Advanced Core for Energetics, Hiroshima University Vol. 22

HU-ACE NEWS LETTER

Vol.22
2018.10

Advanced Core for Energetics, Hiroshima University

Activities of the Core

Oct. 22, 2018	1st Joint Workshop for efficient utilization of renewable bioresources
Oct. 25, 2018	The 25th HU-ACE Steering Committee Meeting
Oct. 25, 2018	The 68th Hiroshima University Biomass Evening Seminar (co-organization)

1st Joint Workshop for efficient utilization of renewable bioresources

The first joint workshop on efficient utilization of renewable biological resources was held on October 22, 2018 with support of HU-ACE. This workshop was held in commemoration of the inter-departmental exchange agreement between Graduate School of Advanced Science of Matter (ADSM), Hiroshima University and the Indonesia Sweetener and Textile Crop Research Institute (Balittas). Three researchers, including Dr. Mohammad Cholid, who is the Dean of Balittas, introduced organization and biomass research of Balittas, and three researchers from Hiroshima University including Prof. Yukihiko Matsumura gave presentations on research activity on biomass conversion. Based on this workshop, we are planning to actively engage in human interaction and collaborative research on the research of energy and useful substance production utilizing renewable biological resources.

Issued by Advanced Core for Energetics, Hiroshima University

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HU-ACE NEWS LETTER Advanced Core for Energetics, Hiroshima University Vol. 22 No. 1

Research Topics

No-Tar Supercritical Water Gasification of Biomass

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Research field: Engineering/Mechanical Engineering/Thermal Engineering
Keyword: Biomass, Supercritical water, Hydrothermal treatment, Biodiesel

Abstract

Background Wet biomass such as *shochu* residue and food waste can be efficiently treated using supercritical water gasification , where biomass is gasified in hot compressed water. However, there were problems of char (tar) generation as by-product that caused plugging of the reactor and reduction in carbon gasification efficiency. Thus, mechanism of char formation was studied in the laboratory, and it was found that there are two kinds of char: one produced at lower temperature and the other produced at higher temperature.

Methods Biomass contains cellulose and lignin, both of which easily form char. Thus, glucose that behaves like cellulose and guaiacol that behaves like lignin were treated in hot compressed water at various temperature, and the products were analyzed. Experimental apparatus shown in Fig. 1 was utilized, where feedstock and preheated water were mixed to reach the reaction temperature quickly, and after desired time in the reactor, the effluent was mixed with cooling water to stop the reaction by rapid cooling down. This allows to make reactions proceed at desired temperature for desired time.

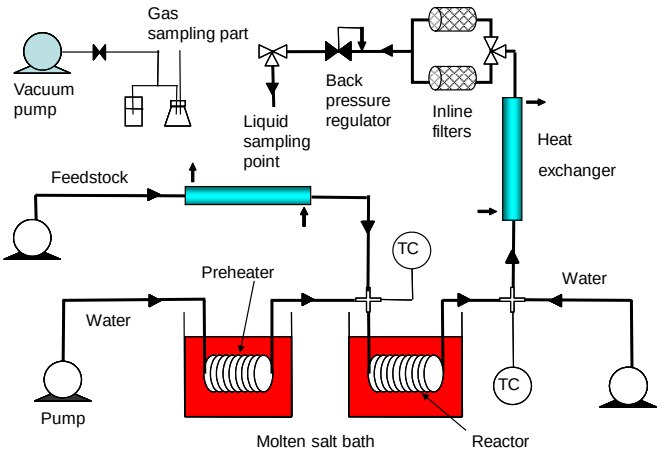

Fig. 1 Experimental apparatus

Results When glucose was treated, char was produced at 300-350 °C, and char was not observed at temperatures higher than 375 °C [1]. Because char is produced by keeping biomass at low temperature region, we concluded rapid heating to bring biomass rapidly into high temperature region is effective. When guaiacol was treated, char was produced in high temperature region. Because reactions proceeding in high temperature region are radical reaction, we added radical scavengers and found that char formation was suppressed as shown in Fig. 2 [2]. Using these results, we proposed gasification of wet biomass without char formation, and with the support from New Energy and Industrial Technology Development Organization (NEDO), we are continuing studies for commercialization using a 1 t/d pilot plant.

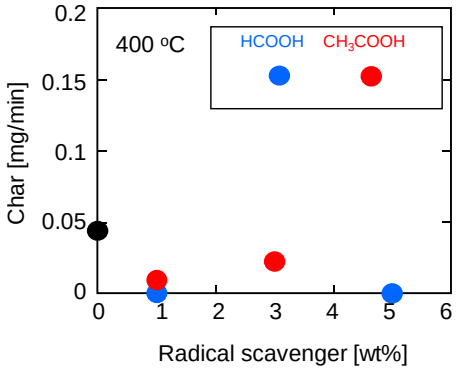

Fig. 2 Effect of radical scavenger addition

Reference 1) Promdej, C. et al., *J. Jpn. Inst. Energy*, 89(12), 1179-1184 (2010). 2) Matsumura, Y. et al. *Energy Fuels*, 32(9), 9568–9571 (2018).