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Effect of Temperature and Biomass Ratio on Fluidbed gasification using Agro Waste

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Abstract

This work examine the feasibility of generate the combustible gas in a fluidbed gasifier using rice husk and sugar cane bagasse. The main aims of these studies investigate the effect of gasifier temperature and composition of producer gas. The gasifier performed in the temperature range of 650ºC to 950 ºC and steam to biomass ratio 0 to 1.0. Temperature is a prime factor for biomass gasification process and also it is leads to develop the gas yield. The highest gas produced in temperature range of 700 ºC and ratio of 0.20 with the maximum gas yield for hydrogen and nitrogen 31.8 and 44.1 respectively. When the temperature increases in the reactor and also H_2 and N_2 production is increased and other side carbon dioxide, methane is reduced. The experimental result suggested maximum hydrogen and nitrogen produced the rice husk and bagasse with temperature of 700 ºC and biomass ratio of 2.0.

Keyword: Gasifier, Biomass, Reactor, Temperature, Fluidbed

INTRODUCTION

Biomass is one of the important renewable energy and also it's reducing the greenhouse emissions. Thermochemical conversion process in this case biomass into gasification (or) producer gas in this technic conversion of waste to energy [1]. Biomass is a recent developing technique in the world for now a day. Fluidized bed gasification technology is one of the effective conversion technologies for liquid and solid fuels. It's also applicable for low grade energy fuels and organic wastes. In this gasification process mainly depends on many types of gasifier, it's like fluidized bed system, circulating system, moving system, pressure of gasifier, temperature of the gasifier [2]. Biomass is an important in energy conversion processes due to their favorable status with respect to greenhouse gas emissions. However, conversion of biomass into producer gas by thermal gasification broadens the scope of biomass applications. Biomass research is recently receiving increasing attention because of the probable waste-to-energy application. Fluidized bed gasification (FBG) is an emerging energy conversion technology for solid and liquid fuels, well suited to low-grade fuels and waste materials. Biomass is potentially an attractive feedstock for producing transportation fuels as its use contributes little or no net carbon dioxide to the atmosphere [3]. Fluidized bed reactors are mostly operated at superficial gas velocities well above the minimum fluidization velocities and therefore the minimum fluidization velocity is not a quantity with a precise significance for industrial applications [4]. Now a days many technologies [5] have been created especially waste to energy.

