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Power Generation Potential Analysis by Non Woody Biomass

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Abstract: India is a developing nation, but sustainable development is more important. In developing nations, energy is being consumed at a very faster rate and it is a initial requirement for economic development. In order to meet the increasing demand for electricity in the country, massive addition to the installed generating capacity is required. There are different type of renewable energy sources like solar, wind, hydropower, biomass energy etc. In all of renewable energy sources, biomass is more easily feasible for almost all the continents in the world. Power generation from biomass becomes attractive way for energy generation due to their high energy potential and less pollutants. In this paper, We discuss the various technologies that can be used to use dry or wet biomass for power generation .In this we analysis the proximate analysis of various agriculture crops.
Keywords: Biomass, Biomass Energy, Technology, Power Generation.

I. INTRODUCTION

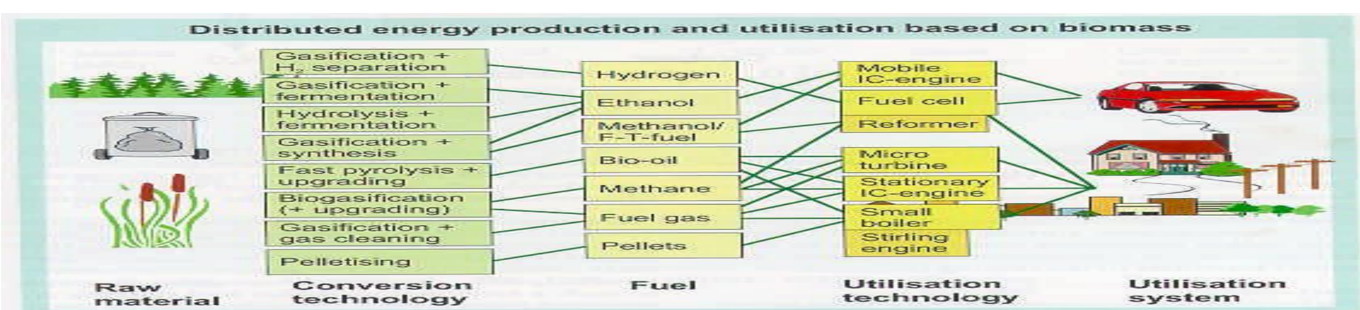
Fossil fuel reserves are very limited in nature and these reserves are expected to last up to 100 years more. Due to fast depletion of fossil fuel resources for power generation and growing concern over the environmental degradation caused by conventional power plants, power generation from biomass is becoming attractive through out the world. Sustainable production and utilization of biomass in power generation can solve the vital issues of atmospheric pollution, energy crisis, wasteland development, rural employment generation and power transmission losses. Thus, the development of biomass-based power generation system is thought to be favorable for majority of the developing nations including India. Unlike other renewable, biomass materials, pre-dried up to about 15% moisture, can be stored for a considerable period of time without any difficulty.

II. BIOMASS MATERIAL

The main biomass resources include the following: short rotation forestry (Willow, Poplar, Eucalyptus), wood wastes (forest residues, sawmill and construction/industrial residues, etc.), sugar crops (Sugar beet, Sweet Sorghum, Jerusalem Artichoke), starch crops (Maize, Wheat), herbaceous lignocellulosic crops (Miscanthus), oil crops (Rapeseed, Sunflower), agricultural wastes (straw, slurry, etc.), municipal solid waste and refuse, and industrial wastes (e.g. residues from the food industry). In this ,energy crops can be an important biomass feedstock. At present, however, wastes, either in the form of wood wastes, agricultural wastes, municipal or industrial wastes, are the major biomass sources and, consequently, the priority fuels for energy production. There is also an additional environmental benefit in the use of residues such as municipal solid waste and slurry as feed stocks as these are withdrawn from polluting land filling.

