**1. Calculate the higher heating value using equation 2 and ΔTmeasured.**

Starting with Equation 2 from Dr. Kassegne’s ME 495 Experiment 2 Bomb Calorimeter [1], we need to isolate by using the given heating value of the benzoic acid pellet, . We do this to use a corrected value for the mass of the water in order to solve for the higher heating value for diesel, .

Solving for ,

Now that has been isolated we can plug in the values of the recorded data located in Tab. 1 below.

Table 1: Recorded and calculated values for Bomb Calorimeter Experiment for the benzoic acid pellet run.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Variable** | **Value** | **Units** |
| Mass of Acid Pellet |  | 0.988 | *g* |
| Difference of mass of wire before and after experiment |  | 0.0032 | *g* |
| Heating Value of benzoic acid pellet |  | 26430 |  |
| Heating Value of fuse wire |  | 5857.60 |  |
| Specific heating value of water |  | 4.186 |  |
| Temperature change | Δ | 2.62 | °C |

Plugging in the values from Tab.1, we can now calculate ,

Now that we have the value for we can now calculate by using equation 2 from the lab manual [1].

Now that we have the equation for we can use the data recorded from the diesel run of the experiment which is tabulated in Tab.2 below.

Table 2: Recorded and calculated values for Bomb Calorimeter Experiment for the diesel fuel run.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Variable** | **Value** | **Units** |
| Mass of diesel fuel |  | 0.794 | *g* |
| Difference of mass of wire before and after experiment |  | 0.0099 | *g* |
| Corrected mass of water |  | 2382.68 |  |
| Specific heating value of water |  | 4.186 |  |
| Temperature change | Δ | 3.60 | °C |
| Heating value of fuse wire |  | 5857.60 |  |

**2. Calculate a percent error verses the theoretical value of 46,446kJ/kg for diesel fuel.**

Comparing the calculated value of the higher heating value of the diesel fuel with the theoretical value via the equation for percent error yields,

Questions

**1. What is m\* and how is it different from mwater?**

In the bomb calorimeter experiment, we use to define a quantity in which all the necessary components which have absorbed heat in the system due to combustion are taken into account. The heat absorption in the system takes into account the heat absorbed by the cup for holding the fuel, the steel bomb, and other parts of the system that were heated during the combustion process. This differs from the measurable value for the mass of water,, which was measured to 2000 *g* because it takes into account the various components which absorbed heat during combustion which is why the value of is larger than the measured 2000 *g* put into the system which assumes the other components in the system do not absorb heat.

**2. Compare the theoretical and actual heating values for diesel fuel.**

From the calculated data in the Experimental Results section, we used the known heating value of the benzoic acid pellet in order to calculate for the system. This let us determine how much heat was absorbed from the components of the system and use a corrected value for the mass of water to account for heat absorption while calculating the heating value of the diesel fuel. From this process we calculated a heating value of 45, 148.7 compared to the theoretical value of 46,466 given by Dr. Kassegne in the lab manual [1]. Using the percent error equation yielded an error of 2.79%. This error is small and is probably due to human error, such as temperature recording or weighing the components of the system before and after each run. There is also the possibility of data error discussed in question 3.

**3. Is there any other possible explanation for a different HHV besides experimental error?**

In order for us to determine the most accurate higher heating value (HHV) we need to know what source the theoretical heating value came from. Due to the vast resources available on the internet it is possible for data to become corrupted or vary depending on the source used. We also do not know the type or age of the diesel fuel contained in the container used, which may be a different quality than that of the theoretical HHV given.

[1] Kassegne, S. “ME495 Lab – Bomb Calorimeter– Lab Number 2." Mechanical Engineering

Department.San Diego State University.Fall 2011.