

A REVIEW PAPER ON ANALYSIS OF CALORIFIC VALUE OF ALTERNATE SOLID FUEL

S.NAKKEERAN¹, J.GILL JEFERIN², RB.MOHAN KUMAAR³, R.DHARUN SHIVA⁴

Abstract: a solid fuel varies widely in composition and properties and they are used in different conditions. Their characteristics are determined by various kinds of analytical and testing data which are of scientific, technical and commercial interest. Ultimate and proximate analysis of solid fuels is to be done and the calorific value is to be compared to find the best alternative solid fuel.

Keywords: Calorific value, Solid yield, Bomb calorimeter.

INTRODUCTION

Fuel can be a substance that, when burned, returns to its current state and produces heat when interacting with atomic number 8 or air. Thus, substances classified as fuel must contain essentially one or more combustible components, that is, carbon, hydrogen, sulfur, etc. In the framework of burning methods, the fuel energy is restored to the energy that. To use the energy of the fuel in the most useful form, it is necessary to convert the fuel from one state to another, that is, from a solid state to a liquid or vapor state, from a liquid state to a vapor state or by means of a single energy, you have to play it. Or a few stages. With this approach, the energy of the fuel will be used more efficiently and effectively for many functions. Woody biomass includes a mixture of structural elements (hemicellulose, polyose, and lignin).

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As the reaction proceeds, carbon becomes difficult to react, forming a stable chemical structure, and as a result, the biomass conversion rate increases, which is believed to increase the activation energy.

BOMB CALORIMETER:

A bomb calorimeter is a constant-volume calorimeter used in measuring the heat of combustion of a

particular reaction, the combustion of a reaction in Bomb calorimeters is taken place at a high pressure so the calorimeter should withstand this pressure so the calorimeter is made of steel. The energy used to ignite the fuel is electrical energy the electrical energy is continuously supplied by employing electrodes; as the fuel is burning, it will heat up the surrounding air, which expands and escapes through a tube that leads the air out of the calorimeter. When the air is escaping through the copper tube it will also heat up the water outside the tube. The change in temperature of the water allows for calculating calorie content of the fuel.



Fig: 1 Bomb Calorimeter

CALORIFIC VALUE:

The hot worth will be the quantity of thermal energy free or physical property of fuel once one unit of measurement or one unit volume of fuel is totally burned at 100% combustion underneath commonplace in operating conditions. Once the organic compound burns fully within the presence of oxygen to create dioxide, heat, and water, the thermal energy dissipates.

FORMULA:

GROSS CALORIFIC VALUE

$$(GCV) = 339 \times \%C + 1427(\%H - \%O/8) + 22 \times \%S$$

SOLID FUELS:

Soil fuels varies widely in composition and properties and they are used in different conditions. Solid fuels



characteristics are determined by various kinds of analytical and testing data, which are of scientific, technical and commercial interest. Following are the definitions of some solid fuels characterization and analysis.

Advantages of solid fuels:

- (A) Its simple to move.
- (B) There is no danger of ignition, and it's convenient to store.
- (C) Producing value is low.
- (D) They need a moderate flash purpose.

Disadvantages of solid fuels:

- (A) There's loads of ash.
- (B) Most of the warmth is lost.
- (C) They type clinker and burn.
- (D) Their combustion operation cannot be simply controlled.
- (E) The value of the process is high.

ASH CONTENT

Ash in solid fuel, which is the remains when solid fuel is burnt, is one of the materials of interest. Ash is derived from the mineral matter content of solid fuel. The inorganic materials which were actually the part of the plant structures, constitute the 'inherent' mineral matter of solid fuel, whereas, the 'extraneous' mineral matter is that which was introduced probably as air-borne dusts or waterborne silts at the later stage of solidification. Mineral matter of coal predominantly consists of kaolinite, pyrite and calcite and upon combustion; These oxides are the essential part of ash. When solid fuels burns, shales and other hydrated materials, which are also the constituents of mineral matter of solid fuels, decompose and lose their water hydration and also emit carbon dioxide, sulphur dioxide gases. As there is a loss in weight, so, amount of ash of solid fuel is always less than its mineral matter content.

