

International Conference on Solid Waste Management, 5IconSWM 2015

Torrefaction Reaction Characteristic of various Biomass Waste on Pilot Scale of Torrefaction Reaction System

S. B. Nam, Y. S. Park, D. J. Kim, J. H. Gu*

Plant Engineering Center, Institute for Advanced Engineering, Yongin-Si, South Korea

Abstract

Torrefaction processes of three kinds of waste biomass species, including EFB(Empty Fruit Bunches), wood pellet and rice husks were investigated on the pilot scale of torrefaction reaction system with rotary kiln type of reactor. The yield of torrefied material from EFB(61.0 wt%) and waste pellet(76.7 wt%) was higher than that of gas and liquid, while only 30.8 wt% of torrefied rice husks was obtained. Especially, the energy density of torrefied material with respect to waste biomass species is following order; rice husks \approx EFB > wood pellet. In addition, O/C and H/C for EFB and Rice husks after torrefaction reaction was similar with that of coal, while wood pellet was affected slightly. It is mainly related to the lignocelluloses components in waste biomass materials. From this result, we concluded that the torrefied EFB is more suitable to coal-firing power plant compared to rice husks and wood pellet.

© 2016 Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of the organizing committee of 5IconSWM 2015

Keywords: Char, Biomass, Torrefaction, Pyrolysis;

1. Introduction

Renewable energy resources from biomass have been globally attention from advantage of steady supply power generation for reducing reliance on fossil fuel and curbing global warming. To produce energy from biomass, a variety of thermochemical conversion techniques is commonly used such as combustion, gasification and pyrolysis. Especially, torrefied biomass can be easily adjusted to coal-fired power plants and entrained-flow gasification plants[Bridgeman T.G., et al, 2008]. The torrefaction, which is a mild pyrolysis process with the temperature in the

* Corresponding author.

E-mail address: jaehoi@iae.re.kr

range of 225~230°C at inert atmosphere, substantially reduce organic volatile components and moisture in raw biomass with higher energy density. The characteristic of torrefied material is quite similar with that of coal substitute for co-firing power plants.

Recently, the torrefaction of waste biomass has attracted more interest from its potential application in world wide. 20 million tons of EFB (Empty Fruit Bunches), which are generated annually in Malaysia, are restrictively treated such as soil mulching and boiler fuel. However, the incineration of biomass is strictly regulated by the Department of Environment (DOE) [Baharuddin A.S., et al, 2010]. Since 2012, Renewable Portfolio Standard (RPS) has been a regulatory mandate to power generation plant to supply electricity from biomass in Korea [http://www.energy.or.kr/knres/index.asp].

Accordingly, in the present study, the torrefaction characteristics of three different biomass materials has been explored on the pilot scale of torrefaction system with rotary kiln type of reactor. The characteristic of system has been evaluated using mass yield and calorific value of torrefied materials. These results will contribute to further work involving economic analysis for this torrefaction technique.

2. Materials and Methods

EFB provided from palm oil mill in Malaysia after drying process was shredded to 20 cm length to feed into the torrefaction reactor. Two types of biomass including wood pellet and rice husks obtained in Korea were selected as the raw materials to be tested. Proximate, ultimate and calorific value analysis of employed waste biomass were conducted as listed in Table 1. Most of raw materials are including combustible components. This result is quite related to 44.66% of carbon and 45.4 % of oxygen in EFB, while wood pellet and rice husk are including 39.1% and 41.7% for CI from ultimate analysis.

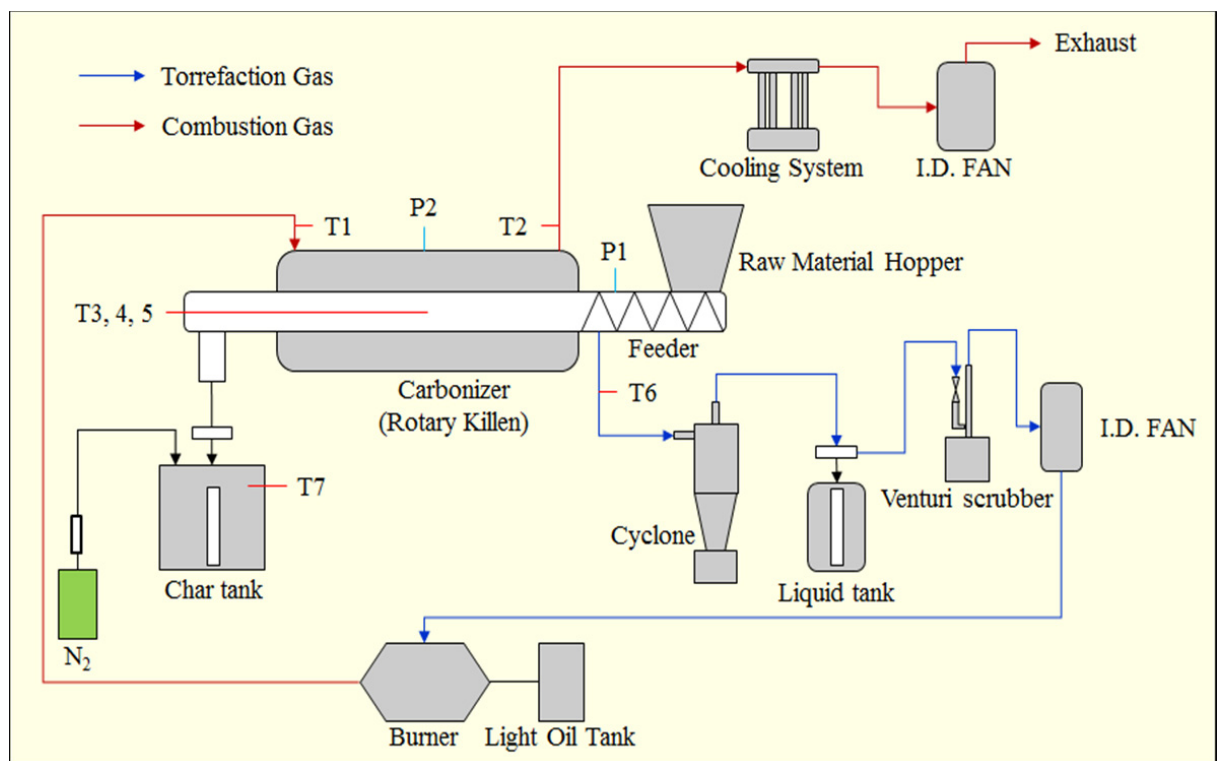


Fig. 1. Pilot scale of waste biomass torrefaction system

Download English Version:

<https://daneshyari.com/en/article/4401448>

Download Persian Version:

<https://daneshyari.com/article/4401448>

[Daneshyari.com](https://daneshyari.com)