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RESEARCH ARTICLE

Investigation on charecteristic analysis of rubber (*Hevea brasiliensis*) wood for biomass gasification

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ABSTRACT

Conventional practice of drying natural rubber is through biomass combustion with rubber (*Hevea brasiliensis*) wood used as fuel in smoke house. It creates unhealthy environment in around the rubber producers' society, leads to poor efficiency and inferior quality of rubber production. In order to enhance fuel efficiency the attempt was made to investigate the charecteristics analysis-3 of rubber wood for biomass gasification. Producer gas generated from biomass gasification is 852 Kcal/Nm^3. Thermo-gravimetric analysis of fuel wood was studied for various heating rate as 10, 20, 30 and 40°C min^{-1} with degradation temperature of 1000°C. The moisture content can be easily removed in the temperature range of 20°C to 100°C and volatile matter can be removed in between 200°C and 400°C.

Key words: *Rubber wood, proximate analysis, TGA, gasification*

INTRODUCTION

India is the fourth largest producer of *Hevea brasiliensis* (rubber) which is 0.86 million tons in the world. Kerala accounts about 90% of the total production (2.7 lakhs tones) of the country (RRII, 2014). Since rubber (*Hevea brasiliensis*) wood is available in plenty, and its physical, chemical and thermal properties shows its a good potential for feedstock for biomass gasification. Hence, the investigation was attempted to analyse the charecteristics of rubber wood as feedstock in gasifier.

MATERIALS AND METHODS

Physical, chemical and thermal composition of the rubber wood was studied for analysing the suitability of feedstock for biomass gasification process. The fuel wood undergoes variety of reactions during thermal degradation process. To understand the kinetic behavior and weight loss of the fuel wood during combustion, thermo gravimetric analysis and differential thermal analysis was studied under the same conditions of combustion. Thermo gravimetric analysis (TGA Q50) was carried out for the fuel wood at various heating rate of 10, 20, 30 and 40°C min^{-1} for the degradation temperature of 1000°C. Nitrogen was used as the purge gas with a flow rate of 60 ml min^{-1}.

RESULTS AND DISCUSSION

Characterization of rubber wood includes physical, proximate and thermo gravimetric analysis. Table 1. represents the physical and proximate analysis of the biomass sample.

Table 1. Physical and proximate analysis of *Hevea brasilensis*

Properties	Units	Values	Method
Moisture content	%	11.57	ASTM E 871
Volatile content	%	78.8	ASTM D 3175-89
Ash content	%	1.3	ASTM D 3174-89
Fixed carbon	%	29.26	-
Calorific value	Kcal m	852	ASTM D 2015-77

Proximate and thermo-gravimetric analysis of *Hevea brasilensis* indicated its suitability as a feed stock for combustion with higher volatile matter and lower ash content. The properties of *Hevea brasilensis* revealed that the calorific value of 852 Kcal m was sufficient to liberate energy during gasification process.

Thermo- gravimetric analysis of Hevea brasilensis

Fig.1 (a), (b) and (c) showed that TGA curve for *Hevea brasilensis* at heating rate of 10°C, 20°C and 30°C repectively. The major weight loss occurs between 200 and 500°C, due to biomass volatilization and char oxidation processes. This second phase of curve indicates a sudden drop due to the degradation of volatiles, which accounted for 89 per cent of total mass. At the temperature of about 500°C, almost all the volatile matter is combusted from rubber wood and the weight loss is

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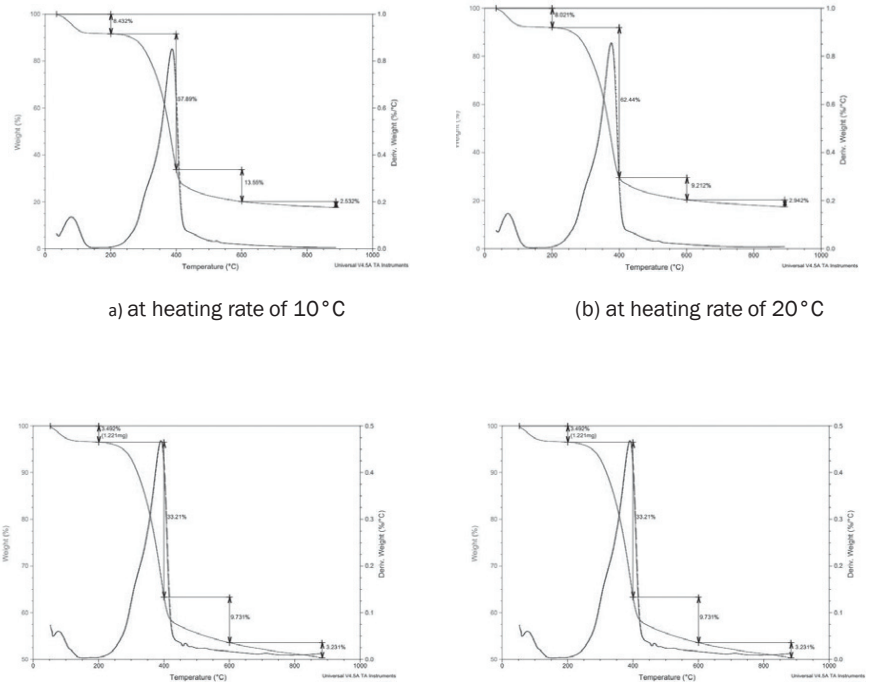

a) at heating rate of 10°C

(b) at heating rate of 20°C

(c) at heating rate of 30°C

(d) at heating rate of 40°C

Figure 1. TGA curve for *Hevea brasilensis*

stabilized. After this temperature, there is a gradual decrease in weight loss. It is due to the oxidization of carbonaceous residues within inorganic solid particles, which progress until 1000°C.

CONCLUSION

Rubber wood has less than 15 per cent moisture content, makes it suitable feed stock in downdraft gasifier for thermal application. The producer gas heat content of rubber wood was calculated as 852 kcal/m^3 and thermo-gravimetric analysis conclude that the moisture content can be easily removed in the temperature range of 20ºC to 100ºC and volatile matter can be removed in between 200ºC and 400ºC. These thermochemical properties will accelerate the possibility of *Hevea brasilensis* to use in gasification process. This biomass gasification enables to replace the conventional smoke house, which also leads to reduction in pollution.

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