



APPLICATION NOTE | DDS CALORIMETERS

CALORIFIC MEASUREMENT OF FOOD: SUGAR

INTRODUCTION

Many institutions are doing research and development on food. The aim is to improve or control the nutritional value of the food. The parameters may be to compare different foods or different manufactures or to generically improve the food.

Part of the research involves determining the calorific value of the food. The calorific value of a particular food is the same as the energy content of that food.

Institutions performing this type of research include:

- Animal and Dairy research
- Department of Agriculture
- Universities
- Industries
- Government or private food industries

SAMPLE PREPARATION

A calorimeter is used to determine the calorific value of any substance that can be ignited. The sample to be measured must be a representative sample and homogeneous. For sugar the sample should be well stirred and approx. 0.7g is put in to the crucible.

ANALYSIS

Once the sample has been prepared the determination can be carried out in the normal method. Ensure that the firing cotton touches the sample. After a determination clean the inside of the vessel and the crucible before starting the next determination.

RESULTS

The following sections are the results of various sugar manufacturers.

1. Local Brown Sugar





Manufacturers of CAL2K/CAL3K Oxygen Bomb Calorimeters

Results of Local Brown Sugar As is:

RESULT	MASS	SID	DATE	BN	INIT DRIFT	FIRING TEMP	AMBIENT TEMP	RS	FINAL TIME
16.617	0.8001	441	5/26/2005	1	0.0013	21.6	24.7	OK	3.1
16.532	0.8001	442	5/26/2005	2	0.0018	21.8	24.9	OK	3.1
16.636	0.8001	443	5/26/2005	1	0.0010	22.1	25.3	OK	3.1
16.584	0.8002	444	5/26/2005	2	0.0014	21.8	25.5	OK	3.1
Average MJ/Kg = 16.592									

Results of Pongola Brown Sugar Freeze Dried:

RESULT	MASS	SID	DATE	BN	INIT DRIFT	FIRING TEMP	AMBIENT TEMP	RS	FINAL TIME
16.587	0.8003	445	5/26/2005	1	0.0014	22.1	25.8	OK	3.1
16.549	0.8000	446	5/26/2005	2	-0.0006	25.5	260	OK	3.1
16.552	0.8004	447	5/26/2005	1	0.0013	23.0	26.4	OK	3.1
16.475	0.8000	448	5/26/2005	2	0.0004	23.6	26.6	OK	3.1
Average MJ/Kg = 16.540									

2. Local Caramel Sugar



Results of Caramel Sugar As is:

RESULT	MASS	SID	DATE	BN	INIT DRIFT	FIRING TEMP	AMBIENT TEMP	RS	FINAL TIME
16.468	0.8003	423	5/25/2005	2	0.0006	22.0	24.2	OK	3.1
16.700	0.8007	424	5/25/2005	1	0.0015	21.2	24.4	OK	3.1
16.531	0.8005	426	5/25/2005	2	0.0017	21.3	24.6	OK	3.1
16.636	0.8001	425	5/25/2005	1	0.0008	22.5	24.8	OK	3.1
Average MJ/Kg = 16.584									



3. Local Mill Sugar



Results of Local Mill Sugar As is:

RESULT	MASS	SID	DATE	BN	INIT DRIFT	FIRING TEMP	AMBIENT TEMP	RS	FINAL TIME
16.641	0.8002	431	5/25/2005	1	0.0012	21.9	25.5	OK	3.1
16.499	0.8002	432	5/25/2005	2	0.0014	22.6	25.7	OK	3.1
16.694	0.8005	433	5/25/2005	1	0.0018	21.8	25.8	OK	3.1
16.616	0.8006	434	5/25/2005	2	0.0020	21.0	26.2	OK	3.1
Average MJ/Kg = 16.613									

4. Local Treacle



Results of Local Treacle As is:

RESULT	MASS	SID	DATE	BN	INIT DRIFT	FIRING TEMP	AMBIENT TEMP	RS	FINAL TIME
16.161	0.8005	397	5/24/2005	2	0.0006	23.1	26.1	OK	3.1
16.197	0.8010	399	5/24/2005	2	0.0016	22.3	26.4	OK	3.1
16.207	0.8016	396	5/24/2005	1	.0000	24.4	26.5	OK	3.1





