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"Making of waste fuel from solid waste for sustainable development"

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Abstract:- *The aim of this project is to **waste minimize and energy production**. The rising prices of raw material and benefits from waste recycling have resulted in an increasing concern for material recovery and reuse from the both management and technical aspects. Waste managing is one of the chief services provided by most urban Authorities. Solid wastes need to be characterized by sources, generation toll, Types of wastes formed, and composition in order to observe and control current waste management systems while humanizing the existing system. So keeping this aim in mind we have used paper waste, empty fruit bunches, rice husk and coal by the combination of these waste we have made two types of RDF one is without coal and another is with coal . In total 25 sample were made for the test analysis, After making the RDF of this combination, we check the proximate analysis (moisture content, volatile matter content, ash content & Fixed Carbon content) and calorific value. Result of the test showed that of the combination that S25, S16 & S20 RDF with following calorific values 3491.23 kcal/kg, 3475 kcal/kg & 3421.32 kcal/kg. So we can say that by using solid waste we have made a good calorific value of RDF.*

***Keywords**: - Rice husk, empty fruit bunches, paper waste, coal, starch binder, calorific value and proximate analysis.*

Introduction: - Fuel is considered the basis for the progress prosperity for the land and society's .it is also the important part of economic development .Waste material has turn into a basic part in our day by day life as an essential requirement. Paper waste, empty fruit bunch and rice husk are the some kind of waste .the traditional method of solid waste disposal is open dumping, burning (incineration)

solid waste – means any garbage, refuse sludge from a waste treatment plant, water supply treatment plant or air pollution control facility and other discarded material including solid, liquid or semisolid or contained some gaseous material resulting from industrial, commercial, mining and agricultural operation and form community activity but does not include solid or dissolved material in domestic sewage or solid or dissolve material in irrigation return flows or industrial discharge.

Rice husk - The rice husk is the outermost layer of the paddy grain that is separated from the rice grains during the milling process. Around 20% of paddy waste is husk and rice production in Asia produces abuts 770 million tons of husks annually. India has a major agribusiness area which has obtain remarkable over the last three and a half decades .agricultural waste or residue is made up of organic compounds from organic source such as rice straw, oil plam empty fruit bunches , sugar cane bagasse, coconut shell and there . rice husk from paddy is ne example f alternative material that has a great potential. Rice husk is the major by product f the rice milling industry that can be converted t different types fuels and chemical feed through a variety of thermo chemical processes. Rice husk is agricultural residue available in rice producing countries. The husk surrounds the paddy grain. During milling f paddy about 78% is received as rice broken rice and bran. Rest 22% weight of paddy is received as husk. This husk is used as fuel in the rice mill generate steam for the parboiling process.

Paper waste- paper is the material shaped by pressing together wet fiber of cellulose pup consequent from rags, wood and grasses and drying them into flexible sheet. It is versatile material with many use including writing, painting, packaging, cleaning and a number of industrial and construction processes.

Binders are defined as additives to the material being agglomerated that produce bonding strength in the final product. A binder can be a liquid or solid that forms a bridge, film or matrix filler or that causes a chemical reaction. Binders are substances that improve the mechanical strength of green ceramic bodies so they can pass through production steps, before firing, without breakage. In many cases, binder additions to bodies are essential (without them some production processes would be impossible). For instance, in the pressing of powders, adding organic binders makes possible a forming method that is independent of the plasticity).

Objective - The aim of the research work is to investigate the cost comparison of waste derived fuel with and without coal composition to pure coal as a fuel. Raw material used-starch binder**,** Preparation of binder- it is prepared with Luke worm water. Rice husk, paper waste, empty fruit bunches and coal.

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Process of Preparation Of Sample-

4.4 Procedure of Proximate Analysis- the proximate analysis is an experimental analysis which records moisture, volatile matter, ash and fixed carbon as percentage of the original weight of the fuel sample. The composition of solid fuel varies widely and hence it is necessary to analysis the solid fuel sample.

