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Statistical Survey and Review on Virtualisation of Biomass Gasification System

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ABSTRACT: The extraction of solar energy in the Biomass through photosynthesis have been utilised from ages as a source of heat and light**.** The consecutive improvement in increasing the efficiency of the process involved to extract the hidden solar energy from biomass is being analysed and improved time to time**.** Sustainable energy or clean energy is the practice of using energy in a way that "meets the needs of the present without compromising the ability of future generations so that they are capable in having their own needs**".** When referring to methods of producing energy, the term "sustainable energy" is often used interchangeably with the term "renewable energy"**.**The present work deal in studying virtualisation of the biomass gasification system in ASPEN PLUS software that could be simulated for actual working gasification plant**.** In this work, we discuss about the developed virtual model considering some standard literatures. These standard literatures would include the virtual Simulation models that have been developed for different biomass for different working, influencing parameters that can be used for estimating experimental results, saving lot of energy.

Keywords: Biomass gasification, ASPEN plus, Numerical methods, Property attributes.

I. INTRODUCTION

Utilising the Solar energy installed in the green plants or biomass through Photosynthesis is renewable. When the biomass is burnt, the stored chemical energy is released as heat. Biomass is a renewable energy source because its supplies are not limited. We can always grow trees and crops, and waste will always exist. Biomass can be derived from numerous sources, which include by-products from Timber industry, agricultural waste, raw materials from the forest, organic kitchen waste etc. It is also used as raw material in various industrial and production process. Research on biomass energy crops is concentrating on generating reliable data on potential yield, environmental impact, limitations and economics.

II. BIOMASS COMPOSITION

For effective energy production, it is keen to know the composition of the biomass. Biomass is generally represented as CxHyOz Compound. Generally, biomass ligno cellulosic or herbaceous which consists of cellulose, hemicellulose and lignin. Plants also contain the crude oils and extractives in minor quantity that can be extracted. Cellulose $(C_6H_{12}O_6)_n$ has been classified as the most predominantly available polysaccharide made of long unbranched fibrils composed of glucose monomers linked uniformly by β-glucosidic bonds. These linkages are being responsible for which cellulose is resistant to hydrolysis.

Hemi cellulose are hetero polysaccharides that include xylose, mannose and glucose. They are found to be in cell walls of the plants. They differ in quantity and structure depending on the type of plants. Hemi cellulose may constitute 20 – 30% of cell walls.

Lignin is second most abundant biopolymer in nature that makes up 90% of lingo-cellulosic and 80% herbaceous biomass. Lignin is a set of aromatic alcohols having covalent bonding with cellulose and hemicellulose is responsible for the rigidity of the plants.Hemicellulose and Lignin are rich natural carbon resources on the earth and are found in many kinds of Biomass.

III. PRESENT SCENARIO IN INDIA:

The programme for deployment of small biomass plants in the remote rural, semi-urban areas of the country facilitating the beneficiaries to convert cattle dung, organic wastes into clean gaseous fuel.

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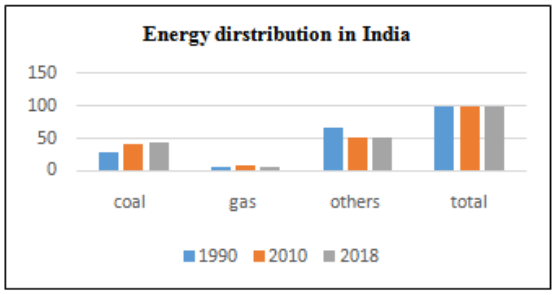

Figure 01: Energy distribution in India

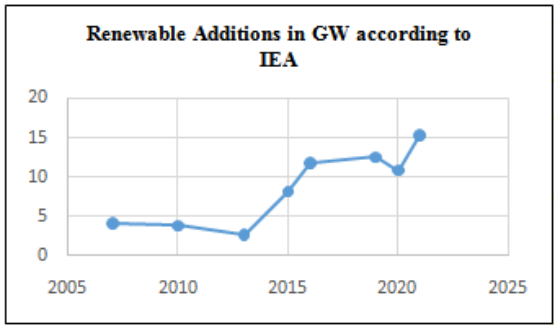

Figure 02: Renewable energy in India

IV. BIOMASS GASIFICATION:

Biomass Gasification is a thermochemical conversion of Biomass into a combustible non-volatile gas mixture, by partial oxidation of biomass at very high temperatures around 700 to 800 °C in a gasification medium (air, oxygen and steam). Gasification is a two-stage reaction consisting of oxidation and reduction processes. These processes occur under sub-stoichiometric conditions of air with biomass.