Manufacturers of CAL2K/CAL3K Oxygen Bomb Calorimeters

16.153	0.8003	398	5/24/2005	1	0.0018	21.8	26.5	OK	3.1
Average MJ/Kg = 16.179									

5. Local White Sugar

Results of Local White Sugar As is:

RESULT	MASS	SID	DATE	BN	INIT DRIFT	FIRING TEMP	AMBIENT TEMP	RS	FINAL TIME
16.645	0.8004	1	5/30/2005	1	4.0E-05	14.8	17.1	OK	3.1
16.666	0.8005	2	5/30/2005	2	0.0015	14.5	17.4	OK	3.1
16.613	0.8000	4	5/30/2005	2	0.0005	17.0	18.1	OK	3.1
16.585	0.8000	3	5/30/2005	1	-0.0013	19.8	18.4	OK	3.1
Average MJ/Kg = 16.627									

Results of Local White Sugar Freeze Dried:

RESULT	MASS	SID	DATE	BN	INIT DRIFT	FIRING TEMP	AMBIENT TEMP	RS	FINAL TIME
16.411	0.8002	5	5/30/2005	2	-0.0011	20.3	18.8	OK	3.1
16.591	0.8001	6	5/30/2005	1	-0.0016	20.4	19.2	OK	3.1
16.441	0.8000	7	5/30/2005	2	-0.0010	20.4	19.8	OK	3.1
16.501	0.8002	8	5/30/2005	1	-0.0012	20.6	20.4	OK	3.1
Average MJ/Kg =16.494									

6. Freeze dried white sugar



SID	MASS (GRAM)	MJ/KG
1	0.8012	16.40
2	0.8011	16.42
3	0.8011	16.43
4	0.8000	16.41
5	0.8008	16.41
6	0.8007	16.42





Manufacturers of CAL2K/CAL3K Oxygen Bomb Calorimeters

7	0.8007	16.42
8	0.8007	16.41
9	0.8008	16.40
10	0.8004	16.42
AVERAGE		16.41

7. Illovo Umzimkulu VHP Sugar



Results of Umzimkulu VHP Sugar As is:

RESULT	MASS	SID	DATE	BN	INIT DRIFT	FIRING TEMP	AMBIENT TEMP	RS	FINAL TIME
16.339	0.8001	412	5/25/2005	2	-0.0001	19.9	21.5	OK	3.1
16.628	0.8006	413	5/25/2005	1	0.0007	19.4	21.8	OK	3.1
16.353	0.8001	416	5/25/2005	2	-0.0002	20.5	22.4	OK	3.1
16.624	0.8005	417	5/25/2005	1	0.0004	20.4	22.7	OK	3.1
Average MJ/Kg = 16.486									

8. Illovo Umzimkulu Caramel Sugar

Results of Caramel Sugar As is:

RESULT	MASS	SID	DATE	BN	INIT DRIFT	FIRING TEMP	AMBIENT TEMP	RS	FINAL TIME
16.468	0.8003	423	5/25/2005	2	0.0006	22.0	24.2	OK	3.1
16.700	0.8007	424	5/25/2005	1	0.0015	21.2	24.4	OK	3.1
16.531	0.8005	426	5/25/2005	2	0.0017	21.3	24.6	OK	3.1
16.636	0.8001	425	5/25/2005	1	0.0008	22.5	24.8	OK	3.1
Average MJ/Kg = 16.584									



Manufacturers of CAL2K/CAL3K Oxygen Bomb Calorimeters

Results of Caramel Sugar Freeze Dried:

RESULT	MASS	SID	DATE	BN	INIT DRIFT	FIRING TEMP	AMBIENT TEMP	RS	FINAL TIME
16.486	0.8007	428	5/25/2005	2	0.0007	22.5	25.0	OK	3.1
16.565	0.8016	427	5/25/2005	1	0.0010	21.9	25.3	OK	3.1
16.457	0.8003	430	5/25/2005	2	0.0012	22.3	25.4	OK	3.1
16.655	0.8019	429	5/25/2005	1	0.0017	21.8	25.5	OK	3.1
Average MJ/Kg= 16.562									

9. Illovo Pongola White Sugar

Results of Pongola White Sugar As is:

RESULT	MASS	SID	DATE	BN	INIT DRIFT	FIRING TEMP	AMBIENT TEMP	RS	FINAL TIME
16.645	0.8004	1	5/30/2005	1	4.0E-05	14.8	17.1	OK	3.1
16.666	0.8005	2	5/30/2005	2	0.0015	14.5	17.4	OK	3.1
16.613	0.8000	4	5/30/2005	2	0.0005	17.0	18.1	OK	3.1
16.585	0.8000	3	5/30/2005	1	-0.0013	19.8	18.4	OK	3.1
Average MJ/Kg = 16.627									