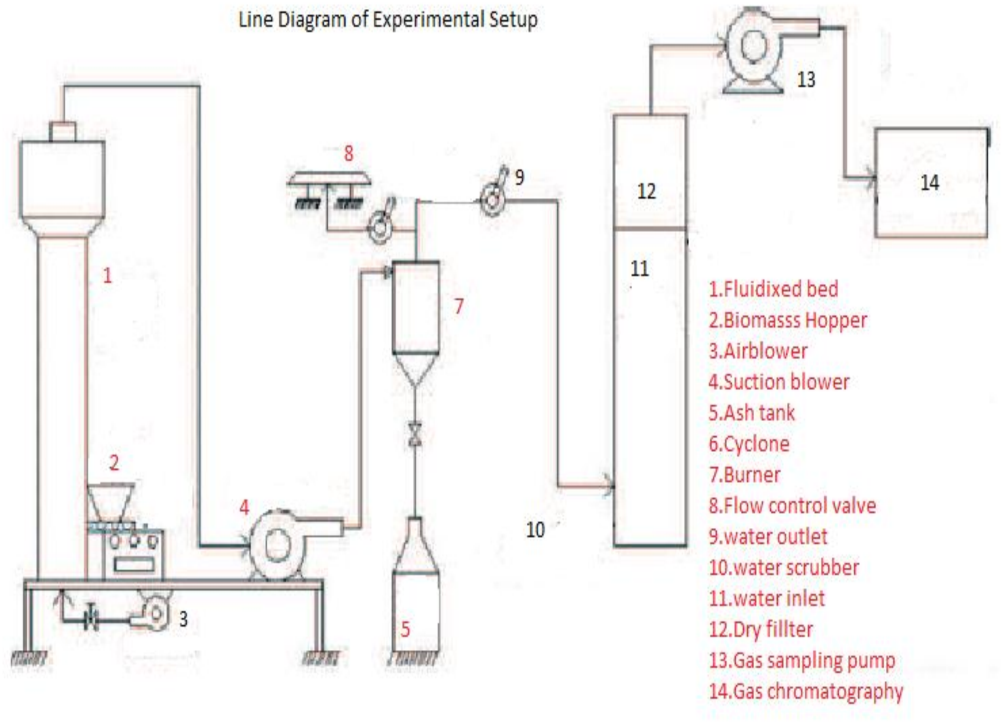

Fig .1.Line Diagram of the Experimental Setup

conversion in biomass fuelled in combined heat and power (CHP), covering a primary conversion of biomass to hot water, high pressure steam, liquid or gaseous products by means gasification pyrolysis and also these technology convert products to power and heat by using steam engine, steam turbines, external combustion engines, fuel cells or turbines. [6] First gasifiers was developed and constructed in 2005 (laboratory scale) and second was created in 2010 (small scale). Biomass gasification generate the formation of tar it is one of the huge problems that should be done with it blocks and stains the equipments such as valves and pipes, [7] India alone generate minimum 18 million tons of rice straw per year as by product generate from rice mill. Bubbling fluidized bed gasifier is better alternate for biomass gasification. [8]

This gasifier shows in higher capacity biomass gasification applications due to uniform temperature and clean gas. The main aim of this work is to produce the producer gas in a bubbling fluidized bed gasifier with rice husk and bagasse various temperatures. It is very compact one and exchanges the heat, reaction rate due to intensive mixing in the fluidized bed and using many feed stocks with fully grained materials with high ash contents and density low bulk [9] was reported some developments in biomass gasification with controlled air, similar to the research examined.

EXPERIMENTS AND METHODS

A lab scale bubbling fluidbed gasifier is fabricated for this experiments using rice husk and bagasse. This Fig .1. Shows line diagram of the experimental setup. Fluidbed gasifier with screw feeder, automatic control unit based on microprocessor is fabricated and flue gas behaviour with agricultural wastes rice husk and bagasse. When the gas is produced, the composition of producer gas is analysed using gas analyzer. The flue gas from gasifier through cycle separator then eliminates the dust and impurities. Then, further cooled and cleaned by passing it through a water scrubber. The cleaned and dry flue gas is analyzed using gas analyzer to calibrate the CO_2, CH_4, N_2, and H_2 respectively. The biomass is feeded using rice husk and sugar cane bagasse is produced locally in Chennai. The rice husk and bagasse is dried sun light for one week then crushed mechanically. The higher calorific valve and moisture (wet basis) content of the samples are 12.91 MJ/Kg and 9.81 % respectively. The gasifier operated with different temperature around 650ºC, 700 ºC, 800 ºC, 900 ºC, 950 ºC. When the bed temperature again turned steady state, the screw feeder was turned on at the desired rotate speed and the test began. Typically, it took 30 min for the test conditions to reach a stable state. Five samples were taken at an interval of 5 min after the test ran in a stable state. This state was continued until the reactor temperature could reach about 700º C.

RESULT AND DISCUSSIONS

The Different gas composition with various temperature ranges during the gasification period using rice husk and bagasse is analyzed. The temperature of the gasifier is varied from 600ºC to 950 ºC and the corresponding producer gas composition is measured. The Fig .2. Showed the concentration of H2 and CO2 are increasing gradually with increase in gasifier temperature from 700 ºC to 900 ºC and then slightly decreases. Here concentration of methane and corbondi oxide is lower because if it is having lower percentage of volatiles in biomass and also more moisture content. The methane various between 5.8 to 6.1 percentage and hydrogen concentration is found in the range from 30.6 to 31.2 percentages. These corbondi oxide concentrations, Nitrogen concentration range from 20.6 to 20 and 49 to 48.1 respectively. The results showed that the effect of temperature from gasifier of rice husk and bagasse with temperature and biomass ratio 0.20 and feeding rate of 20kg/hr these results are good agreement with previous work report [10].