III. POWER GENERATION TECHNIQUE THROUGH BIOMASS

Biomass is a versatile source of energy in that it can be readily stored and transformed into electricity and heat. It has also the potential that it is used as a raw material for production of fuel and chemical feedstock. This section summarises the current status of biomass technology from biomass crops, conversion technologies to end products, technologies available and end products of the conversion process.



IV. CONVERSION PROCESSES

A. Combustion

The majority of biomass and agricultural waste derived energy comes from wood combustion. There is a constant drive to improve the combustion efficiency up to more than 30% and a reduction in pollutant emissions. Combustion can be represented by:

$$C_6H_{10}O_5 + H_2O = 3\ CH_4 + 3\ CO_2 + \text{Heat}$$

B. Gasification

Biomass gasification is the thermo-chemical transformation of biomass in an oxygen deficient environment leading to conversion of all the raw materials into gas. Biomass gasifiers are devices that thermo-chemically convert biomass into high energy combustible gas to be used in gas turbine. A temperature of about 600-800 ^{0}C is required for gasification process. Biomass, particularly woody biomass, can be transformed to highly flammable gas to be utilized in internal combustion engines for mechanical or electrical applications. This happens in two stages. In the first stage, partial combustion of biomass forms producer gas and charcoal. In the following stage, the CO_2 and H_2O produced in the former phase are chemically lowered by the charcoal, forming CO and H_2. The composition of the gas is 18-20% CO, an equal portion of H_2, 2-3% CH_4, 8-10% CO_2 and the rest nitrogen. A number of gasifiers have been developed over the time. These incorporate the smaller scale fixed bed updraft, downdraft and cross flow gasifiers. For small scale applications, downdraft gasifiers are prominent as the tar production is comparatively low. Low melting point fuels are not suitable to be used for this process. Between various biomass power alternatives, small-scale gasifiers with power production potential of 20–500 kW have the prospective to meet all the rural electricity requirements and leave the excess to feed into the national grid.

C. Pyrolysis

Pyrolysis is defined as the thermal decomposition of organic materials in the absence of oxygen. It is the basic thermo-chemical process for conversion of biomass into a more functional fuel. The temperature window for pyrolysis process is 300-600 ^{0}C . In general, gas and liquid products are produced by pyrolysis and solid residue with rich carbon content is left. Extreme pyrolysis largely produces carbon as the residue, which is called carbonization. Pyrolysis varies from other high-temperature combustion methods as there is no use of oxygen, water or any other agents .

D. Esterification

It is the chemical modification of vegetable oils into vegetable oil esters, which are suitable for use in engines. Vegetable oils are produced from oil crops (e.g. rapeseed, sunflower) using pre-pressing and extraction techniques. The by-product of the oil production is a protein 'cake' which is a valuable feedstuff for animal feeding. Esterification is needed to adapt the properties to the requirements of diesel engines. This process eliminates glycerides in the presence of an alcohol and a catalyst (usually aqueous sodium hydroxide or potassium hydroxide). Methyl esters are formed if methanol is used while ethyl esters are formed if ethanol is used. The most common vegetable oil ester for biofuel is RME (rape methyl ester).The schedule of the process is represented below. This example considers an initial biomass (raw material) quantity of 3000 kg of rapeseed. During the extraction process this is converted to approx. 1000 kg of rape oil and 1900 kg of protein feedstuff. In the esterification process the rape oil is treated with methanol to produce 1000 kg RME and 110 kg of glycerine.

E. Anaerobic Digestion

It is a well-established technology for waste treatment. In this method it produces methane from wastes. This is the natural breakdown of organic matter, such as biomass, by bacterial populations in the absence of air into biogas, i.e., a mixture of methane (40-75% v/v) and carbon dioxide. This bioconversion takes place in "digesters," i.e., sealed, airless containers, offering ideal conditions for the bacteria to ferment the organic feedstock to biogas. During anaerobic digestion, typically 30-60% of the input solids are converted to biogas; by-products consist of undigested fibre and various water-soluble substances. Biogas, either raw or usually after some enrichment in methane, could be used to generate heat and electricity through gas, diesel of "dual fuel" engines, at capacities up to 10 MW(e).The average production rate is 0.2-0.3m^3 biogas per kg dry solids. Nowadays 80% of the industrialised world 'biogas production' is from commercially exploited landfill. R&D is mainly concentrating on factors affecting microbial population growth. High solids digesters are being developed for the rapid treatment of large volumes of dilute effluents (wastes from agro-industrial processes. This process has the advantage of a low cost feedstock and offers substantial environmental benefits as a waste management method.

