International
Journal
Of Advanced Research in Engineering& Management (IJAREM)
ISSN: 2456-2033 || PP. 01-06

A review on Biomass gasification

Saradhambal. M[1], Mrs R. chitra[2], Prathyusha KS[3]
[1,3]*Department of food processing and preservation technology*
[2]*Department of electonics and communication engineering , Avinashilingam institute for home science and higher education for women, Coimbatore, India*

Abstract: Gasification is a well arranged process to obtain valuable products from biomass with several potential applications, which has received increasing attention over the last decagons. Biomass gasification has been explained. Further development of gasification technology requires innovative and economical gasification methods with high systematic. Various methods of biomass gasification as good as new technologies and recent development are discussed in this paper.

Introduction:

Biomass gasification:

Biomass currently provides about 14% of the world's energy, equal to 25 million barrels of oil per day. It is the most important source of energy in the developing world (35% of total energy) where three-quarters of the world's people now live and 90% of the world inhabitants will reside by the mid of the upcoming century.

Biomass is the part of important source with the energy after coal, petroleum, and natural gas, and currently provides more than 10% of the universal energy (Saidur et al., 2011). It is evaluated that biomass and waste will contribute a quarter or third of overall primary energy will be given by 2050 (Bauen et al., 2009).

The first approved application of gasification for electricity manufacturing was reported in 1792. yet, the first victory of gasifier unit was created in the year 1861 by Siemens, while the fluidized bed gasifier (FBG) was only progress in 1926, leading to begin the first trade coal gasification plant at Wabash River in the USA at 1999. An issue of unstable oil prices and discuss over climate change, biomass gasification has continuously received interest from 2001 (Basu, 2010).

Biomass gasification is a thermo chemical part of the oxidation process that transform biomass into gas in the presence of gasifying agents, i.e., oxygen, carbon dioxide, air, steam or a mixture of these (Ruiz et al., 2013). The synthesis production is a mixture of CO, H2, CH4, and CO2, as well as light hydrocarbons, i.e., ethane and propane, and heavier hydrocarbons such as tars. The standard of produced gas is damaged by the feedstock material, gasifying agent, design of the reactor, the appearence of catalyst, and operational conditions of the reactor (Parthasarathy and Narayanan, 2014). The low level of heating value (LHV) of the synthesis ranges from 4 to 13 MJ/Nm3, as a function of feedstock, technology of gasification, and the operational conditions (Basu, 2013). The manufacture char is a mixture of unconverted organic fraction and ash

Gasification is a gas or syngas consists primarily of H2, CO, CH4, CO2 and N2.

Technologies used in gasification:

Gasification is a technology used to transform carbon based raw material such as coal into fuel gas, also known as syngas. Gasification occurs in a gasifier, at the primary stage a high temperature, pressure vessel where oxygen and steam are directly contacted with coal or other feed material is a source serious of chemical reaction.

It is the standby to more developed way to transform feed stocks like waste, coal biomass, waste stream into electricity and other product. Some of the advantages of the gasification in specific application and conditions, distinct in generation of electricity from coal , may make it and increasing importance of gasification biomass gasification is technology uses to manage procedure involving heat, steam, and oxygen to convert biomass to hydrogen and other product with ignition.

Types of gasification:

