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# Environmentally Safe Renewable Energy Technology Using Sugar Cane

**Jadhav R. T.**

Department of General Science (Physics), LNBC Institute of Engineering and Technology, Raigaon, Satara (Maharashtra)

**Corresponding author: jadhav.drramchandra434@gmail.com, ramchandrajadhav.1470@rediffmail.com**

## Abstract:

**Energy and environment are the two basic components of the new global of sustainable development. The story of the energy starts with wood, wood came to be replaced by coal and coal by oil only partially. Now a stage appears to have been reached when oil may also have to be substituted by Biomass. Sugar industry is one of the most important industries, playing vital role in the economic development of the nation and also a most advanced processing industry in the agricultural sector in India. After processing for cane sugar, the precipitate down at the bottom of the clarifier is called press mud, otherwise known as sugar cane mud, Mostly the cane leaves are supposed to be nuisance to the farmers and are so called waste residues. The bagasse and cane leaves are good candidates for gasification.**

**Keywords:** Biomass, Agricultural Sector, Economic Development, Social Development, Cane Leaves

## 1.0 Introduction:

Energy is an essential pre- requisite for the economic and social development of the country. Energy and environment are the two basic components of the new global of sustainable development. Development involves improving the material condition and the total quality of the vast majority of the human race living in developing countries. Since the down of civilization, man has been dependent on energy in one form or the other. The story of the energy starts with wood, wood came to be replaced by coal and coal by oil only partially. Now a stage appears to have been reached when oil may also have to be substituted by Biomass. Sugar industry is one of the most important industries, playing vital role in the economic development of the nation and also a most advanced processing industry in the agricultural sector in India. In our country more than 377 sugar mills, in which 0.25 million tons of sugar cane is crushed per day, 4% of cane crushed is press mud. After processing for can sugar, the precipitate otherwise down at the bottom of the clarifier is called press mud, otherwise known as sugar cane mud, sugar cane filter mud, filter press cake, and filter mud. Mostly the cane leaves are supposed to be nuisance to the farmers and are so called waste residues.

## 2.0 Materials and Methods:

At the time of harvesting sugarcane crop, the top of the cane are removed and the steers are cleaned of their leaves (trash), on the average the cane tops and trash constitute 25-30% of the cane weight in the field.

### *2.1 Field Survey:*

Field survey was conducted to estimate the quantitative availability of cane leaves except cane tops. Five plots of one acre area of sugarcane cultivated fields were selected and marked. The total cane rows planted in each plot per acre were counted. The counts were made for number of cane plants per row and total leaves per plant. The leaves from randomly selected plants were collected and carried to the laboratory for the measurement of its weights and its proximate analysis. All samples were selected by Random sampling method.

### *2.2Analytical Methods:*

***a) For moisture:*** Randomly selected samples of feed stock was weighted and then heated at $80^0$c in oven for evaporating the moisture.

***b) For total solids****:* The determination of quantity of solids is essential to observe the gasification efficiency. The weight of sample after the evaporation of the moisture was calculated as total solids.

***c) Volatile solids:*** The weighted total solids where ignited in the muffle furnace at a temperature of $550^0$c+$50^0$c for two hours. Difference between total solids and the weight of sample after ignition.

***d) Fixed solids:*** Biologically inert material is referred as fixed solids. The weight of sample residue after the ignition of dry matter at $550^0$c+$50^0$c in muffle furnace was calculated as fixed solids.

## *2.3 Feed Stock Collection and Preparation:*

Cane leaves were dried in muffle furnace $80^0$c for 48 hours to remove its moisture content as shown in fig 1. Electrical grinder (Nippon Ele. India) as shown in fig 2. Grinder used for the preparation of powder samples. The samples of four different particulate sizes were prepared and sieved through the respective sieves. The grain size employed in the present investigation is shown in table 1.