MOISTURE CONTENT:

Moisture of solid fuel may also become inherent or extraneous. Inherent moisture is the moisture associated with coal inherently, which cannot be removed by only air drying, it can be removed when coal is heated above 1000C. Extraneous moisture can be removed by air drying of solid fuels.

VOLATILE MATTER

Volatile matter is the volatile part of Solid fuel when coal undergoes thermal decomposition. The volatile part of organic mass of solid fuel is the main constituent of it. The moisture content of solid fuel is not included in it. But volatile matter of may contain water, when hydrogen and oxygen of solid fuel produce water at high temperature of decomposition. The water of hydration, which is liberated

during decomposition, is also a part of volatile matter. It is observed that, as the maturity of solid fuel increases, volatile matter decreases. Fixed carbon is the non volatile part of organic mass after decomposition. Ash is not included in it. Fixed carbon should not be confused with the total carbon of solid fuel.

PROPERTIES OF CASHEW NUT SHELL :(SAMPLE – A)

The experiments for the determination of varied engineering properties of a co-1 style of soybean. The hardness and angle of repose at 7.5 nothing (wb) wet



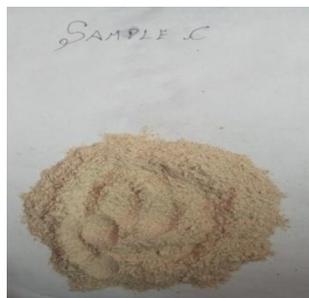
content found to be 8.1 metric weight unit and 2.500 severally. the utmost worth of static constant of friction was found to be with plywood surface and also the minimum worth

with glass surface among the assorted surfaces tested. The porousness, bulk, and true densities were found to be shriveled with the rise of wet content. With the rise of wet content, the thermal physical phenomenon inflated. a number of the physical properties of castor nut namely: form, size, extent, the angle of repose, the static constant of friction and also the behavior of the nut underneath compressive loading. The results of the investigation show that the statistical distribution of the dimensions, form and call space for haywire of every selection follows a traditional distribution curve. The angle of repose of the nut ranges between 25 and 29 .3. Castor nut had the very best worth of angle of repose.

PROPERTIES OF COCONUT PITH: SAMPLE -B



Coconut plays an important role in the agricultural land economy of India. Coconut is known to be a rich source of raw materials for various products. His nuts are the center of the oil, the most versatile, widely used for food and industrial use. Coconut shell is the raw material of the coconut industry. Coconut oil is widely used in the manufacture of industrial products such as soap, hair oil, cosmetics. Shell is the source of fiber that supports the important coconut tree industry. Delicate walnut delivers popular thirsty quencher and coconut water for health and nutritional value. The coconut seeds are peeled off 2 to 3 inches (5 to 8 cm) from the outer shell of the leather and the middle layer of the pulp. The fiber extracted from this pulp is called coir. Fibers range from sturdy yarns suitable for bristle bristles to yarns that can be spun into coarse durable and durable spun yarns. India produces about 3,099 tons of coir per year.



Gender is a potential material that is suitable for value added. There are many uses of rice husk in raw and ash form. Most of the flour shell is burned or thrown away as waste in an open field, and a small amount is used as a filler for composting a boiler, generating electricity, and fertilizing animals. The tooth-like rectangular element consists of a thick cuticle and silica, covered with surface bristles. It was confirmed that the presence of amorphous silica was not concentrated on the surface of the rice husk, but concentrated on the surface of the rice husk since the central region and the inner epidermis almost did not contain silica.