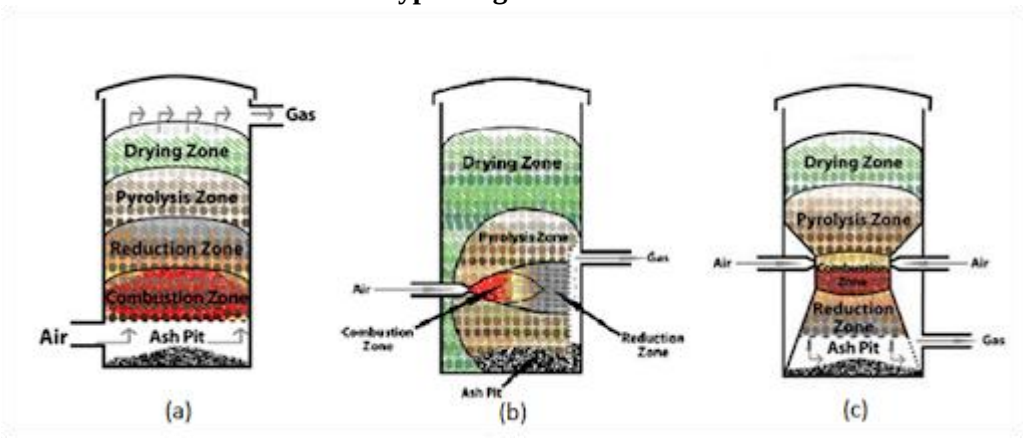

Fig 1 different zones of gasification

Fluidized bed gasifier

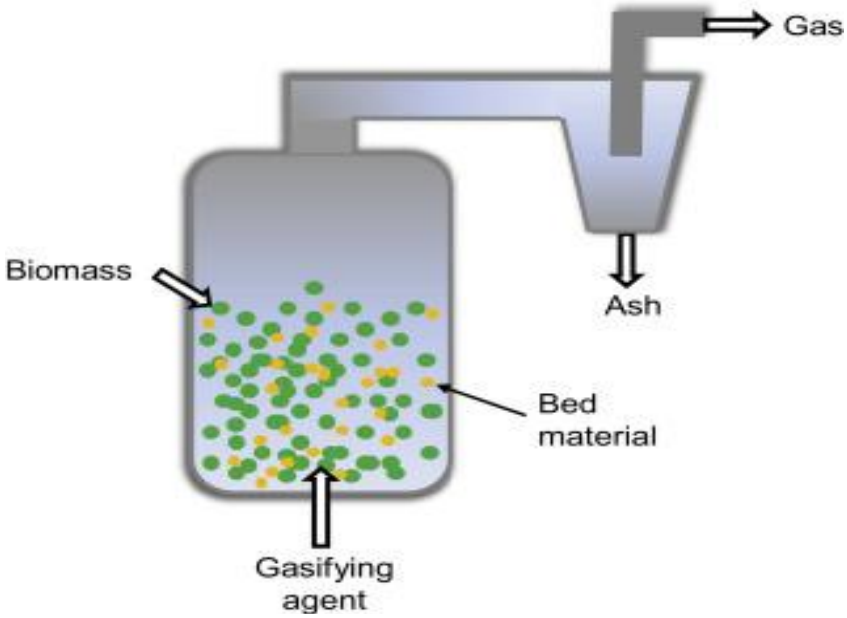

Fig 2 fluidized bed gasifier

Fluidized bed gasifiers are taking the range of 800-1000 °C to avoid ash agglomeration, which is acceptable for biomass usage. Unlike other reactor types, a fluidized bed gasifier contains a bed of inert materials that help to carry heat and mixer, while the gasifying medium acts as the fluidizing gas. Generally, biomass molecule is heated to bed temperature (as a result of contact with hot bed solids) and undertaken drying and pyrolysis, bring forth char and gases. Bubbling fluidized bed (BFD) and circulating fluidized bed (CFD) are the most known types of fluidized bed gasifiers.

A BFD cannot accomplishment complete char conversion because of the back-mixing of solids. As an effect of high degree of solid mixing, BFD gasifiers reaches the proper temperature . An essential disadvantage of BFD gasifiers is the slow diffusion of oxygen from the bubbles to the emulsion phase, which reduce gasification capacity (the combustion occurs in the bubble phase) (Basu, 2013).