The first part of sub-stoichiometric oxidation leads to the loss of volatiles from biomass and is exothermic; it results in peak temperatures of 850°C to 1000 °C and generation of gaseous products like carbon monoxide, hydrogen in some proportions and carbon dioxide and water vapour which in turn are reduced in part to carbon monoxide and hydrogen by the hotbed of charcoal generated during the process of gasification.

V. ASPEN PLUS:

Aspen is a process simulation software package widely used in industry today. Given a process design and an appropriate selection of thermodynamic models. Aspen uses mathematical models to predict the performance of the process. Aspen uses mathematical models to predict the performance of the process.

VI. LITERATURE REVIEW

[1] Ashok J. Keche et.al has studied about Simulation of biomass gasification in downdraft gasifier for different biomass fuels using ASPENPLUS. T he author has been developed a comprehensive model for biomass gasification in an atmospheric fixed bed rector using the ASPENPLUS.

The model developed using ASPENPLUS is validated with experimental data obtained with four different types offeedstock's like babul wood, neem wood, mango wood, and bagasse.The gasifier conversion efficiency was observed to be higher with babul wood when compared with the other three types of wood due to its high carbon and H2 and fewer ash concentrations in the following figure.

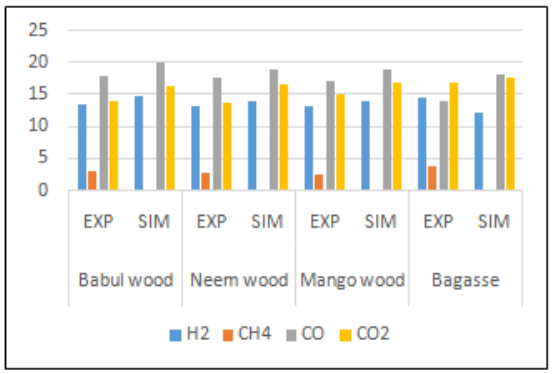

Figure 03: Syngas composition

[2] Raquel Tavares et.alhas studied regarding reliable numerical methodology using ASPENPlus process simulator capable of performing a sensibility analysis of the downdraft gasification of Portuguese forest residues. The work reveals the effects of critical parameters, including gasification temperature and steam-to-biomass ratio (SBR) on the composition of the produced gas. The simulation results also demonstrated that the use of steam as a gasification agent allows increasing the hydrogen content and heating value of the produced gas in comparison to the use of air as a gasifying agent.

[3] Wajeha Tauqir et.al in his work has done a Parametric analysis of a steady-state equilibrium-based biomass gasification model for syngas and biochar production and heat generation. In this study, he has developed a steady state equilibrium model for biomass gasification system using ASPENplus software. The simulated model was compared with the results of a wood-fed downdraft and sawdust fed gasifier reported in the literature. The model was simulated and compared with the

results of a wood-fed downdraft and sawdust fed gasifier reported in the literature

VII. CONCLUSIONS & REVIEW

1. The statistical surveys of the present energy scenario in India and its trends have been discussed in the paper.
2. The dependencies of the renewable energy have been increased drastically and there is a requirement of developing sustainable technology.
3. ASPEN PLUS software package has been a very successful and reliable for developing and simulating virtually developed gasification model.
4. PR-BM (Peng Robinsons Equation of state with Boston-Mathias-alpha) can be used as property method dnaeach zone of the reactor is separated into unit operational reactors.
5. They have divided the gasification system into three Parts; Pre-drying, Gasification unit and Syngas post-treatment
6. ASPEN enables the user to conduct the simulation model for varying influential factors and modes like complete, restricted and kinetic equilibrium models.
7. From the above gasification of biomass is leading technology in hydrogen production which can be used for fuel cells especially HOFC- Hydrogen Operated Fuel cells, Steam methane Reforming etc.
8. The Authors have been concentrated only on the complete equilibrium simulation of the gasification model. The models could be also developed on for Restricted and Kinetic model.
9. The models that have been developed is static and zero-dimensional models. This could be developed for dynamic and Multi-dimensional simulation.

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