ENVIRONMENTAL SYSTEMS

COLÉGIO PLANALTO

Calculating the energy released by a dried fruit

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BACKGROUND

Which is the quantity of energy released from the combustion of dry fruits?

First for making this experience possible there are a few materials that we must have and also there is a method. But as this is already described in the procedure I won't take that into account .

We have several variables, the dependent and independent in which:

Dependent: humidity, mass, Tº of the water.

Independent: Tº of the bean (I'll combust the seed)

What I am expecting from this experience?

Well from the beginning I'm not expecting anything because my knowledge cannot afford to make assumptions of that kind, so the only thing that I can mention that will happen is that we have a fried seeds and a burned boiling tube.

DATA COLLECTION

Group 1

1ml H2O=1cm3=1gH2O	butter bean	bean-caper	brown bean	almond	grain
Tº of the water start (ºC)	21,000	21,000	21,000	21,000	21,000
higher tº (ºC)	26,000	27,000	23,500	85,000	39,000
weight of the dry fruit (g)	0,524	0,196	0,447	1,339	0,611

Group 2

1ml H2O=1cm3=1gH2O	Butter bean	bean-caper	brown bean	almond	grain
Tº of the water start (ºC)	21,5	21,5	21,5	21,5	21,5
higher tº (ºC)	33	28	25	86	27
weight of the dry fruit (g)	0,472	0,179	0,679	1	0,702

Group 3

1ml H2O=1cm3=1gH2O	butter bean	bean-caper	brown bean	almond	grain
Tº of the water start (ºC)	21	21	21	21	21
higher tº (ºC)	25	30	27	77	34
weight of the dry fruit (g)	0,557	0,283	0,558	1,254	0,564

Group 4

1ml H2O=1cm3=1gH2O	butter bean	bean-caper	brown bean	almond	grain
Tº of the water start (ºC)	20,5	20,5	20,5	20,5	20,5
higher tº (ºC)	27	29	33	95,5	39,5
weight of the dry fruit(g)	0,53	0,18	0,53	1,5	0,57

Group 5

1ml H2O=1cm3=1gH2O	butter bean	bean-caper	brown bean	almond	grain
Tº of the water start (ºC)	21,5	21,5	21,5	21,5	21,5
Higher tº (ºC)	26	26,5	29	95	34
weight of the dry fruit (g)	0,833	0,219	0,655	1,58	0,56

DATA PROCESSING AND PRESENTATION

Now as we have the raw data we are going, as mentioned in the title to calculate, how much energy has been released by the combustion of a seed of a dry fruit. There are three elements that we know, the Tº, the highest Tº and the weight of the dry fruits; with this data we are going to know and calculate how many kilojoules have been released. For that I'll use two formulas in one it will calculated the heat produced by the whole fruit and the other is how much Kj have been released in only one gram of dry fruit. The formulas are:

$\frac{20g \times DºC \times 4.2kj}{1000}$ for the whole fruit and $\frac{20g \times DºC \times 4.2kj}{1000 \times x}$ for only 1 gram of the dried fruit and in which x is the weight of the dry fruit. Here we can see the tables of the different groups:

Group 1

1ml H2O=1cm3=1gH2O	butter bean (1)	bean-caper (2)	brown bean (3)	almond (4)	grain (5)
t change of water	5,000	6,000	2,500	64,000	18,000
heat produced by whole nute	0,42	0,504	0,21	5,376	1,512
heat produced by 1gram of peanut	0,802	2,571	0,470	4,015	2,475

Group 2

1ml H2O=1cm3=1gH2O	butter bean (1)	bean-caper (2)	brown bean (3)	almond (4)	grain (5)
t change of water	11,5	6,5	3,5	64,5	5,5
heaat produced by whole nute	0,966	0,546	0,294	5,418	0,462
heaat produced by 1gram of peanut	2,047	3,050	0,433	4,679	0,658

Group 3

1ml H2O=1cm3=1gH2O	butter bean (1)	bean-caper (2)	brown bean (3)	almond (4)	grain (5)
t change of water	4	9	6	56	13
heaat produced by whole nute	0,336	0,756	0,504	4,704	1,092
heaat produced by 1gram of peanut	0,603	2,671	0,903	3,751	1,936