Fixed bed gasifier

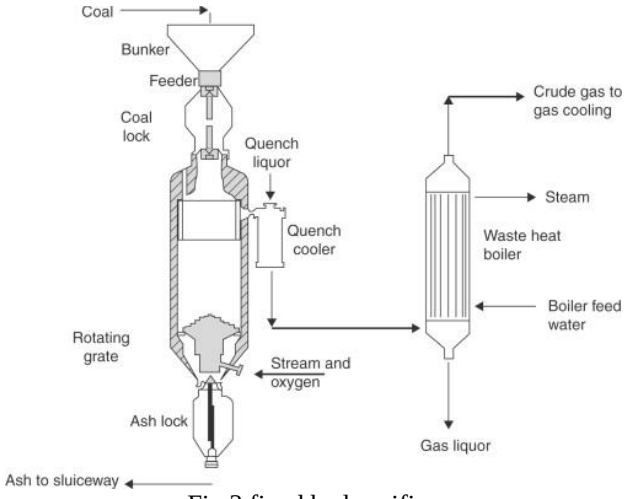

Fig 3 fixed bed gasifier

In a typical fixed bed (updraft) gasifier, fuel is fed from the top, while the pre-heated gasifying agent is fed through a grid at the bottom. As the gasifying region enters the bottom of the bed, it reaches the hot ash and expose the chars go down from the top and complete combustion process, producing H2O and CO2 while also increasing the temperature. The released heat will heat up the upward moving gas as well as descending solids. The combustion reaction rapidly consumes most of the available oxygen; further up partial oxidation occurs, releasing CO and moderate amounts of heat. The mixture of CO, CO2, and gasifying medium from the combustion zone, moves up into the gasification zone where the char from upper bed is gasified. The remaining heat will be rising hot gas pyrolyzes the dry biomass (Basu, 2010). Updraft gasifier is not appropriate for many advanced application, due to production of 10-20 wt.% tar in the produced gas (Ciferno and Marano, 2002).

In downdraft gasifiers, the reaction regions differ from the updraft gasifiers, as biomass fed from the top descends, while gasifying agent is fed into a lower section of the reactor. The hot gas then moves into a descending over the last it reaches hot char, where the gasification takes place.

Entrained flow gasifier:

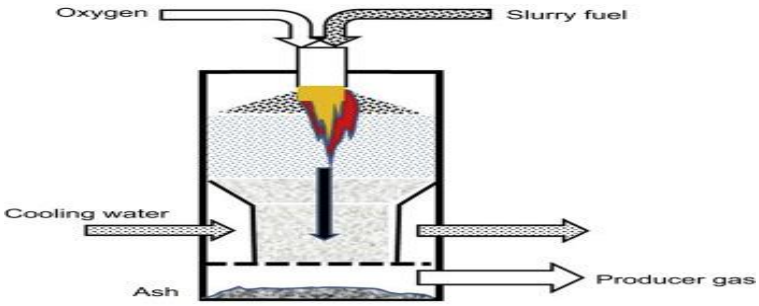

Fig 3 Entrained flow gasifier

Entrained flow gasifiers are highly efficient and useful for large scale gasification and are typically operated at high temperature (1300-1500 °C) and pressure values (20-70 bar), where the feed fine fuel (<75 µm) and the gasifying agent (commonly pure oxygen) are injected in co-current (**Fig. 1**). The high operating temperature (well above melting point of ash) results in complete destruction of tar; therefore, these gasifiers are advantageous for biomass gasification where tar is a serious issue. To facilitate feeding into the reactor, the fuel may be mixed with water to prepare a slurry, which will lead to additional reactor volume for evaporation of the large amount of water (Basu, 2013) and 20% higher oxygen consumption than that of dry-feed system (Higman and Van der Burgt, 2011). Utilization of biomass fine particles usually requires a torrefaction based pre-treatment (Couhert et al., 2009; Svoboda et al., 2009).

