

Nitrogen/Protein determination in Beans by the Thermo Scientific FLASH 4000 Series

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Introduction



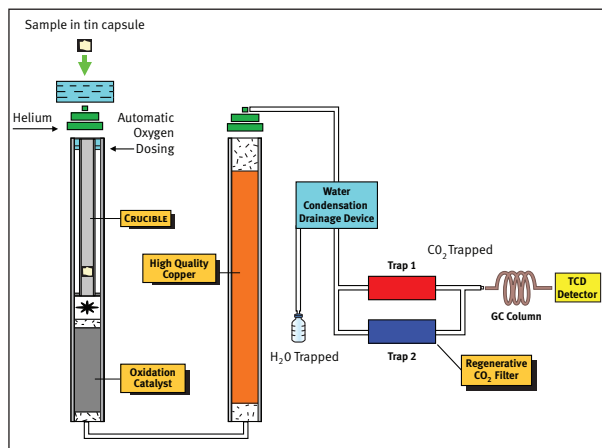
Beans are significant components of the human diet and one of the principal part of feeding stock for domestic animals. One of the most important nutrients is Protein and the monitoring of its amount, through the determination of Nitrogen, must be accurate to determine the nutritional quality of these products. In addition to its dietary importance, the Protein content also has become a guideline for some cereal trade transactions.

For this reason, the capabilities of the combustion method have been greatly improved to make it faster, safer and more reliable than the traditional Kjeldahl method. As a direct consequence of these advantages, the combustion method was approved and adopted by the Association of Official Analytical Chemists (AOAC method 990.03).

The FLASH 4000 N/Protein Analyzer, based on the dynamic flash combustion of the sample, copes effortlessly with the wide array of laboratory requirements such as accuracy, day-to-day reproducibility and high sample throughput.



Analytical Configuration



Analytical conditions

Temperature left reactor: 950 °C
Temperature right reactor: 840 °C
Temperature oven: 50 °C

Carrier Flow (He): 300 ml/min
Reference Flow (He): 300 ml/min

Standard: 500 mg EDTA (9.59 %N)

Sample weight: 600 mg - 1.6 g

Note: The Oxygen amount necessary for the complete combustion of samples is calculated automatically by the OxyTune® function present in the Eager Xperience dedicated software.

Official methodology requirements for Protein determination by Combustion

AOAC (Association of Official Analytical Chemists, Method 992.23) indicates that the suitable fineness of grind must be determined (for each different material analyzed) to achieve precision that gives RSD of $\leq 2\%$ for 10 successive determinations of Nitrogen.

Results

Different beans were chosen to validate the system in terms of accuracy and reproducibility according with the pre-treatment of the sample. The Protein content is calculated automatically by the Thermo Scientific Eager Xperience Software using the default Protein factor of 6.25. The Protein factor can be changed in accordance with the food type.

Key Words

- Beans
- Flash Combustion
- Food Safety
- Nitrogen/Protein

Table 1 shows the analysis of 10 consecutive determinations of beans samples with different homogenization, 1 mm and 2 mm particle size. The data obtained indicate that it is not necessary a fine homogenization to reach a RDS % less 2 % as suggest in the official methods.

