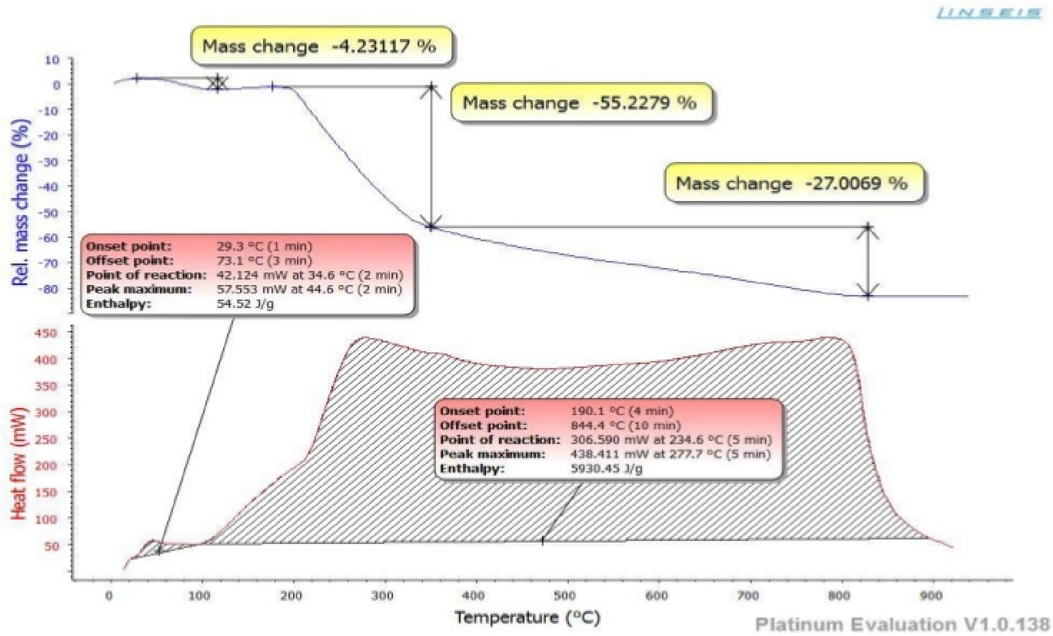

Fig.3. Combustion characteristic 20 mg

It shows that 15 mg sample has the higher enthalpy among the others. It caused probably Air Fuel Ratio combination in the setting of Simultaneous Thermal Analysis. The heat flow and air flow for the other initial mass maybe different than 15 mg. Since the DSC is at constant pressure, heatflow is equivalent to enthalpy changes

$$\left(\frac{dQ}{dT}\right) = \left(\frac{\mathrm{dH}}{\mathrm{dT}}\right)$$

Hence dH/dt is the heatflow measured in mcal/sec. The heatflow difference between the sample and the reference is :

$$\Delta\frac{dH}{dt} = \left(\frac{dH}{dt}\right) sample - \left(\frac{dH}{dt}\right) reference$$

The reference is an inert material such as alumina, or just an empty aluminium pan.
The enthalpy determined from the integral under the peak, above the baseline, gives totally changes for the process :

$$\int \left(\frac{dH}{dt}\right) dt = \Delta H$$

Isothermal and non-isothermal thermogravimetric techniques have commonly been used to investigate the reactivities of carbonaceous materials[3]. A plot of the rate of weight loss against temperature while burning a sample under an oxidizing atmosphere is referred to as the ''burning profile''.The burning profiles of the biomass samples are shown in Figs.1–3. The first peak observed on the burning profiles of the biomass samples corresponds to their moisture release. After releasing the moisture, some small losses in the mass of the sample occurred due to desorption of the adsorbed gases. A sudden loss in the mass of the samples started at the temperatures between 200 and 250 ^{0}C, representing the release of some volatiles and their ignition. In the rapid burning region,the rate of mass loss proceeded so rapidly that it reached its maximum value

4. Conclusion

The conclusions of this work are summarized as follows:

1. It was observed that the investigated the variation of initial mass showed different combustion characteristics.
2. The ignition temperatures of the samples were determined from their burning profiles.These temperatures were determined as 240,4 ºC for 10 mg, 206,4 ºC for 15 mg and 190,1 ºC for 20 mg.
3. The burning peak temperatures were determined as 560,3 ºC for 10 mg, 795, 5 ºC for 15 mg and 844,4 ºC for 20 mg.
4. The heat capacity were determined as 6365,16 J/g for 10 mg, 6820,55 J/g for 15 mg and 5930,45 J/g for 20 mg.

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