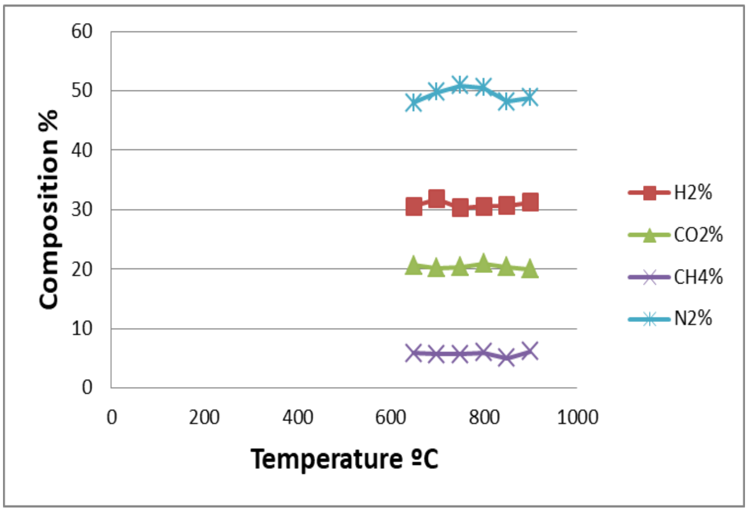

Fig.2. Effect of Temperature with gas composition

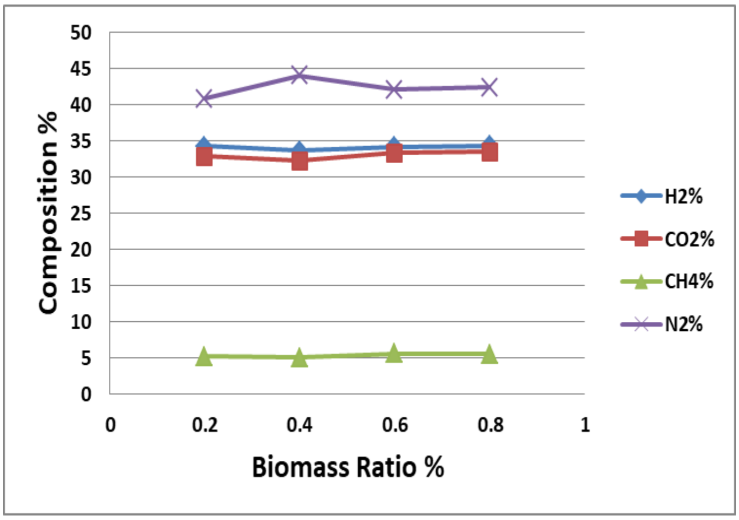

Fig.3. Effect of Biomass Ratio with gas composition

The effect on steam biomass ratio and gas composition from the fluidized bed gasifier using rice husk and bagasse shown in Fig..3. There is a significant in CO_2 concentration up to steam biomass ratio of about 0.8 and higher values of this ratio, no significant changes were occur. The hydrogen concentration is very higher for steam biomass ratio with percentage of H_2 is high about 45 to 41 percentage with ratio of biomass is 0.6 to 1.0 maximum rate is obtained. In other hand corbondi oxide and methane is low compare to hydrogen. It is also suggested by [11].