Updraft and downdraft gasifier:

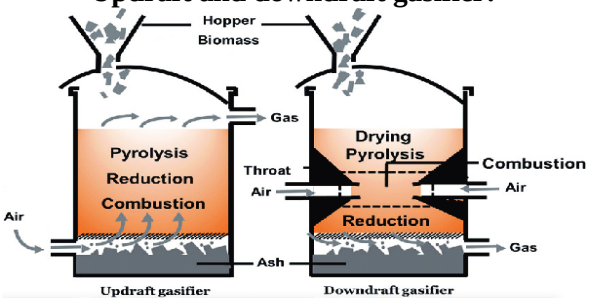

Fig 4 updraft and down draft

In the updraft gasifier the downward-moving biomass is first dried by the upflowing hot gas is obtained. After drying, the solidified fuel is pyrolysed, giving char which carried to move down to be gasified, and pyrolysis vapours which continue to upward by the upflowing hot material gas. The tars in the vapour futher condense on the cool downward fuel or are moved to the reactor with the gas, then it come up with the high tar content (Bridgwater et all, 1990). The gas from an updraft gasifier thus hold a important proportion of tars and hydrocarbons, which gives to its high heating value. Usually the gases are directly used in a jointly coupled furnace or boiler. The fuel gas need huge cleanup if upcoming processing is to be performed. There is engrossment in the cleaning of the updraft gas for electricity production, as low temperature tars are more automatic and thus simple to removed, than the high-temperature tars produced in much lower amounts by downdraft and fluidized bed gasifiers (Buekens et all,1990).

The primary mertis of updraft gasifiers are their high heating thermal capacity,easy to construct and high thermal capacity: the detectable heat of the gas produced to remove by direct heat exchange with moved into the feed, thus it dried, preheated and pyrolysed before moving into the gasification zone (Bridgwater, 1995). Updraft gasifiers are acceptable for sizes between 2 and 20 MWe. Several industrial updraft are in process of Northern Europe for peat as good as straw and wood chips (Kristensen, 1996, Kurkela et all., 1989, Haavisto, 1997).

Downdraft gasifier

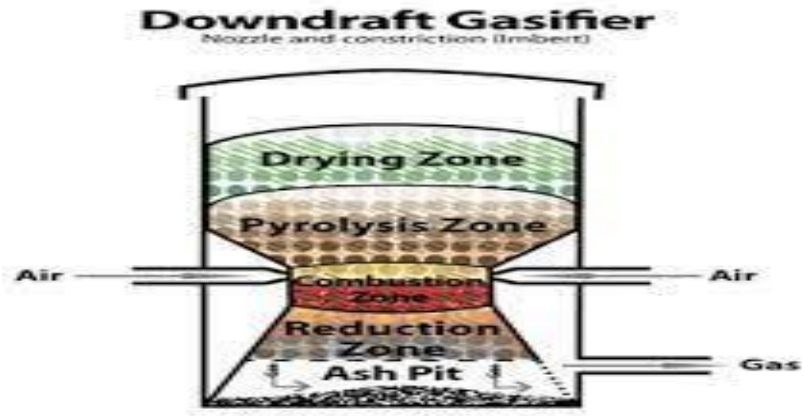

Fig 5 Downdraft gasifier

The downdraft gasifiers or cocurrent gasifiers are the most basic type of gasifiers. In cocurrent gasifiers, biomass feedstock is fed from the head while air is passed decrease and producer gas leaves from the base of the gasifier. Oxidation zone is lower the pyrolysis zone, and depltion zone is under the oxidation zone, studied by Khosasaeng et al. . Because air is passed in the same manner as that of biomass feedstock. A clean mixture of burning gases in the exit stream is obtained. It produces less tar gas, and acceptable by gas engines. The posture of the oxidation zone is thus a difficult parameter to design a downdraft gasifier . The air is moved at high velocity in crossdraft gasifiers through a nozzle mounted on one side of the gasifier, which produces substantial

rotation and flows across the biomass feedstock bed. The producer gas is produced in the horizontal direction and the nozzle moves forward and moves through a vertical grate on the opposite side. The temperature produced in that small volume is very much larger and helps to produce very low tar gas. generally, the crossdraft gasifiers are not used for producing producer gas.

Recent development in biomass gasification:

Due to quick climate change and to predict damage through global warming, opportunity to clean and green energy has become very much essential development of the public, around the world. Biomass energy is one of the common and renewable energy resources to take daily energy requirements and its an ancient old time human civilization. Biomass gasification is one of important side of bioenergy for producing heat, power and biofuels for useful applications. Inspite of, the accessibility of writing, scientific and advancements in substance, the dissemination of gasification technology could not overcome the analytical barriers for the universal acceptability over the current energy resources.