4.4.1. Determination of moisture content-

One gm.(1 gm) f air dried -212 mess size powder f the above said materials was taken in crucible and heated at a temperature f 105 +110.C foe one hour in air oven . after one hour the crucible were then taken out the oven and material were weight .the percentage loss in weight was calculated which give the % moisture contains in the soild fuel (SF)

% of moisture in SF = (Loss in weight of SFS /weight of SFS initially taken) x 100

4.4.2. Determination of volatile matter:

One gram of -212 mess size (air dried) powder of the above sample was taken in a volatile matter crucible. the crucible is covered from top with the help f silica lid .the crucible were placed in a muffle furnace maintain at the temp of 925+25·C and kept there for 7 minute .the volatile matter crucible were taken out from the furnace and cooled in air . The devolatized sample was weighted in an electronics balance and the % less in weight in each of the sample was calculated.

% volatile matter = (loss in weight of moisture free SFS / weight of moisture free SFS) x 100

4.4.3 Determine of ash content:

One gm (1 gm) of -212 mess size was taken in a crucible and kept in a muffle furnace maintained at the temp of 725+25c. The material was heated at this temp. For half hour .5 the weight of the residue was taken in an electronic balance.

% ash = (weight of residue ash formed / weight of SFS initially taken) x 100

4.4.4 Determine of fixed carbon:

Fixed carbon is determine by subtracting the sum of total f moisture , volatile matter and ash content from 100% age f fixed carbon thus the fixed carbon is

% = 100 – (moisture% + volatile + ash %)

4.4.5 Determination of calorific value

The calorific value of these sample (-212 mesh size) were measured by using an oxygen bomb calorimeter (BIS, 1970) 1gm of briquette sample was taken in a nicron crucible A 15 cm long cotton thread was placed over the sample in the crucible to facilitate in the ignition . Both the electrodes of the calorimeter were connected by a nicron fuse wire. Oxygen gas was in the bomb at a pressure of around 25 to 30 atm . The water (2 lit) taken in the bucket was continually starred to homogeneous the temp. The sample was ignited by switching n the current through the fussed wire and the rise in temperature f water was automatically recorded. The following formula was used to determine the energy value of the sample.

1. Weight of the solid fuel sample= m gm.
2. ;Gross calorific value of sample = GCV cal/gm
3. Weight of water taken calorimeter= w gm .
4. Water equivalent of the bomb calorimeter , thermometer = W gm
5. Initial temperature = t_1 degree .C
6. Final temperature = t_2 degree .C
7. Heat liberated by the combustion of fuel = m.GCV

   Since heat liberated = heat absorbed

   $m.GCV=(w+W) . (t_2 – t_1)$

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$$GCV = (w+W) \cdot (t_2 - t_1) / \mathbf{m}$$

3.2 RDF preparation - The briquette was produced using moulds with base plate. In RDF preparation we have made 25 samples. First 12 samples made with rice husk, paper waste and empty fruit bunches of different compositions. Another 13 samples were made from rice husk, paper waste; empty fruit bunches with coal of different composition. In sample no. S26, S27 and S28 were made from 100% pure rice husk, empty fruit bunches, paper waste respectively.

Table 3.1 composition of various samples without coal

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S.N.	Sample No.	Rice husk %	Paper waste%	Empty fruit bunches %
1	S-1	30	50	20
2	S-2	25	50	25
3	S-3	20	50	30
4	S-4	25	25	50
5	S-5	30	20	50
6	S-6	20	30	50
7	S-7	50	25	25
8	S-8	50	30	20
9	S-9	50	20	30
10	S-10	40	40	20
11	S-11	30	20	50
12	S-12	40	30	30

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Table 3.2 - composition of various samples with coal

SN	Sample	Coal %	Rice husk %	Paper waste%	Empty fruit bunches %
1	S-13	80	5	10	5
2	S-14	80	10	5	5
3	S-15	80	5	5	10
4	S-16	60	15	10	15
5	S-17	60	15	15	10
6	S-18	60	10	15	15
7	S-19	40	10	30	20
8	S-20	40	30	20	10
9	S-21	40	20	10	30
10	S-22	20	20	30	30
11	S-23	20	30	30	20
12	S-24	20	30	20	30
13	S-25	100	0	0	0
14	S26	0	100	0	0
15	S27	0	0	0	100
16	S28	0	0	100	0

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4 Result- The Proximate Analysis of 28 Samples (Wt %) And Calorific Value (Kcal/Kg).

