Research Inventy: International Journal of Engineering And Science
Vol.7, Issue 4 (April 2017), PP -07-10
Issn (e): 2278-4721, Issn (p):2319-6483, www.researchinventy.com

Comparison of Calorific Values of Various Fuels from Different Fuel Stations

Dr. A. Rajesh Kanna[1, #], Akhil Chandran[2], Anandu S Nair[2], Arun R[2], Jeffrey Jones Benedict[2]

[1]Professor & Head, Department of Petroleum Engineering, Lords Institute of Engineering and Technology, Hyderabad, India.
[2] Undergraduate students, Department of Petroleum Engineering, Lords Institute of Engineering and Technology, Hyderabad, India.
[#]corresponding author email: rajeshkanna@lords.ac.in

ABSTRACT: *Current research takes in to account of calorific value of various fuel (Diesel) available in the state of Telangana (India). The purpose of this experiment is to determine the heat of combustion for diesel and to learn basic bomb procedures. This experiment will be accomplished by using an adiabatic bomb calorimeter. The fuel sold by different company show different calorific value; by finding out the change in the calorific we can find out the high quality fuel available in the market. This research had covered the importance of calorific value of different fuel (diesel) with the help of a case study from Lords Institute of Engineering & Technology.*
Keywords: *adulteration, crucible, calorimeter, guinea pigs.*

I. INTRODUCTION

The main aim of the project is to calculate the calorific value of different fuel (diesel) available at different pumps owned by different companies, by calculating the calorific value we can understand the adulteration by comparing the different values and will also get an idea about the best fuel available in the market.
The calorific value of any fuel in solid or liquid state can be calculated with the help of Bomb Calorimeter, by using a simple formula;
(m1+m2)*(TC+T1-T2)*CW/mf
Where;
m1 and m2 => mass of water and equivalent mass of bomb
T1,T2 are initial and final temperature. mf mass of fuel sample.
TC radiation losses

1.1 *CALORIMETER*:

A calorimeter is an object used for the process of measuring the heat generated during chemical reactions or during combustion of fuel. Different types of calorimeter are there in use some of them are scanning calorimeter, isothermal micro-calorimeter, titration calorimeter, and accelerated rate calorimeters. A calorimeter is just a simple equipment consists of a thermometer attached to container full of water (distilled water) suspended above a combustion chamber.

1.1.1 HISTORY

The calorimeter was first used in 1780 by Antoine Lavoisier;[1] he used a pig (guinea pig) to do the experiment of measuring heat produced in his experiment the heat from guinea pig's melted down snow surrounding the calorimeter which showing respiratory gas exchange is combustion, the process was similar to that of burning a candle. [2]

1.2 *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

In more recent calorimeter designs, the whole bomb, pressurized with excess pure oxygen (30atm) and containing a weighed mass of a sample (1.5-2 g) and a small fixed amount of water is submerged under a known volume of water (ca. 2000g) before the charge is electrically ignited. The bomb, with the known mass of the sample and oxygen, form a closed system - no gases escape during the reaction. The weighed reactant put inside the steel container is then ignited. Energy is released by the combustion and heat flow from this crosses the stainless steel wall, thus raising the temperature of the steel bomb, its contents, and the surrounding water jacket. The temperature change in the water is then accurately measured with a thermometer. This reading, along with a bomb factor, is used to calculate the energy given out by the sample burn. A small correction is made to account for the electrical energy input, the burning fuse, and acid production. After the temperature rise has been measured, the excess pressure in the bomb is released. [3][4]

1.3 *NICHROME WIRE:*

Nichrome is generally refers to any alloy of nickel, chromium and often iron and other element or substances. Nichrome alloys are typically used in resistance wire. They are also used in some dental restoration/ fillings and other applications. Nichrome is an alloy of 80% nickel and 20% chromium, by mass. It is silvery-grey in colour, is corrosion-resistant, and has a high melting point of about 1,400 °C (2,550 °F). Due to its resistance to oxidation and stability at high temperatures, it is widely used in electric heating elements, such as in appliances and tools. Typically, nichrome is wound in coils to a certain electrical resistance, and current is passed through it to produce heat

1.3.1 *USES*

Nichrome is used in a very wide variety of devices where electric heating is required. Almost any conductive wire can be used for heating, but most metals will be rapidly oxidized when heated in air. When heated to red hot temperatures, nichrome wire develops an outer layer of chromium oxide [1] thermodynamically stable in air, mostly impervious to oxygen, and protects the heating element from further oxidation.