Conclusion:

The trading of biomass gasification is still at the primary stage of development and leaves a more to be want on the technology based. In extracting, large-scale usage of biomass still needs to control the challenge of biomass collection and transportation, due to its low energy substance. One of the major uses of biomass gasification is the generation of different gases. Each gas is picked and sold to the right vendor. The gasification of waste lower the need for landfill space, decreases methane emissions and decrease the use of fossil fuels. Similarly, coal gasification provides one of the neat and most versatile ways to convert coal into electricity, hydrogen and other useful energy material.

Reference:

[1]. An critical review on biomass gasification, co-gasification, and their environmental assessments **Article** *in* Biofuel Research Journal · December 2016 DOI: 10.18331/BRJ2016.3.4.3
[2]. See discussions, stats, and author profiles for this publication at: https://www.researchgate.net/publication/267737266 Updraft Gasification **Conference Paper** · November 2003
[3]. Abdoulmoumine, N., Adhikari, S., Kulkarni, A., Chattanathan, S., 2015. A review on biomass gasification syngas cleanup. Appl. Energy. 155, 294-307. A
[4]. Agbor, E., Zhang, X., Kumar, A., 2014. A review of biomass co-firing in North America. Renew. Sust. Energy Rev. 40, 930-943.
[5]. Ahmad, A.A., Zawawi, N.A., Kasim, F.H., Inayat, A., Khasri, A., 2016. Assessing the gasification performance of biomass: a review on biomass gasification process conditions, optimization and economic evaluation. Renew. Sust. Energy Rev. 53, 1333-1347.
[6]. Ahmed, T.Y., Ahmad, M.M., Yusup, S., Inayat, A., Khan, Z., 2012. Mathematical and computational approaches for design of biomass gasification for hydrogen production: a review. Renew. Sust. Energy Rev. 16(4), 2304-2315.
[7]. Ahrenfeldt, J., Thomsen, T.P., Henriksen, U., Clausen, L.R., 2013. Biomass gasification cogeneration: a review of state of the art technology and near future perspectives. Appl. Therm. Eng. 50(2), 1407-1417.
[8]. Aigner, I., Pfeifer, C., Hofbauer, H., 2011. Co-gasification of coal and wood in a dual fluidized bed gasifier. Fuel. 90(7), 2404-2412.
[9]. Akia, M., Yazdani, F., Motaee, E., Han, D., Arandiyan, H., 2014. A review on conversion of biomass to biofuel by nanocatalysts. Biofuel Res. J. 1(1), 16-25
[10]. Anis, S., Zainal, Z.A., 2011. Tar reduction in biomass producer gas via mechanical, catalytic and thermal methods: a review. Renew. Sust. Energy Rev. 15(5), 2355-2377.
[11]. Asadullah, M., 2014. Biomass gasification gas cleaning for downstream applications: a comparative critical review. Renew. Sust. Energy Rev. 40, 118-132.
[12]. Aznar, M.P., Caballero, M.A., Sancho, J.A., Francés, E., 2006. Plastic waste elimination by co-gasification with coal and biomass in fluidized bed with air in pilot plant. Fuel Process. Technol. 87(5), 409-420.
[13]. Balat, H., Kırtay, E., 2010. Hydrogen from biomass-present scenario and future prospects. Int. J. Hydrogen Energy. 35(14), 7416-7426.

[14]. Baruah, D., Baruah, D.C., 2014. Modeling of biomass gasification: a review. Renew. Sust. Energy Rev. 39, 806-815.
[15]. Basu, P., 2010. Biomass gasification and pyrolysis: practical design and theory. Academic press.
[16]. Bauen, A., Berndes, G., Junginger, M., Londo, M., Vuille, F., Ball, R., Bole, T., Chudziak, C., Faaij, A., Mozaffarian, H., 2009. Bioenergy-a sustainable and reliable energy source. a review of status and prospects. bioenergy: a sustainable