SN	Sample	MC (wt%)	VMC (wt%)	AC (wt%)	Calorific Value(Kcal/Kg)
1	S1	8	17	21	3273.68
2	S2	7	15.65	22.3	3129.27
3	S3	8	18	24	3067.15
4	S4	7	15	13	2624
5	S5	7.81	16	19.37	2691.12
6	S6	8	18.65	19.2	2698.32
7	S7	9.23	11.538	20	2960.32
8	S8	7	19	13	2976.12
9	S9	8	32	51.2	2966.88
10	S10	7	8	14.2	3159.12
11	S11	7	13	18.13	2542.08
12	S12	8	15	21.5	3048.23
13	S13	7	15	19.5	2715.53
14	S14	8	18	15.9	2707.28
15	S15	7	11	11.7	2693.18
16	S16	3	16	9	2647.63
17	S17	7	11	8	2660.08
18	S18	8	21	28.3	2653.89
19	S19	7	17	13.6	2539.12
20	S20	2	5	4.9	2548.67
21	S21	8	19	13.9	2518.32
22	S22	8	16	15.6	3128.21
23	S23	7	12	9.9	3167.58
24	S24	10	14	22.8	3115.32
25	S25	4.38	17.95	47.84	3491.23
26	S26	8.80	59.20	26.20	3164.43
27	S27	9	24	19	3272.64
28	S28	7	21	20	3195.28

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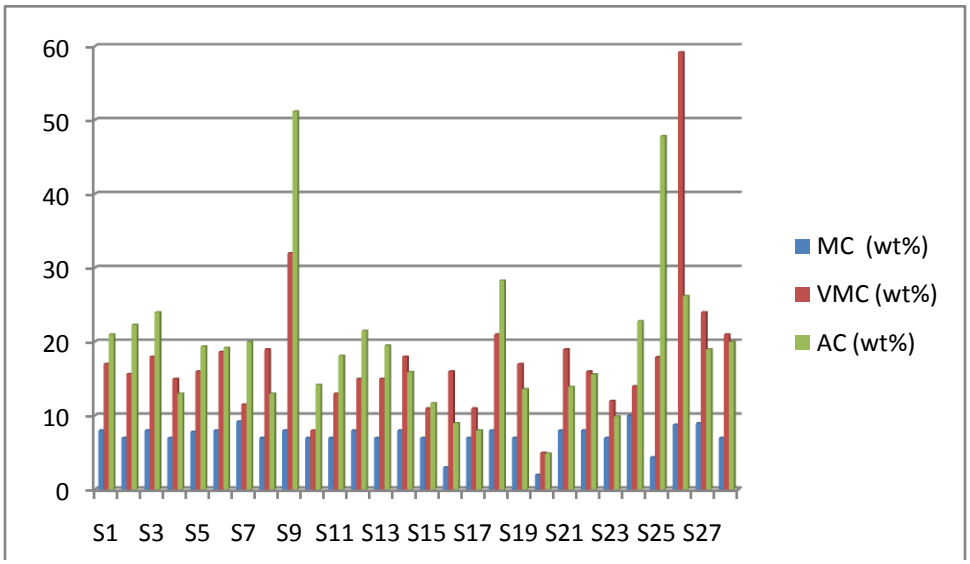