PROPERTIES OF RICE HUSK:
(SAMPLE – C)

TEST REPORT

Sample- A: CASHEW NUT SHELLS Sample- D: PITH75%+HUSK25%

S.No	Test Parameters	Protocols	Results
01	Gross Calorific Value	By Bomb Calorimeter	4729 cal/gm

For Chennai Mettlex Lab Private Limited
Dr. D. SATHIYA NARAYANAN
Quality Manager

S.No	Test Parameters	Protocols	Results
01	Gross Calorific Value	By Bomb Calorimeter	3690 cal/gm

For Chennai Mettlex Lab Private Limited
Dr. D. SATHIYA NARAYANAN
Quality Manager

Sample- B: COCONUT PITHS Sample- E: PITH50%+HUSK50%

S.No	Test Parameters	Protocols	Results
01	Gross Calorific Value	By Bomb Calorimeter	3642 cal/gm

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Quality Manager

S.No	Test Parameters	Protocols	Results
01	Gross Calorific Value	By Bomb Calorimeter	3569 cal/gm

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Dr. D. SATHIYA NARAYANAN
Quality Manager

Sample- C: RICE HUSK

Sample- F: PITH25%+HUSK75%



TEST REPORT Page No. 1of

ISSUED TO : Mr. Gill Jefrin. J, Dharun Shiva. R, Mohan Kumar. R.B, T.C Date : 22.10.2018
 Bharath Institute of Higher Education & Research, 173, Agharam Road, Selayur, Chennai – 600 073. T.C No : CML/18-19/47411
 Date Of Receipt : 15.10.2018
 Cust. Ref : SRF Dated: 15.10.18 Commenced On : 15.10.2018
 Lab No : 1951961 Completed On : 22.10.2018
 Sample Description : Paddy Husk.

S.No	Test Parameters	Protocols	Results
01	Gross Calorific Value	By Bomb Calorimeter	3328 cal/gm

End of Report
 For Chennai Mettlex Lab Private Limited
 Dr. D. SATHIYA NARAYANAN
 Quality Manager

TEST REPORT Page No. 1of

ISSUED TO : Mr. Gill Jefrin. J, Dharun Shiva. R, Mohan Kumar. R.B, T.C Date : 31.10.2018
 Bharath Institute of Higher Education & Research, 173, Agharam Road, Selayur, Chennai – 600 073. T.C No : CML/18-19/49467
 Date Of Receipt : 24.10.2018
 Cust. Ref : SRF Dated: 24.10.18 Commenced On : 24.10.2018
 Lab No : 1951963 Completed On : 31.10.2018
 Sample Description : Coconut Shell 25% + Rice Husk 75%.

S.No	Test Parameters	Protocols	Results
01	Gross Calorific Value	By Bomb Calorimeter	3376 cal/gm

End of Report
 For Chennai Mettlex Lab Private Limited
 Dr. D. SATHIYA NARAYANAN
 Quality Manager

