Thesis Title	Heat Utilization from Gasification Process for Drying Biomass Fuel
Thesis Credits	12
Candidate	Mr. Nuttasun Anutaliya
Thesis Advisors	Assoc. Prof. Dr. Mana Amornkitbamrung
	Dr. Wirachai Soontornrangson
	Asst. Prof. Dr. Rattanachai Pairintra
Program	Master of Engineering
Field of Study	Energy Technology
Department	Energy Technology
Faculty	School of Energy, Environment and Materials
B.E.	2555

Abstract

The present research has studied the gasification process using corn cobs as fuel. To find the best conditions for producer gas production, the reduction zone temperature inside the furnace is controlled by adjusting the air flow rate. Steam was also injected in the middle of the process to increase the gas yield. Moreover, the producer gas was used to dry corn cobs, which will be used as feedstock for the gasification process.

Variations of reduction zone temperatures, i.e. 800, 850 and 900 ^{o}C, have been on trial. The average higher heating values of producer gas obtained from the trial are 3.50, 4.03, and 4.15 MJ/Nm^{3} respectively. The corresponding yields are 18.6 %, 20.4 %, 21.7 % for carbon monoxide, and 3.5 %, 4.9 %, 5.5 % for hydrogen. Results obtained indicate that the increase in reduction zone temperature can result in a higher carbon monoxide and hydrogen content. Consequently, carbon monoxide and hydrogen contents, and HHV (higher heating values) of gas produced from 900 ^{o}C reduction zone are 14.3 %, 34.6 %, and 15.7 % greater than those produced from 800 ^{o}C reduction zone. This is a consequence of reaction between carbon monoxide and hydrogen which is an Endothermic reaction (The process is fastened in a high-temperature environment).

In the case of adding steam with injection rates of 0.03, 0.07, and 0.15 L/min into a 900 ^{o}C reduction zone, the average HHVs are 4.59, 4.57, and 4.49 MJ/Nm^{3} respectively. The corresponding carbon monoxide yields are 22.9 %, 22.4 %, and 21.7 % while the hydrogen yields are 7.1 %, 7.4 %, and 7.7 % respectively. From the experiment findings, the steam can increase carbon monoxide and hydrogen contents which are a result of water gas reaction. However, the overuse of steam input can cause higher water shift reaction that reduces carbon monoxide. The results of this study suggest that the optimal condition is when at the reduction zone temperature is 900 ^{o}C and steam injection rate is 0.03 L/min. The carbon monoxide and hydrogen contents of the produced gas increase by 5.2 % and 22.5 % with the addition of steam. HHV also increases by 96% from the case of no steam.

Using of the producer gas to dry corn cobs, the average temperature of producer gas at the entrance of dryer is 163 ^{o}C that would be able to reduce moisture content from corn cobs up to 28.5 %wb. The dried corn cobs increase the efficiency of producer gas production by 2.7 % compared to the case of regular corn cobs.

Keywords: Corn cobs/Drying/Higher Heating Value/Two-Stage Updraft Gasifier/
Water Gas Reaction