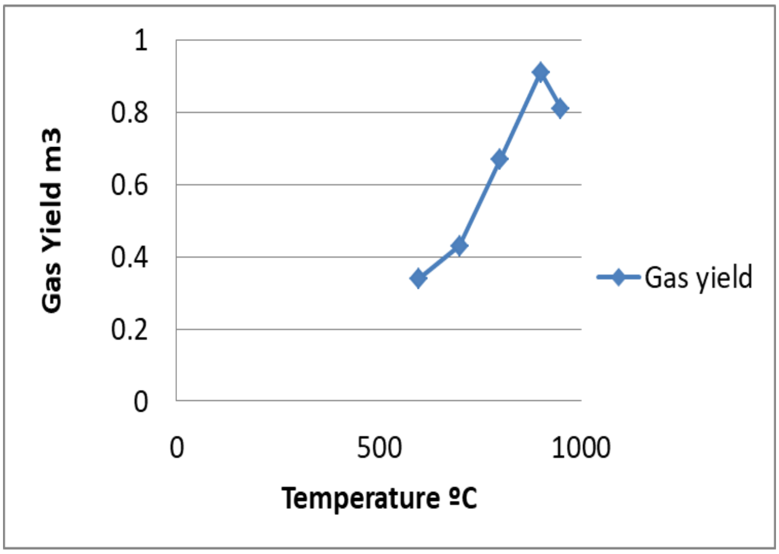

Figure.4.Effect of Temperature with gas yield

These Fig.4. Shown the cumulative gas yield with various temperatures, the maximum gas yield generated at $0.9m^3$ at the temperature range of 900^o C. When the temperature increase the percentage of gas also increased and solid fuel is converted into gaseous products so high producer gas is obtained.

CONCLUSION

The gasification of rice husk and sugarcane bagasse is successfully performed in lab scale bubbling fluidbed gasifier. The gasifier is operated at bed temperature ranging from 700 to 900 ^{o} C at the period of the amount is hydrogen and nitrogen is more during the gasification process compare to other methane and corbondi oxide value. There is a possible reason could be that the equilibrium state not reached for the enough temperature of the gasifier. It is also seen that the hydrogen and nitrogen concentration is more in flue gas were enhanced with rise in the bed temperature and equivalent biomass ratio.

REFERENCES

[1] Jarungthammachote, S., and A. Dutta. Equilibrium modeling of gasification: Gibbs free energy minimization approach and its application to spouted bed and spout-fluid bed gasifiers." Energy Conversion and Management 49.6, 1345-1356 (2008)

[2] Arena, Umberto, Lucio Zaccariello, and Maria Laura Mastellone. Fluidized bed gasification of waste-derived fuels. Waste Management 30.7, 1212-1219 (2010)

[3] Pfeifer, Christoph, Bernhard Puchner, and Hermann Hofbauer. In-situ CO2-

absorption in a dual fluidized bed biomass steam gasifier to produce a hydrogen rich syngas." International Journal of Chemical Reactor Engineering 5.1, 223-221 (2007).

[4] Lahijani, Pooya, and Zainal Alimuddin Zainal. Gasification of palm empty fruit bunch in a bubbling fluidized bed: a performance and agglomeration study." Bioresource technology 102.2, 2068-2076 (2011)

[5] Mayerhofer, Matthias, Influence of pressure, temperature and steam on tar and gas in allothermal fluidized bed gasification. Fuel 99, 204-209 (2012)

[6] Ruoppolo, G., H2-rich syngas production by fluidized bed gasification of biomass and plastic fuel. Waste management 32.4, 724-732 (2012)

[7] Deng, Zhongyi, Computational fluid dynamics modeling of coal gasification in a pressurized spout-fluid bed. Energy & Fuels 22.3, 1560-1569 (2008)

[8] Abu El-Rub, Ziad, Eduard A. Bramer, and Gerrit Brem. Review of catalysts for tar elimination in biomass gasification processes. Industrial & engineering chemistry research 43.22, 6911-6919 (2004)

[9] Skoulou, V., Low temperature gasification of olive kernels in a 5-kW fluidized bed reactor for H2-rich producer gas. International Journal of Hydrogen Energy 33.22, 6515-6524 (2008)

[10] Kirnbauer, Friedrich the positive effects of bed material coating on tar reduction in a dual fluidized bed gasifier. Fuel95, 553-562 (2012)

[11] Lin, Weigang, Kim Dam-Johansen, and Flemming Frandsen. Agglomeration in bio-fuel fired fluidized bed combustors. Chemical Engineering Journal 96.1-3, 171-185 (2003)