TABLE:1

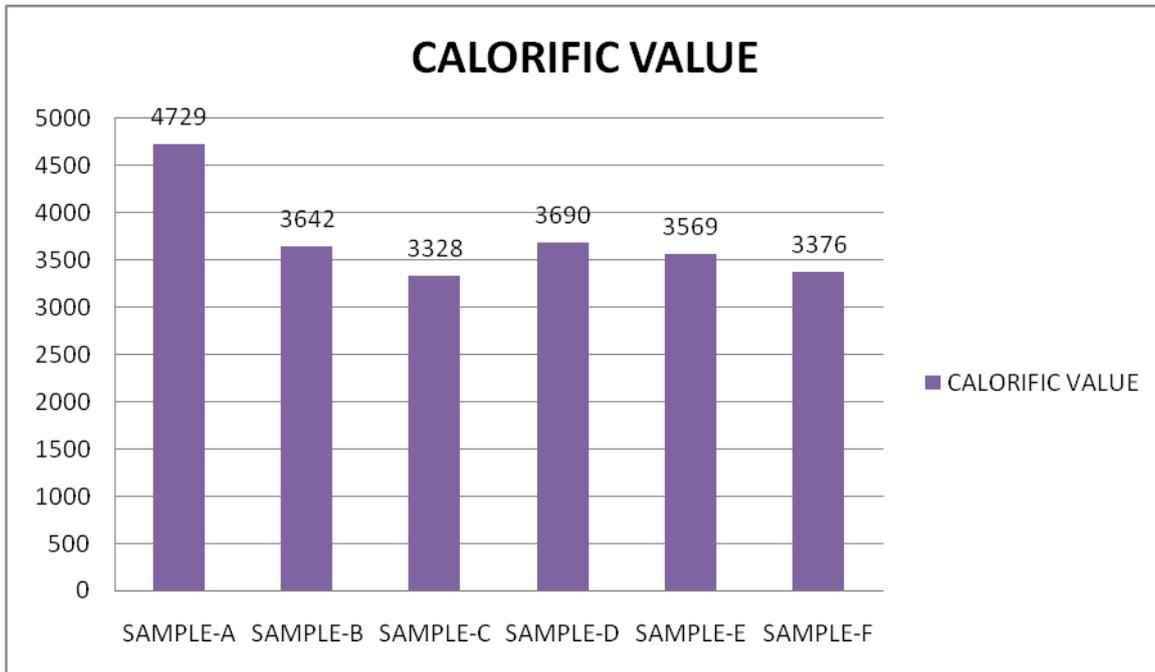
SI. NO	SAMPLES	TEST PARAMETER	PROTOCOLS	STD.VALUE	TEST RESULT
1	SAMPLE-A (CASHEW NUT SHELL)	Gross calorific value	Bomb Calorimeter	4890cal/gm	4729cal/gm
2	SAMPLE – B (COCONUT PITH)	Gross calorific value	Bomb Calorimeter	3500cal/gm	3642cal/gm
3	SAMPLE – C (RICE HUSK)	Gross calorific value	Bomb Calorimeter	3040cal/gm	3328cal/gm
4	SAMPLE – D (PITH75%+HUSK25%)	Gross calorific value	Bomb Calorimeter	-	3690cal/gm
5	SAMPLE – E (PITH50%+HUSK50%)	Gross calorific value	Bomb Calorimeter	-	3569cal/gm
6	SAMPLE – F (PITH25%+HUSK75%)	Gross calorific value	Bomb Calorimeter	-	3376cal/gm

Difference in Value

SI.NO	SAMPLES	STANDARD – RESULT
1.	SAMPLE - A	161 cal/gm
2.	SAMPLE - B	-142 cal/gm
3.	SAMPLE - C	-288 cal/gm

Bar Chart: Calorific value of different sample





Review

Briquettes mixed with coconut coir dust with rice husk at a ratio of 1: 1 and 1: 2 proved to be superior in all aspects including density, damage index, water permeability, consolidation degree, and economic analysis and so on. These rice hulls and coconut marrow were adopted as experiments of 75%: 25%, 50%: 50%, 25%: 75%. At this ratio, a higher calorific value is obtained from 3690 cal / g of sample D (coconut core 75% + rice hull 25%), and the total calorific value of sample A (cashew) is about 4729 cal / g.

CONCLUSION

Cashew Nut Shell has the higher calorific value when compared to others solid fuels we have taken. Rust husk and rice straw were found to be cash-rich. In addition, oxides are the main part of rice husk ashes. With such high ash and oxide content in the ash, it is economically

advantageous to extract the oxide from the ash, which includes a wide market. The reactivity of the edible nutshell is a chemical change with a reactant, ie a mixture of dioxide, water vapor, and hence carbon dioxide. Briquettes made from coconut fiber mud mixed with rice husk at a ratio of 1: 1 to 1: 2 were found on all of the above-mentioned surface-like density, damage index, moisture penetration, degree of concrete formation and economic analysis It was done. These rice husk and coconut pith are taken as an experiment for 75% : 25% , 50%:50% , 25%:75% . on according to this ratio the higher calorific values are obtained from Sample D (Coconut Pith 75% +Rice husk 25%) 3690cal/gm . By calculating the overall samples Sample A(Cashew Nut Shell) has the higher calorific value of about 4729 cal/gm.

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