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Dry Sugarcane Leaves: Renewable Biomass resources for Making Briquettes

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Abstract

The developing country like India produced million tones of agricultural residues out of which large amount of residues are not utilized and burnt them directly in open field, which is huge loss of heat. Inefficiently burning of these residues in loose form cause air pollution. The agricultural waste as biomass fuel can be used to generate the energy by making the briquettes out of agricultural waste. The problems related at their disposal and pollution can be solved by making briquettes. The variety of biomass material like sawdust, woody residues, animal waste, peanuts shell, rice husks, wheat straw, rice straw, energy grass, corn cobs, sugarcane bagasse, sugarcane leaves etc. can be used in manufacturing briquettes. This paper highlight on dry sugarcane leaves as one of agricultural residue, abundantly produced in India. The composition and calorific value of dry sugarcane leaves are compared with other agricultural waste biomass.

Key Words: Biomass, Briquettes, Energy, Agricultural residue, Dry sugarcane leaves.

Introduction

In India the oil and natural gas (non renewable sources) is consumed on large amount to fulfill the demand for process heat and steam. The consumption is increasing day by day because of increase in industrialization. The availability of oil and natural gas is declining day by day. It is not going to last for longer period. This places heavy burden on the economy [1]. Currently the demand for process heat and steam in industry is met by the use of oil and natural gas, which results in an increase in greenhouse gas emissions. The quick solution for the above problems is shifting from non renewable sources to renewable sources like wind, geothermal, solar, nuclear, biomass [2]. Biomass is defined as (renewable) biological material that come from animal, vegetables, agricultural waste and plant matter whether grown on land or water, food processing and forestry by products and municipal wastes [3]. Approximately 320 million tones of agricultural residues are produced by India out of which 100 million tones are burned directly in the open field causes air pollution. This agricultural waste mainly contains of rice husks, paddy straw, wheat straw, rice straw, energy grass, corn cobs, sugarcane bagasse, and dry sugarcane leaves etc [1]. The content of common agricultural residues and wastes are shown in Table 1 [4].

Table 1: Cellulose, Hemicellulose & Lignin Contents in Common Agricultural Residues and Wastes

Sr. No.	Ligno cellulosic Material	Cellulose (%)	Hemi Celluloses (%)	Lignin (%)
1	Hardwood Stems	40-55	24-40	18-25
2	Softwood Stems	45-50	25-35	25-35
3	Nut Shells	25-30	25-30	30-40
4	Corn Cobs	45	35	15
5	Grasses	25-40	35-50	10-30
6	Paper	85-99	0	0-15
7	Wheat Straw	30	50	15

8	Sorted Refuse	60	20	20
9	Leaves	15-20	80-85	0
10	Cotton Seed Hairs	80-95	5-20	0
11	Newspaper	40-55	25-40	18-30
12	Chemical Pulps	60-70	10-20	5-10
13	Solid Cattle Manure	1.6-4.71	4-3.3	2.7-5.7
14	Coastal Bermuda Grass	25	35.7	6.4
15	Switch grass	45	31.4	12
16	Bagasse	40	30	15
17	Saw Dust	40	25-35	20-30
18	Press mud	11.4	10.3	9.3

Due to increasing population in India the amount of agricultural waste is also increasing. So it is becoming an important issue. Almost one third of residue is not utilized and burned them in open field, which is huge loss of energy. It also creates environmental problems, disposal problems etc. The solution for above problems is converting the agricultural residue and waste into biomass briquettes [3].Briquetting is defined as converting loose biomass into high dense biomass material. Briquettes are easier to handle because of uniform in size and composition reduces environmental pollution and used more easily in final applications [5]. The large amount of sugarcane is produced all over the world and in India. It generates huge amount of biomass residues such as dry leaves and bagasses [6]. In this paper dry sugarcane leaves are discussed and compare with other biomass residue. Dry sugarcane leaves are the major source of energy otherwise which is wasted can be used for making briquettes.

