

Eco- friendly Degradation of Biomass Using Electricity in Biomass Power Plant

B.V. Kumbhar¹, R.M. Kurane²

¹Department of Electrical Engineering AMP Vathar, Kolhapur, Maharashtra, India

²Department of Science and Humanities RIT Sakharale, Islampur, Maharashtra, India

Abstract- In the past few decades' biomass fuel is really useful & sustainable fuel & being utilized for electricity generation. The direct burning of biomass in biogas generating station is a major contributor of air pollution. It can emit carbon monoxide, nitrogen oxides & particulate matter. Burning of municipal solid waste can also be extremely dangerous from the potentially releasing known carcinogens & heavy metals in to the environment. This paper deals that instead of direct burning of biomass, degradation is done by electricity to avoid greenhouse gas effects & obtain a clean gas for electricity generation.

Keywords- Biomass, Biomass Degradation, Electrodegradation, Natural gas, Electricity Generation.

I. INTRODUCTION

Biomass energy is a renewable form of energy produced from organic matter. Biomass resources are found almost everywhere & can become a reliable & renewable local energy source to replace fossil fuels. As an energy source, biomass can either be used directly via combustion to produce heat or indirectly after converting it to various forms of biofuel. Direct burning of biomass causes large amount of CO₂ emission also it contains harmful pollutants like carbon monoxide & particulate matter, on the other hand burning of garbage produces air pollution & releases the chemicals and substances in the waste in to the air, some of these chemicals can be hazardous to people & the environment if they are not properly controlled. Also burning trees releases sequestered carbon that will not be re-sequestered for several decades. Fuel crops require water, land, & fertilizers, which have an environmental impact. Biomass degradation is also done by some traditional process like anaerobic digestion by micro bacteria. But it consumes a lot of time and also it requires a high level of investment in large tanks and other process vessels. Its efficiency is comparatively low and can cause an odour nuisance. Electrodegradation of biomass have been recognized as one of the most effective technique for biomass degradation in biomass generating station.

In anaerobic digestion there are four stages Hydrolysis, acidification, acetogenesis and methane production. Different micro-organisms play a vital role in every stage. This can be enhanced by passing electricity in the mass at every stage, optimum amount of electricity through mass helps to produce clean gas for electricity generation. An important feature of

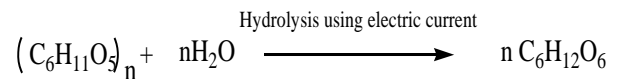
this technique is that the potential at which the electrolysis is occurring can be selected such that particular reaction can be enhanced. Since the type of waste to be degraded is likely to vary; a flexible system can be adopted to provide the optimal potential for the degradation of particular type of waste available.

II. SYSTEM DESCRIPTION

The main objective of proposed system is that the gasification of biomass using electricity is the best possible conversion of solid biomass in to a high calorific product gas. Here the process is done by different stages, each stage is essential for optimum gasification of biomass. This could be done by allowing electricity flowing through it. Different stages are reviewed as

A. Hydrolysis:

In the process of hydrolysis higher molecular weight of fats, starches and proteins present in biomass can be broken down into simpler molecules. This can be synergistically increased by passing of electricity into it. This can be shown by following reaction;

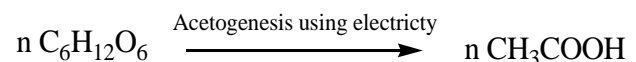


B. Acidification:

It is a process where microorganism of anaerobic group, hydrolyze and ferment into acids and volatile solids. Generally, for the digestion to form acids, two weeks are required. The time required for digestion may get drastically reduced by passing electricity into it.

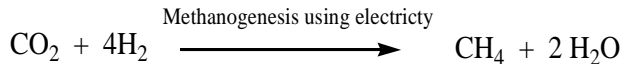
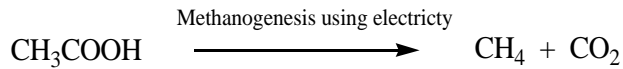
C. Acetogenesis:

Simple molecules of higher acids are get further reduced into acetic acid and hence it is called as acetogenesis. The rate of acetogenesis can be increased by the electro oxidation i.e. by the supply of electricity in the mass. This is shown by following reaction;

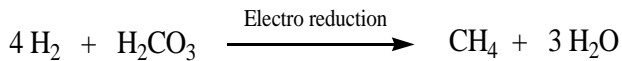
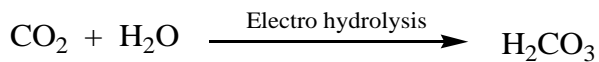


D. Methane production (Methanogenesis):

Conversion of methane and CO₂ by the aerobic oxidation of acetic acid is called as methanogenesis. This can be achieved by two ways; a) methane fermentation bacteria and b) reduction of CO₂ i.e. hydrogenation of carbon dioxide. Both the processes can effectively initiated by the use of optimum amount of electricity.



Large amount of methane can also be prepared by the hydrolysis and subsequent reduction of CO₂ by electro hydrolysis and electro reduction respectively.



III. SYSTEM DESIGN.

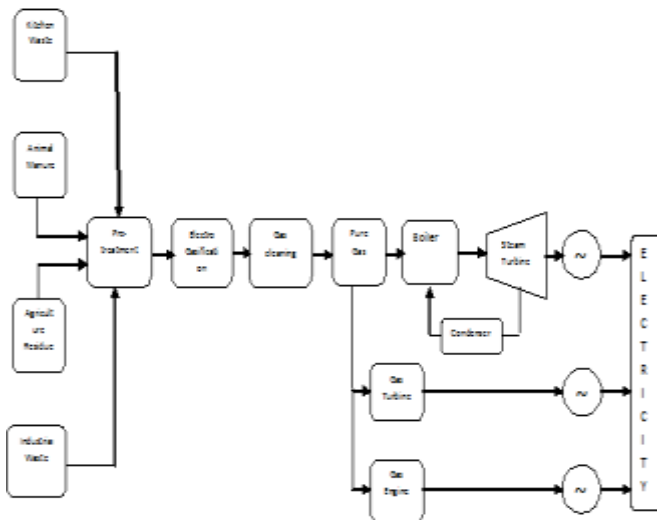


Fig.1.Block Diagram

Fig.1 shows a block diagram of proposed system

A. Organic Material -

Biomass energy sometimes known as bio-energy is a renewable form of energy occurs in the form of living or recently living plants waste which includes kitchen waste, Animal manure, Agriculture residue, industrial waste etc.

B. Pre-treatment chamber

All type of pretreatment of bio-mass is considered one of the most expensive step in overall processing in a bio-mass to gas conversion processing pre-treatment process has been carried out in four different stages in that first step mechanical process in that all material size reduced by shredding & grinding. Then later steps are energy densification, pelletization & fractionation etc.

C. Utilization of Gas

After gasification of biomass pure gas get utilized for generating steam in boiler, generated steam is then provided to steam turbine where generator is connected. Also pure gas may provide to gas engine or gas turbine for generation of electricity.

IV. CONCLUSION

In comparison with direct burning of biomass electro-degradation of biomass is a very efficient, cost effective and environmentally favorable technique. After electro-degradation of biomass, produced biomethane functions similarly as that of natural gas, so it can be used in many of the same energy producing applications. Burning of methane also has net environmental benefits and it also a more potent greenhouse gas than carbon dioxide.

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