PERFORMANCE OF AN UPDRAFT GASIFIER RUNNING ON NONWOODY BIOMASS FUELS

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ABSTRACT

In Uganda, large quantities of unused non-woody biomass fuels exist in form of municipal/industrial waste, animal wastes, and agricultural residues. The latter include bagasse, maize cobs, rice husks and coffee husks. Cultivation of energy crops is also possible because of the availability of arable lands in the tropical climate zone around the equator that enjoys optimal rains and a long growing season.

Efficient, reliable and cost effective technologies for the conversion of these biomass fuels to more user friendly forms like producer gas should be prioritized. Producer gas can be used as a fuel in thermal processes such as drying, cement and ceramic firing and can, after thorough cleaning, be used as an engine fuel for electric or mechanical power production.

Unlike in other parts of the world where gasification technology has been tried, Uganda has had no such experience. With the growing local interest to use gasification systems, design and specification of any such systems is not yet possible without relevant performance data or capacity to select the best fuels for application and the best gasification technology for a specific fuel. With the cooperation of the Department of Energy Technology, Royal Institute of Technology, Makerere University has set up a fixed bed gasifier for use in the study of several aspects of gasification of non-woody biomass and development of human capacity in the technology.

This paper reports on an investigation of the performance of the gasifier running in updraft mode. Producer gas of lower heating values ranging from 2.2 to 4.3 MJ/Nm^3 was obtained. The gasification process was characterized by a high production of condensed tars especially with fuels with small particle sizes such as coffee husks, bagasse and rice husks, high temperature build-ups in the fuel drying section of the reactor leading to a formation of a ring of hot spots with temperatures of about 900^{o}C and high gasifier system clogging that necessitated regular system maintenance after every test run.

With better insulation of gasifier and gas tubes as well as densification of agricultural residues, the performance of updraft gasifiers running on agricultural residues could be improved.

Key words: Non-woody biomass, gasification, updraft gasifier