V. PROXIMATE ANALYSIS

Proximate analysis gives the fixed carbon, volatile matter, moisture and ash content of biomass and gross calorific value or higher calorific value is the heat liberated by the combustion of one Kg of fuel at 0°C and under 760mm of mercury. The Table shows the results of proximate analysis and gross calorific value of different crop samples. For this study only crop residue generated by agricultural productions is considered. The crop residue selected for analysis are rice straw, wheat straw, cotton stalk, mustard straw, mungi and groundnut straw etc.

Table 1 Proximate Analysis Of Different Samples

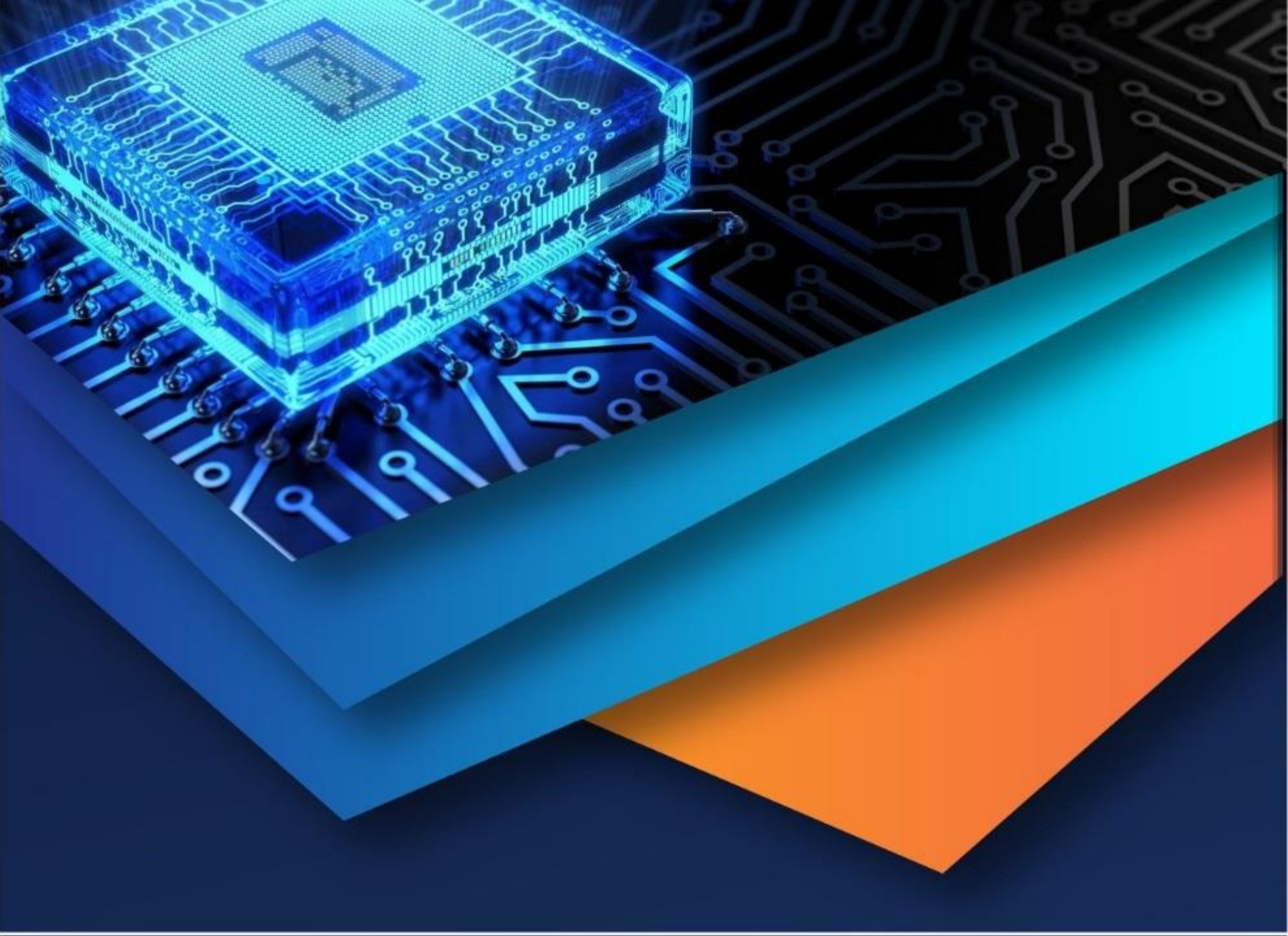
S.NO	COMMODITY	PROXIMATE ANALYSIS				CALORIFIC VALUE
		MOISTURE	ASH	VOLATILE MATTER	FIXED CARBON	KCAL./KG
1	Wheat Straw	4.09	7.58	71.41	15.23	3899
2	Mustard Straw	5.64	6.34	68.36	16.87	3655
3	Rice Wapsi	5.09	17.39	60.82	14.34	4219
4	Channa Straw	5.68	8.01	70.59	17.87	3987
5	Mungi Straw	8.09	11.58	66.33	15.89	3549
6	Mungfali Straw	6.7	16.32	61.41	16.09	4123
7	Paddy Straw	4.5	20.49	61.2	18.67	3865

