Study of Changing Fuel Characteristics of EFB by Hydrothermal Treatment

Sea Cheon Oh[1*], Hyeok Jin kim[1], Rabin Nepal [1], Chan Park[1], Min Jeong Song[1]

1: Kongju National University, 1223-24 Cheonan-daero, Dongnam-gu, Cheonan-si, Chungcheongnam-do, Republic of Korea

*corresponding author: ohsec@kongju.ac.kr

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INTRODUCTION

With the decrease of the oil's mining reserve, renewable energy has received attention as alternative fuel. Especially, PKS (Palm Kernel Shell) and EFB (Empty Fruit Bunch), which are byproducts generated when palm oil is produced, are used in energy generation as raw material. In the case of palm oil, it is produced on a large scale in Indonesia and Malaysia occupies most of the cultivation area of the world. About 10% of palm oil is usually produced from bread oil trees, and the rest will remain in the form of biomass. Correspondingly, a huge amount of by-product is generated, and increases step by step. Therefore, it is judged to be useful to use EFB as a raw material for energy production using combustion and pyrolysis. However, this is complicated by its low heating value compared to coal and difficult pulverization due to large quantities of fiber components. Therefore, torrefaction studies have been actively conducted to improve the fuel characteristics of EFB. The carbon content and heating value of biomass increase during torrefaction due to the decomposition and removal of oxygen; its storage characteristics also improve as the fuel characteristics change from hydrophilicity to hydrophobicity.

MATERIALS AND METHODS

Characteristics of EFB

Table 1 shows the proximate analysis, elemental analysis, and heating value analysis results for the dry EFB sample used in this study. Carbon and oxygen exhibited the highest contents of 42.3% and 36.4%, respectively, and no sulfur was detected. In addition, the higher heating value (HHV) was 16.4 MJ/kg.

Table 1 Characteristics of dry EFB used in this study.

Sample	Elemental analysis [wt.%, dry]					Proximate analysis [wt.%, dry]			HHV [MJ/kg]
	C	H	N	O	Oth	VM	FC	Ash	
EFB	42.3	5.6	0.2	36.4	15.5	76.6	20.5	2.9	16.4

VM: Volatile matter
FC : Fixed carbon
HHV: Higher heating value

Hydrothermal treatment of EFB

For hydrothermal treatment the material properties vary depending on the experimental conditions, such as the sample type, temperature, pressure, and water content. Therefore, in this study, experiments on the hydrothermal treatment of EFB were performed by setting the reaction temperature and water content as experimental parameters.

RESULTS AND DISCUSSION

Effect of reaction temperature and water content

Figure 2,3 shows the mass and energy yields of the EFB hydrothermal treatment according to the reaction temperature and water content respectively.

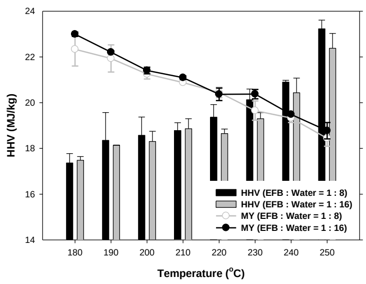

Figure 1 Mass yield, HHV of EFB according to reaction temperature and water content.

Figure 1 shows the mass of the EFB hydrothermal treatment according to the reaction temperature and water content. Figure 1 shows that the mass yield decreased due to decomposition of some volatile organic matter; however, the heating value increased because of an increase in fixed carbon (FC) content as the reaction temperature increased.

CONCLUSION

The mass and energy yield results of hydrothermally treated EFB showed that the mass yield decreased as oxygen-containing volatile matter (VM) was decomposed and removed, but the heating value increased as the content of fixed carbon increased. The water content, however, exhibited minimal influence. In addition, in various analysis results, hydrothermal treatment of EFB the influence of temperature is dominant, however the water content exhibited minimal influence. This indicates that the addition of more water than that required to immerse the sample does not significantly affect the hydrothermal treatment of EFB.

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