Results of Pongola White Sugar Freeze Dried:

RESULT	MASS	SID	DATE	BN	INIT DRIFT	FIRING TEMP	AMBIENT TEMP	RS	FINAL TIME
16.441	0.8002	5	5/30/2005	2	-0.0011	20.3	18.8	OK	3.1
16.591	0.8001	6	5/30/2005	1	-0.0016	20.4	19.2	OK	3.1
16.441	0.8000	7	5/30/2005	2	-0.0010	20.4	19.8	OK	3.1
16.501	0.8002	8	5/30/2005	1	-0.0012	20.6	20.4	OK	3.1
Average MJ/Kg =16.494									

10. Illovo N.Ally White Sugar





Manufacturers of CAL2K/CAL3K Oxygen Bomb Calorimeters

Results of NB Sugar as is:

RESULT	MASS	SID	DATE	BN	INIT DRIFT	FIRING TEMP	AMBIENT TEMP	RS	FINAL TIME
16.675	0.8000	17	5/30/2005	1	0.0016	21.5	24.8	OK	3.1
16.530	0.8004	18	5/30/2005	2	0.0012	22.2	25.3	OK	3.1
16.669	0.8001	19	5/30/2005	1	0.0016	22.7	25.5	OK	3.1
16.563	0.8002	20	5/30/2005	2	0.0016	22.8	25.8	OK	3.1
Average MJ/Kg = 16.609									

11. Illovo Umzimkulu Treacle



Results of Umzimkulu Treacle As is:

RESULT	MASS	SID	DATE	BN	INIT DRIFT	FIRING TEMP	AMBIENT TEMP	RS	FINAL TIME
16.161	0.8005	397	5/24/2005	2	0.0006	23.1	26.1	OK	3.1
16.197	0.8010	399	5/24/2005	2	0.0016	22.3	26.4	OK	3.1
16.207	0.8016	396	5/24/2005	1	0.0000	24.4	26.5	OK	3.1
16.153	0.8003	398	5/24/2005	1	0.0018	21.8	26.5	OK	3.1
Average MJ/Kg = 16.179									

12. Illovo N.Ally Brown Sugar





Manufacturers of CAL2K/CAL3K Oxygen Bomb Calorimeters

Results of NB Sugar As is:

RESULT	MASS	SID	DATE	BN	INIT DRIFT	FIRING TEMP	AMBIENT TEMP	RS	FINAL TIME
16.591	0.8001	9	5/30/2005	1	-0.0011	21.4	20.9	OK	3.1
16.493	0.8003	11	5/30/2005	1	-0.0016	23.0	21.7	OK	3.1
16.577	0.8003	10	5/30/2005	2	0.0017	19.0	22.1	OK	3.1
16.544	0.8001	13	5/30/2005	2	0.0018	19.5	22.9	OK	3.1
Average MJ/Kg= 16.551									

SUMMARY/CONCLUSION:

The sugar is very easy to analyze. It is almost of constant Calorific Value with the exception of the Treacle

- | | |
|---|--------------|
| 1. Local Brown Sugar | 16.592 |
| 2. Local Brown Sugar Freeze Dried | 16.540 |
| 3. Local Caramel Sugar | 16.584 |
| 4. Local Mill Sugar | 16.613 |
| 5. Local Treacle | 16.179 <-Low |
| 6. Local White Sugar | 16.627 |
| 7. Local White Sugar Freeze Dried | 16.494 |
| 8. Freeze Dried White | 16.410 |
| 9. Illovo Umzimkulu VHP | 16.486 |
| 10. Illovo Umzimkulu Caramel | 16.484 |
| 11. Illovo Umzimkulu Caramel Freeze Dried | 16.562 |
| 12. Illovo Pomgola White | 16.627 |
| 13. Illovo Pongola White Freeze Dried | 16.494 |
| 14. Illovo N.Ally White Sugar | 16.609 |
| 15. Illovo Umzimkulu Treacle | 16.179 <-Low |
| 16. Illovo N.Ally Brown Sugar | 16.551 |

The above results are acceptable between different manufacturer and different type of sugar.