VI. CONCLUSION

In the future petroleum fuels will replace from liquid bio-fuels like biodiesel and bio-ethanol. So, these bio-fuels are most important in future. From renewable sources of feedstock the liquid bio-fuel like biodiesel and bio-ethanol derived.Feedstock of bio-renewable can be converted into value-added chemicals and fuels with minimum waste and emissions. Bio-renewable is the thermo chemical and biochemical conversion processes for obtain various type bio-products like bio-oil, bio- ethanol, biodiesel, and diesel-like products. Biochemical and thermo chemical conversion are upgraded from bio renewable. The upgrading is done before ultimate refining processes

REFRENCES

[1] Kumar M. and Patel S.K., Energy Values and Estimation of Power Generation Potentials of Some Non-woody Biomass Species, Energy Sources, Part A: Recovery, Utilization and Environmental Effects, 30:8, (2008): pp. 765 – 773
[2] Werther J., Saenger M., Hartge E.U., Ogada T., Siagi Z. Combustion of agricultural residues, Progress in Energy and Combustion Science , 26 (2000): pp. 1–27
[3] Chauhan Suresh. Biomass resources assessment for power generation: A case study from Haryana state, India, biomass and bioenergy, 34 (2010):pp.1300-1308
[4] Chauhan Suresh. District wise agriculture biomass resource assessment for power generation: A case study from an Indian state, Punjab, biomass and bioenergy, 37 (2012): pp. 205-212
[5] Raghuvanshi Shiv Pratap, Chandra Avinash, Raghav Ashok Kumar. Carbon dioxide emissions from coal based power generation in India, Energy Conversion and Management , 47 (2006): pp. 427–441
[6] Kumar A., Kumar K., Kaushik N., Renewable energy in India: Current status and future potentials- Renewable and Sustainable Energy Reviews, 14 (2010): pp. 2434–2442
[7] Ministry of New & Renewable Energy (MNRE): http://mnre.gov.in/prog-biomasspower.html
[8] Energy India Alternatives: http:// www.eai.in/ref/ae/bio/bio/biomass_concepts.html
[9] Demirbas Ayhan. Biomass resource facilities and biomass conversion processing for fuels and chemicals , Energy Conversion and Management , 42 (2001): pp. 1357



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