Sugar Cane

The sugarcane crop is the best example of renewable resources abundantly available and a quick fix solution for current energy problems [7]. Sugarcane is from grass family (Saccharum officinarum), cultivated on large amount all over the world and it is main source of sugar production. After treatment on sugarcane it yields sugar juice, sugar as a main product, bagasse as waste product along with leaves and tops as abundant biomass resource [8]. Because of global importance of sugarcane's lot of efforts are taken to make good use of it as biomass. Bagasses, fiber of the stalk are studied more as biomass compare to leaves and top. The dry sugarcane leaves is burned in the open fields, emitting the green house gases and creating the environmental issue [9].

Sugar Cane Production

In India, Sugarcane is grown as a Kharif Crop. It needs hot and humid climate with an average temperature of 21°C to 27°C. 75-150 cm rainfall is favorable for sugar cane cultivation. Irrigation needed for areas with lesser rainfall. Sugarcane can grow in any soil which can retain moisture. Ideal soil for sugarcane is deep rich loamy soil. The soil needs to be rich in nitrogen, calcium and phosphorus but neither it should be neither too acidic nor too alkaline. Sugarcane is grown on around 2.8% of Gross Cropped Area of India. World Sugar cane production is 1877105 thousand metric tons in 2015. Brazil is top ranker in production of sugarcane with 739267 thousand metric tons and India ranking second with production of 341200 thousand metric tons [7, 10]. The top ten sugarcane producing countries are listed in Table 2 [10].

Table 2: Top Ten Sugarcane Producers, 2015

Rank	Country	Production (TMT)
1	Brazil	739267
2	India	341200
3	China	125536
4	Thailand	100096
5	Pakistan	63750
6	Mexico	61182
7	Colombia	34876
8	Indonesia	33700
9	Philippines	31874
10	United States	27906

The top ten sugarcane producing states in India are listed in Table 3 [11].

Table 3: Top Ten Sugarcane Producing States, 2012-13

Rank	State Name	Production (000MT)
1	Uttar Pradesh	132427.6842
2	Maharashtra	69648.0768
3	Karnataka	35732
4	Tamil Nadu	33919.17
5	Andhra Pradesh	15567
6	Bihar	12741.42
7	Gujarat	12690
8	Haryana	7437
9	Uttarakhand	6784.82
10	Punjab	5919

Content of Sugarcane Leaves

The content (cellulose, hemicelluloses and lignin) of dry sugarcane leaves is listed in Table 4 and other biomass is listed in Table 1. If the content of dry sugarcane leaves compared with the other agriculture residue, the dry sugarcane leaves have comparative lignin content which librates energy on burning and also used for making briquettes.

Table 4: Cellulose, Hemicellulose & Lignin Contents in Dry Sugarcane Leaves

Ligno cellulosic Material	Cellulose (%)	Hemi Celluloses (%)	Lignin (%)
Dry Sugarcane Leaves	27.64	19.15	11.95

Calorific Values

The calorific value of dry sugarcane leaves is equal to other biomass. The calorific value of dry sugarcane leaves and biomass is listed in Table 5 and Table 6.

Table 5: Calorific Value of Dry Sugarcane Leaves

Raw Material	Calorific value (Kcal/Kg)
Dry Sugarcane Leaves	3500 - 4196

Table 6: Calorific Values Some Biomass [12, 13]

Sr. No.	Raw Material	Calorific values (Kcal/Kg)
1	Sugar Cane	3996
2	Corn cob	4060.38
3	Rice Husk	3742.71
4	Bagasse	4139.19
5	Saw dust	4769.75
6	Sun flower Stalk	4300
7	Wheat Straw	4060.38
8	Wood	4418.64
9	Cotton stalk	4788.86
10	Cattle Dung	3700
11	Groundnut Shell	4626

Conclusion

India produces 341200 TMT sugarcane per year. So huge amount of waste is also generated during the treatment of sugarcane. Approximately TMT of dry leaves are generated. This dry leaves are burned directly in pen field creating pollution.

From above study it may be revealed that the dry sugarcane leaves has 11.95 % lignin which librates energy on burning and calorific value between 3500 – 4196 Kcal/Kg. These values are good enough when compared with other biomass. Therefore dry sugarcane leaves can also be used for making briquettes to overcome problems related to pollution and energy.

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