**Table 1: Grain Size for Samples**

| Sr. No. | Samples | Mesh Size (mm) |
|---|---|---|
| 1) | A | 0.5 |
| 2) | B | 0.8 |
| 3) | C | 2.5 |
| 4) | D | 3.5 |

## *2.4 Process Principle:*

Experimental set up is as shown in fig 4. This is schematic sketch. The various reactions that take place during the gasification process can be synthesized to elementary steps to have a clear understanding about the entire process. Gasification process is carried out in four distinct stages 1) Oxidation 2) Drying 3) Pyrolysis 4) Reduction. ***Oxidation process***: Required temperature 900-$1200^0$c. The products of oxidation zone are high temperature gases containing products and water vapors. ***In drying:*** The drying process usually air dried biomass contains moisture in the range 13-15%. It occurs below $110^0$c. Due to this, weight of a material is reduced. ***In Pyrolysis:*** This zone in which biomass loses all its volatiles' and gets converted into two parts as a) Primary pyrolysis zone- in 200-$600^0$c range and 2) Secondary zone-300-$600^0$c range. ***Reduction:*** This zone is maintained within close temperature limits $900^0$c to $600^0$c. The final result is a gas consisting mainly CO, $H_2$, N2, CO2 steam and hydrocarbons.

## *2.5 Tabular Gasifire: A New Concept:*

The availability of low density feed stock is considerable in India, especially the waste generated in agro- industries and farms. This include the bagasse, cane trash, rise husk etc. to overcome the difficulties in utilization of these wastes for energy generation through the thermal decomposition, the new concept of tubular gasifire is taking roots recently.

## 3.0 Results and Discussion:

The tubular powdery gasifire was tested for its use to gasify the powdery biomass under the laboratory conditions. Gasification process was not observed for bagasse below $800^0$c, but little gasification was observed for cane leaves at the temperature above $600^0$c. The percentage of gasification for cane leaves was increased from $600^0$c to $1000^0$c. and attained the maximum possible percentage of gasification for lower powdery grain size. The overall percentage gasification for cane leaves was higher at smaller grain size of power and was decreased at larger grain size. For the small grain size, there was grain attachment to the surface. And formation of a layer was observed. But for higher grain size was less gasified. To have more gasification without layer formation of burned powder, the grain sizes of 1mm to 2.5mm are likely to be useful under continuous operations of gasification with least nuisance of layer formation and optimum percentage gasification.


**Fig 1: Muffle Furnace**


**Fig 2: Grinder**

**Fig. 3: Samples of Cane Leaves**

**Table 2: For Feeding Rate 0.5g per Minute**

| Samples | Gasified % | Temperature |
|---|---|---|
| A | 40 | 600 |
| | 48 | 800 |
| | 68 | 1000 |
| B | 35 | 600 |
| | 38 | 800 |
| | 63 | 1000 |
| C | 30 | 600 |
| | 31 | 800 |
| | 60 | 1000 |
| D | 27 | 600 |
| | 29 | 800 |
| | 58 | 1000 |

**Table 3: For Feeding Rate 1g per Minute**

| Samples | Gasified % | Temperature |
|---|---|---|
| A | 37 | 600 |
| | 42 | 800 |
| | 66 | 1000 |
| B | 29 | 600 |
| | 32 | 800 |
| | 58 | 1000 |
| C | 27 | 600 |
| | 23 | 800 |
| | 55 | 1000 |
| D | 19 | 600 |
| | 22 | 800 |
| | 25 | 1000 |

**Table 4: For Feeding Rate1.5g per Minute**

| Samples | Gasified % | Temperature |
|---|---|---|
| A | 28 | 600 |
| | 32 | 800 |
| | 57 | 1000 |
| B | 27 | 600 |
| | 29 | 800 |
| | 53 | 1000 |
| C | 23 | 600 |
| | 45 | 800 |
| | 47 | 1000 |
| D | 16 | 600 |
| | 18 | 800 |
| | 47 | 1000 |

**Table 5: For Feeding Rate 2g per Minute**

| Samples | Gasified % | Temperature |
|---|---|---|
| A | 26 | 600 |
| | 30 | 800 |
| | 50 | 1000 |
| B | 22 | 600 |
| | 27 | 800 |
| | 47 | 1000 |
| C | 19 | 600 |
| | 23 | 800 |
| | 46 | 1000 |
| D | 14 | 600 |
| | 15 | 800 |
| | 40 | 1000 |

## 4.0 Conclusion:

The tubular powdery gasifier model is efficient for gasification of the powders of grain size up to 2.5mm. The laboratory results are encouraging to for the fabrication of pilot scale multitubular powdery gasifier.

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