Group 4

1ml H2O=1cm3=1gH2O	butter bean	bean-caper	brown bean	almond	grain
t change of water	6,5	8,5	12,5	75	19
heat produced by whole dried fruit (kj)	0,546	0,714	1,05	6,3	1,596
heat produced by 1gram of the dried fruit	1,030	3,967	1,981	4,200	2,800

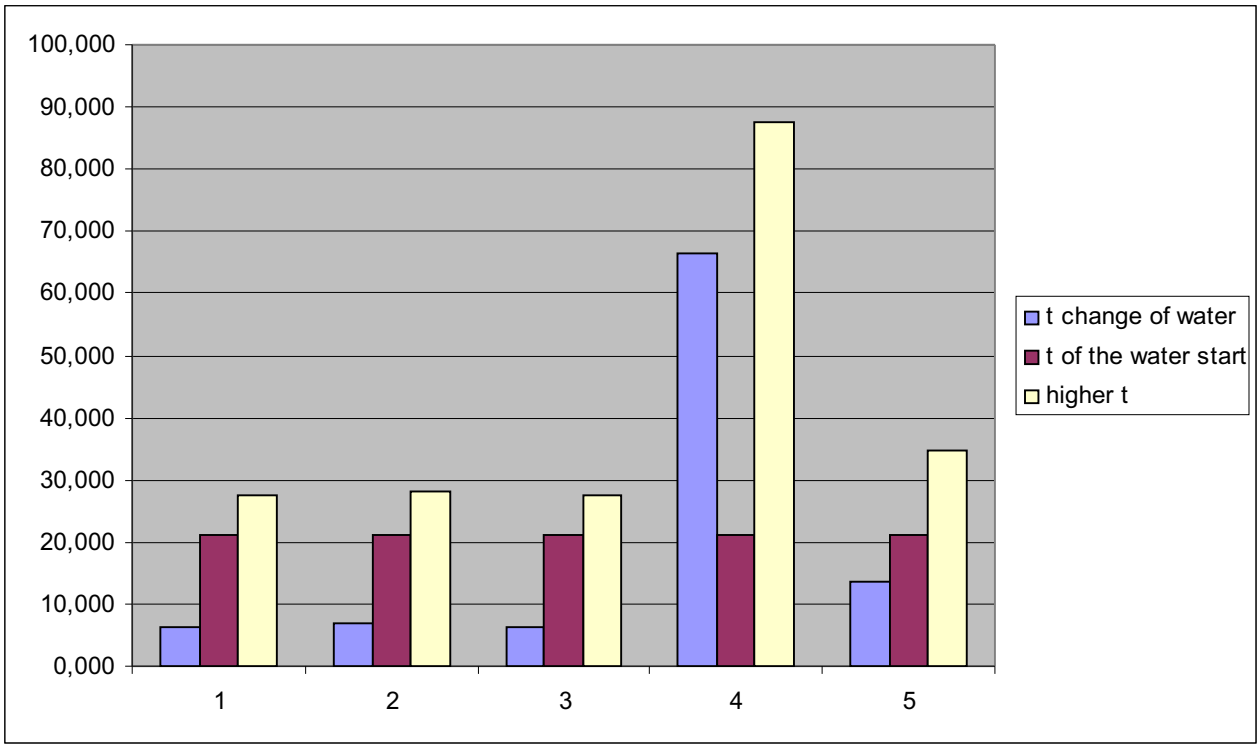
Group 5

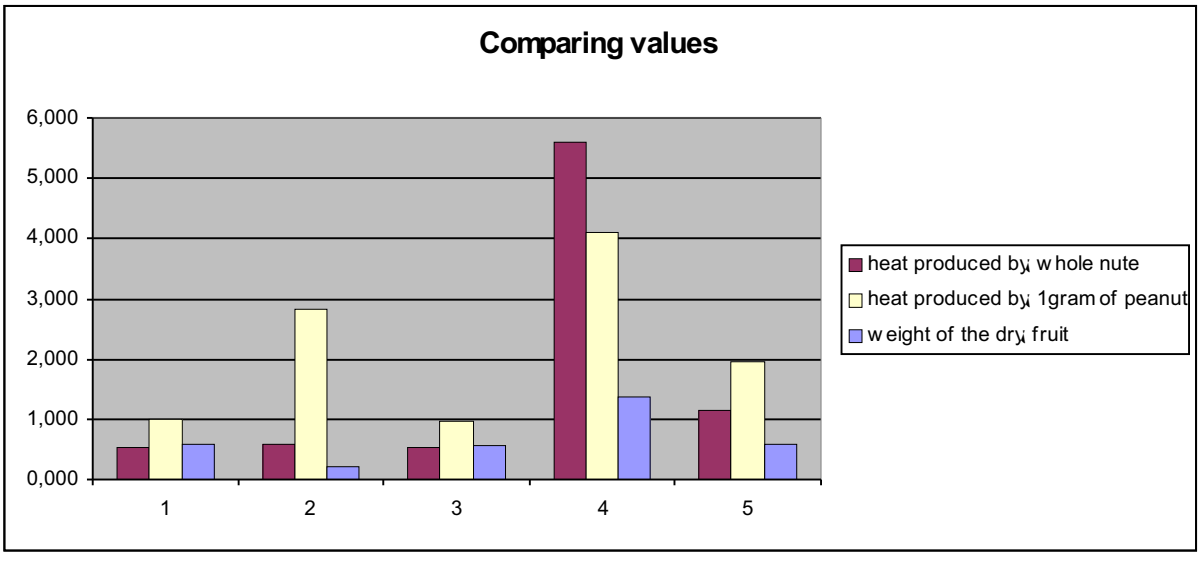
1ml H2O=1cm3=1gH2O	butter bean	bean-caper	brown bean	almond	grain
t change of water	4,5	5	7,5	73,5	12,5
heaat produced by whole nute	0,378	0,42	0,63	6,174	1,05
heaat produced by 1gram of peanut	0,454	1,918	0,962	3,900	1,875

Therefore, for having a better comprehension I'll find the average number amongst this three values, and will compare the energy released amongst the dry fruits.

The formula used will be $\frac{x+y+z...}{5}$ where the variables are the different values in the tables and five are the number o f groups that we have.

averages	butter bean (1)	bean-caper (2)	brown bean (3)	almond (4)	grain (5)
t of the water start	21,100	21,100	21,100	21,100	21,100
higher t	27,400	28,100	27,500	87,700	34,700
weigh of the semente	0,583	0,211	0,574	1,367	0,601
t change of water	6,300	7,000	6,400	66,600	13,600
heat produced by whole nute	0,529	0,588	0,538	5,594	1,142
heat produced by 1gram of peanut	0,987	2,836	0,950	4,109	1,949


100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0,000
1
2
3
4
5
t change of water
t of the water start
higher t


Comparing values
6,000
5,000
4,000
3,000
2,000
1,000
0,000
1
2
3
4
5
heat produced by whole nute
heat produced by 1gram of peanut
weight of the dry fruit

EVALUATION

