DEVELOPMENT OF UPDRAFT GASIFIER AND PERFORMANCE ANALYSIS FOR DIFFERENT TYPES OF BIOMASS MATERIALS

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ABSTRACT

Traditional fossil fuels such as coal, gas and oil are still major candidates to fulfill the energy requirement but their depletion at sharp rate due to increase in demand is at alarming condition. High prices and environmental pollution issues associated with fossil fuels has diverted thefocus of the world to find out the new energy roots. Biomass is one of energy candidates, environment friendly, which can be utilized to generate heat and power. Biomass can be converted into useful products by thermochemical process such as gasification.

This study focuses on to design and development of pilot scale updraft gasifier with gas cleaning unit. Performance analysis in terms of producer gas composition, LHV of producer gas, A/G,G/F, gasifier efficiency and gasification efficiency for different biomass materials at different air flow with and without the packing plate was studied. Other main objective was to find out energy potential of mango pit shell as new biomass material and its comparison with coconut shell, ginisyria (*Gliricidia sepium*) and a mixture of 50%, 25%, 25% coconut shell, mango pit shell and *Gliricidia sepium* respectively as an arbitrary selection.

Bench scale updraft gasifier was designed and fabricated. Elemental analysis for each biomass was performed in laboratory to find out the properties such as moisture contents, ash contents, volatile matters etc. Reactor was operated successfully, producer gas and other useful byproducts was obtained. Producer gas was analyzed for compositional analysis as major product and reactors performance parameters was calculated.

It has been observed that biomass we utilized contains the sufficient energy potential. In case of without packing plate at ER of 0.2 LHV (MJ/Nm^3) of producer gas was 4.40, 3.35, 4.20, 3.14 for coconut shell, mango pit shell, ginisyria and mixture respectively. When air flow rate increased, ER increased up to 0.25 it was observed that LHV of producer gas has been decreased. With packing plate experiments it has been found that LHV of producer gas at ER of 0.2 is 4.02, 3.29, 3.70, and 3.21 for coconut shell, mango pit shell, ginisyria and mixture respectively. In packing plate case as well with increase of air flow decrease in LHV of producer gas was observed. Collectively without packing plate results obtained are good as compare to with packing plate case. Gasifier thermal efficiency for different biomass has been found in the range of assumed designed value which was 70%.

Bio-char and black condensate was obtained as valuable by products which can be utilized for different applications. Mango pit shell which is thrown as waste can be utilized as biomass to generate the heat and fulfill the respective industry energy demand especially juice industry. Results without packing plate were found good rather than with packing plate.

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ACRONYAMS

HHV: Higher heating value

HHV_f : Higher Heating value of fuel

LHV: Lower heating value

FCR: Fuel Consumption rate

VM: Volatile Matters

FC: Fixed Carbon

ER: Equivalence ratio

SGR: Specific Gasification rate

ft: feet (units)

mm: millimeter (units)

A/G: Air to gas ratio

G/F: Gas to fuel ratio

GHG: Green House Gases