Thermodynamics of Food IA

When organisms consume food, their bodies convert the stored energy, known as Calories, to chemical energy, thereby allowing them to do work. A calorie is the amount of heat (energy) required to raise the temperature of 1 gram (g) of water 1 degree Celsius (°C).

You can determine energy content of food by burning a portion of it and capturing the heat released to a known amount of water. This technique is called calorimetry. The energy content of the food is the amount of heat produced by the combustion of 1 gram of a substance.

So multiplying the rise in temperature of water by the mass of the water and then by 4.2 gives the number of joules of energy that were transferred to the water.

Energy (J/g) = (final temperature – start temperature) x mass of water (g) x 4.2 (J per oC)

(Mass of food burned (g)

You are given the method for this IA. Your task is to complete the method using two different foods, then complete the following for your assessment:

* Aim
* Hypothesis
* Variables
* Data Collection and Processing
* Discussion, Evaluation and Conclusion

Method

1. Calculate the mass of the weigh boat. Record your results.
2. Determine the weight of the bread to the nearest 0.01 grams Record your data. (Resist eating any bread; they have to last through the lab….and there’s no eating in lab.)
3. Using the graduated cylinder, measure out 25 ml of distilled water and pour into boiling tube. (1g of water = 1cm3)
4. Measure the initial temperature of the water to the nearest 0.1 degree (Ti). Record your data.
5. Attach boiling tube to ring stand clamp. Adjust the tube so it is at a 45 degree angle.
6. Carefully pick up the bread with your tongs. Using the Bunsen burner, light the food.
7. Once lit, put the food under the boiling tube over the flame to where the bottom of the tube touches the flame.
8. Allow the bread to burn until it goes out. If possible try to keep an eye on it and if it goes out quickly (less than a minute), relight
9. Once the bread has finished burning, carefully stir the water and then measure the temperature (Tf). You may have to leave the thermometer in the water for a while in order to get the highest reading. When the temperature begins to decrease record your data.
10. After the burnt bread has cooled, transfer it to the original weigh-boat (use the forceps if necessary) and weigh the remnants (wf). Record your data.
11. A calorie is the quantity of heat required to raise 1gram (1cm3) of water by 1°C. Calculate how many calories were released in the heating process by dividing the temperature change into the exact mass of water (in grams). Record your data.
12. Test 4 more pieces of bread
13. Repeat Steps 2 – 12 with the crisp. Be sure to use new water.

Safety considerations:

1. Be cautious when light the chips. They are full of oil and combust very quickly.
2. Be cautious when hold food stuff with metal tongs as they can get hot quickly.
3. Point the boiling away from any person
4. Do not handle any hot objects
5. Wear safety goggles

Task: For this investigation, you will complete the following:

* Aim
* Hypothesis
* Variables
* Results, analysis and conclusions
* Discussion and Evaluation