Table 1 – N/Protein determination in beans

RED BEANS						GREEN PEAS					
Particle size 1 mm			Particle size 2 mm			Particle size 1 mm			Particle size 2 mm		
Weight (mg)	N %	Protein %	Weight (mg)	N %	Protein %	Weight (mg)	N %	Protein %	Weight (mg)	N %	Protein %
999.6	4.0691	25.4320	1017.4	4.0133	25.0829	1009.2	4.0807	25.5041	1004.8	4.0423	25.2644
1004.7	4.0202	25.1262	1009.2	4.0166	25.1037	998.5	4.0559	25.3492	1002.6	4.0379	25.237
1001.3	4.0690	25.4313	1010.2	4.0462	25.2888	1005.5	4.0555	25.3468	1003.9	4.0338	25.2110
1006.0	4.0066	25.0413	993.3	4.0282	25.1765	1002.5	4.0548	25.3424	1005.9	4.0400	25.250
1002.6	4.0540	25.3374	994.5	4.0625	25.3908	1000.4	4.0635	25.3972	996.5	4.0366	25.2289
994.9	4.0231	25.1442	1011.2	4.0144	25.0901	1006.6	4.0310	25.1935	1009.3	4.0255	25.1595
995.6	4.0247	25.1542	997.4	4.0355	25.2219	1001.8	4.0486	25.3039	1000.9	4.0079	25.0495
997.5	4.0133	25.0829	992.5	4.0195	25.1219	1006.5	4.0513	25.3208	996.0	4.0122	25.0765
996.2	4.0535	25.3341	1010.6	4.0248	25.1552	985.0	3.9939	24.9616	996.4	3.9983	24.9891
1004.2	4.0331	25.2071	995.2	4.0015	25.0093	1022.0	4.0775	25.4843	1002.4	4.0066	25.0414
Av.N %	4.0367	25.2290	Av.N %	4.0262	25.1641	Av.N %	4.0513	25.3204	Av.N %	4.0241	25.1507
RSD %	0.5688	0.5688	RSD %	0.4432	0.4432	RSD %	0.6090	0.6090	RSD %	0.4060	0.4060

Table 2 shows the Nitrogen and Protein data obtained of red beans sample changing the weight of sample. Excellent reproducibility was obtained in the range 600 to 1600 mg. No memory effect was observed changing sample weight.

In the case of lentils, see Table 3, the sample was analyzed after homogenization at 1 and 2 mm particle size and without homogenization. The average of the data obtained are comparable with the results of the homogenized lentil sample at the different particle size and the RSD % obtained is according to the official methods, indicating that depending of the sample nature it can be analyze directly without pre-treatment.

Table 2 – N/Protein determination in red beans

Particle size 1 mm		
Weight (mg)	N %	Protein %
797.6	4.0683	25.4269
1410.0	4.0122	25.0762
601.7	4.0924	25.5775
1197.9	4.0455	25.2844
1608.0	4.0706	25.4412
1206.5	4.0059	25.0369
601.2	4.0710	25.4437
1406.1	4.0016	25.0100
1608.7	4.0488	25.3050
604.6	4.0049	25.0306
Av.N %	4.0421	25.2632
RSD %	0.831	0.831

Table 3 – N/Protein determination in Lentils

LENTILS								
Particle size 1 mm			Particle size 2 mm			Whole sample		
Weight (mg)	N %	Protein %	Weight (mg)	N %	Protein %	Weight (mg)	N %	Protein %
998.5	4.0199	25.1244	1001.8	4.1137	25.7106	1011.70	3.9483	24.6770
999.4	4.0196	25.1224	1000.9	4.1169	25.7305	1015.10	4.0343	25.2146
994.1	4.0223	25.1395	1004.1	4.1027	25.6416	998.30	3.9595	24.7466
1000.3	4.0193	25.1209	996.5	4.0534	25.3340	1007.0	4.0457	25.2853
1008.0	4.0197	25.1230	998.4	4.0379	25.2368	1016.9	4.0683	25.4271
1000.7	4.0358	25.2239	1007.0	4.0702	25.4387	1006.4	4.1350	25.8439
1006.7	3.9688	24.8053	981.0	4.0405	25.2529	1002.5	4.0999	25.6242
1002.2	3.9901	24.9381	978.6	4.0531	25.3317	1016.3	4.0806	25.5040
1002.9	4.0774	25.4839	711.9	3.9917	24.9483	1001.0	4.0517	25.3232
991.8	4.0233	25.1457	986.0	4.0350	25.2188	994.0	4.0674	25.4215
Av.N %	4.0196	25.1227	Av.N %	4.0615	25.3844	Av.N %	4.0491	25.3068
RSD %	0.697	0.697	RSD %	0.980	0.980	RSD %	1.428	1.428

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AN42125_E 05/08C