圧搾ホテイアオイの燃料利用のための水熱炭化の最適化

Optimization of hydrothermal carbonization for compressed water hyacinth fuel

Wutisirirattanachai Tassapak[1,*] and Shinjiro Sato[1]

1) 創価大学理工学部共生創造理工学科

1. Introduction

A worldwide infested water hyacinth (*Eichhornia crassipes*) is mainly composed of lignin and cellulose which can use as fuel source thermochemical treatment[1)]. One of the treatments is hydrothermal carbonization which is heating biomass with water in an autogenous pressure to convert biomass to carbon-rich micro-nano biochar, high energy content bio-oil, and rich chemical aqueous phase[2)]. This study aims to produce value-added hydrocarbons from compressed water hyacinth. The objective of the study was to evaluate the effect of various reactions at different temperatures and the retention times of products derived from compressed water hyacinth through hydrothermal carbonization.

2. Materials & Methods

The compressed water hyacinth was used as feedsteock in hydrothermal carbonization at three different temperatures and retention times: 210ºC, 240ºC, 270ºC for 1, 2, 4 hr. The product was recovered from the reactor and extracted bio-oil with dichloromethane. The final products were solid residual, bio-oil, and aqueous phases. Yield, CHNO content, and higher heating value (HHV) were analyzed, and carbon capture, energy densification, and energy yield were calculated.

3. Results & Discussions

When biomass had enough temperature and retention time, the product was carbonized and had yield below 70% on solid residual except for products from operation 210/1, 210/2, and 240/1 (Fig. 1). Increasing carbonization temperature and time decreased biochar yields due to the decomposition of the solid residue, which the O/C ratio and H/C of biochar was decreased with the dehydration dominant (Fig. 2). It also led to high HHV. Bio-oil yield also increased, but HHV was clinging due to multiple reactions.

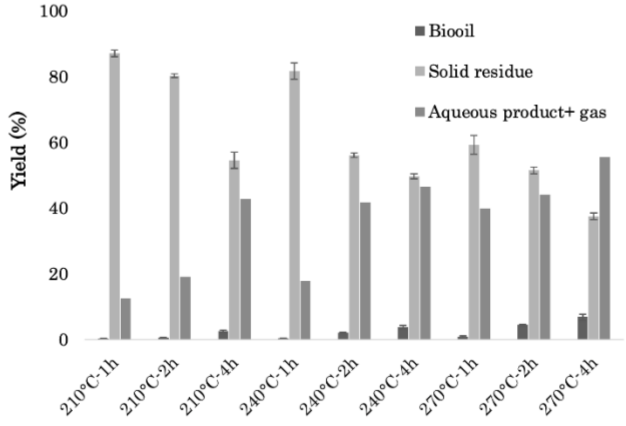

Fig. 1 product yield from hydrothermal carbonization of compressed water hyacinth

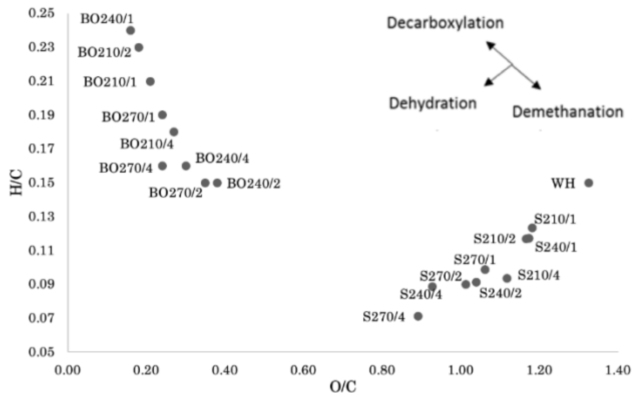

Fig. 2 Van Krevelen diagram of the WH, and the other product sample used in this study: S is solid residual when, BO is bio-oil

4. Conclusion

It was shown in this study that hydrothermal carbonization had potential to increase value on water hyacinth feedstock due to producing rich carbon fuel when the appropriate temperature and time were used, which was possible to generate energy sources from water hyacinths. However, increasing the yield of bio-oil is still challenging.

References

[1] Zhang (2020), *Energy* 197, 117193
[2] Sahoo (2019), *Carbon Resources Conversion* 2, 233-241