Nichrome is used in the explosives and fireworks industry as a bridgewire in electric ignition systems, such as electric matches and model rocket igniters. Industrial and hobby hot-wire foam cutters use nichrome wire. Nichrome wire is commonly used in ceramic as an internal support structure to help some elements of clay sculptures hold their shape while they are still soft. Nichrome wire is used for its ability to withstand the high temperatures that occur when clay work is fired in a kiln. Nichrome wire can be used as an alternative to platinum wire for flame testing by colouring the non-luminous part of a flame to detect cations such as sodium, potassium, copper, calcium etc. Other areas of usage include motorcycle mufflers, in certain areas in the microbiological lab apparatus, as the heating element of plastic extruders by the RepRap 3D printing community, in the solar panel deployment mechanism of spacecraft LightSail-A, as the heating coils of electronic cigarettes. The alloy price is controlled by the relatively more-expensive nickel content. Distributor pricing is typically indexed to market prices for nickel.

II. EQUIPMENT DESCRIPTION

- *Bomb calorimeter*: made of stainless used to calculate calorific value.
- *Oxygen inlet valve*: the bomb is charged with oxygen which will carry the combustion. And also provide the pressure necessary (30atm).
- *Thermometer*: used calculate the change in temperature (T1&T2).
- *Water bath*: the bomb is surrounded by a pack of water which is used to identify the change in temperature with the help of thermometer.

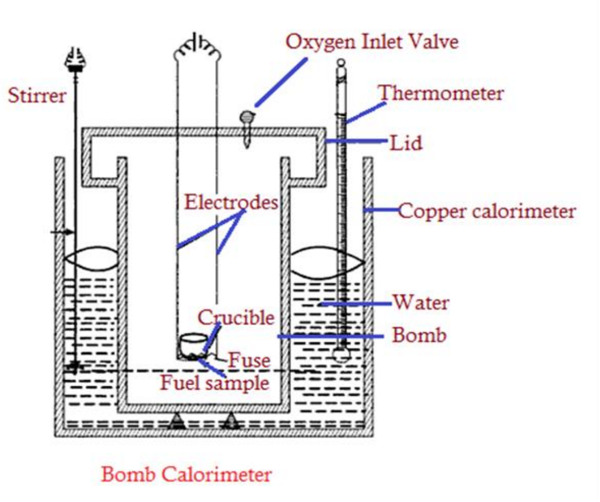

Fig.2 Bomb Calorimeter Set up

- *Crucible*: it is use to collect samples inside the bomb. The crucible has the capacity of 2 g , it also has a fuse of nichrome .
- *Electrodes*: it used to ignite the fuel sample with the help of nichrome wire.

III. PROCEDURE

Fill the crucible with fuel (~=2g), and insert in to the bomb. Connect the fuse with nichrome wire and fill the bomb with oxygen and place it inside the jacket. Fill the jacket with 2000ml of water, and assemble the calorimeter and run the motor for five minutes ignite the bomb at the sixth minute. Measure the temperature every minute using a thermometer until a constant temperature reached. Note down the values. Repeat the steps for all four samples. Calculate the calorific value of samples using the formula
(m1+m2)*(TC+T1-T2)*CW/mf
m1 and m2 => mass of water and equivalent mass of bomb
T1,T2 are initial and final temperature. mf mass of fuel sample.
TC radiation losses .

IV. OBSERVATION

Table.1 Bomb Calorimeter Readings

Samples	m_1	m_2	T_2	T_1	T_C	C_W	mf
Sample 1	2000g	755g	29.7°C	26°C	0.5°C	1	2g
Sample 2	2000g	755g	30.1°C	26°C	0.5°C	1	2g
Sample 3	2000g	755g	31.5°C	26°C	0.5°C	1	2g
Sample 4	2000g	755g	31.8°C	26°C	0.5°C	1	2g

V. CALCULATIONS

Sample 1 = 5510 cal/g
Sample 2 = 5785.5 cal/g
Sample 3 = 7336.5 cal/g
Sample 4 = 8678.25cal/g

VI. RESULTS

From the data collected it is calculated that the calorific values are:
Sample 1 = 5510 cal/g
Sample 2 = 5785.5 cal/g
Sample 3 = 7336.5 cal/g
Sample 4 = 8678.25cal/g

VII. CONCLUSION

It is found out that from conducted experiment with various samples the following conclusion had been arrived.
Sample 4 > Sample 3 > Sample 1 >Sample 2 also, the adulteration in the Sample 4 diesel is less.

REFERENCES

[1]. Antoine Laurent Lavoisier. (1789). Elements of Chemistry: In a New Systematic Order; Containing All the Modern Discoveries. 12, 178 – 186.
[2]. Buchholz, Andrea C; Schoeller, Dale A. (2004). "Is a Calorie a Calorie?" American Journal of Clinical Nutrition. 79 (5): 899S–906S. PMID 15113737. Retrieved 2007-03-12.
[3]. Polik, W. (1997). Bomb Calorimetery. Retrieved from http://www.chem.hope.edu/~polik/Chem 345-2000/bombcalorimetry.htm
[4]. Bozzelli, J. (2010). Heat of Combustion via Calorimetry: Detailed Procedures. Chem 339-Physical Chemistry Lab for Chemical Engineers –Lab Manual.