Fig- 1 proximate analysis of all samples

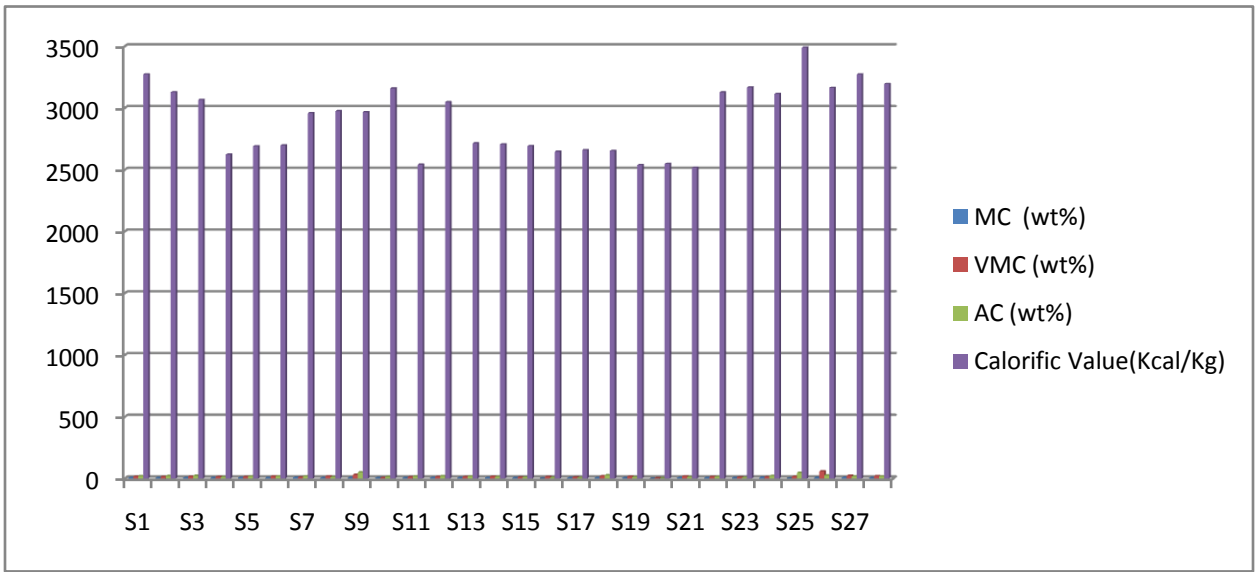

Fig-2 calorific value of all samples

5. Conclusion - Refuse derived fuel have drawn worldwide interest as an energy source because it does not negatively affect the environment.

The following conclusions may be drawn on the basis of the present study.

1. The calorific value of refuse derived fuel is near about same as solid fuel with coal which indicates that it can be used suitably in the range of 3000 – 3200 Kcal/kg.

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2. Solid fuel samples with 20% coal have calorific value 3100 – 3170 Kcal/kg. Shows that calorific value difference in comparison with solid fuel without coal is only marginal. It indicates that these samples also can be used suitably.

3. Refuse derived fuel shows the same proximate analysis result as solid fuel with coal for example sample S1, S2 , S3, S10 and S12 .

4. Among the entire sample shows the same moisture content value. Sample S2, S8 have highest volatile matter content value and sample S20, S10 have the lowest volatile matter content.

5. Sample S9 shows the highest ash content which has % composition of 50% rice husk, 20% paper waste and 30% empty fruit bunches and lowest ash content sample is sample S17 which has 60% coal, 15% rice husk , 15% paper waste and 10% empty fruit bunches.

6. Energy values of sample S1 has (solid fuel without coal composition which have 30% rice husk, 50% paper waste and 20% empty fruit bunches) highest value i.e. is 3273.68 Kcal/kg. And sample S11 has (solid fuel without coal composition which has 30% rice husk, 20% paper waste and 50% empty fruit bunches) lowest energy value i.e. 2542 Kcal/kg.

7. Energy value of S24 has (solid fuel with coal composition which has 20% coal, 30% rice husk, 20% paper waste and 30% empty fruit bunches) highest value i.e 3114.32 Kcal/kg. And. Energy value of S21 has (solid fuel with coal composition which has 40% coal, 20% rice husk, 10% paper waste and 30% empty fruit bunches) lowest value i.e 2518.32 Kcal/kg .

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