So, in conclusion, the dry fruit that gave more energy was the almond ; the second was the bean caper, and in the third position is the grain and in the fourth are the brown bean and the butter bean. As we have 1 gram for each seed than from here we can take that one of the factors for the better combustion is the chemical composition of the body itself probably from the hydro carbonates. In terms of Tº we can find an error as the % of humidity might not be in the needed conditions and so the nºs fluctuates.

From this summarisation we conclude that the hydro carbonates and the humidity are relevant when speaking in energy, as a body with more Hydro carbonates might release more energy than a lesser one unless the humidity is changed.

This value can be seen in the first graphic, in which I de monstrate that the Tº changes were reasonable to consider it an error.

There could be another thing that is the fact of the brown bean combusted better than the butter bean but this values are not relevant as the change among the seeds is from 0,1.

I don't know why but when I searched on the USDA (org responsible for the caloric valorisation in USA) our results were completely wrong. Perhaps 6 times plus.

	butter bean (1)	bean-caper (2)	brown bean (3)	almond (4)	grain (5)	
Cal por 100g	23,502	67,512	22,614	97,834	46,400	
Cal por 100g (USDA)	320,000	360,000	320,000	578,000	310,000	aprox
mines	13,616	5,332	14,150	5,908	6,681	

I believe that for a better experience, next time the variab les should be better controlled, especially the humidity as it determines how the combustion is processed.

The experience actually met my expectations.

BIBLIOGRAPHY

- http://www.nal.usda.gov/fnic/foodcomp/cgi -bin/list_nut_edit.pl