

APPLICATION NOTE

Determination of nitrogen content in fertilizers – Elemental analysis for solid and liquid fertilizer samples

Dumas method application – based on standards **AOAC 993.13** – Nitrogen (Total) in Fertilizers, Combustion Method, **DIN EN 13654-2:2001** – Soil improvers and growing media – Determination of nitrogen – Part 2: Dumas method



Introduction

Nitrogen is a critical macronutrient for plant growth. Because of the continuous intensive agriculture, the natural regeneration process of the soil is impossible, and thus, the nutrients have to be added artificially using fertilizers. The addition of nitrogen increases crop yields but too much nitrogen can have a negative impact on the environment and on the quality of the products. A good balance must be found, and this is possible only by knowing the exact nitrogen content of the fertilizers used.

In the Dumas method, the nitrogen contained in the sample is oxidized to nitrogen oxides in an oxygen atmosphere, at high temperatures and in the presence of a catalyst. Then the nitrogen oxides are reduced to nitrogen with the help of copper. The side products, water and carbon dioxide, are separated in specific traps. Last the nitrogen is detected by a thermal conductivity detector (TCD) and its amount is determined using a calibration previously performed by analysing a suitable substance with known nitrogen content.

C. Gerhardt instruments:

- DUMATHERM N Pro
- **Recommendation:** Upgrade Kit 18, Reactor holder Ø 6mm (Order No. 14-0231)

Additional equipment:

- Analytical balance
- Centrifugal mill
- Encapsulating device

The method

Sample preparation (Solid fertilizer)

The sample is homogenised with a variable speed rotor mill. Immediately before weighing in, it is again thoroughly mixed by hand. Then the sample is weighed with tin foil. After sealing the tin foil, the sample is placed in the transfer tray.

➔ **App note:** Depending on the sample matrix, the sample weight can be reduced to increase the lifetime of the consumables.

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Sample preparation (Liquid fertilizer)

The sample must be representative for the analysis. Immediately before weighing, the sample is shaken again thoroughly. Tin foil (e.g. DumaFoil) is tared and some Super-Absorber (ratio 1:10) is added. After the balance has been tared again, the sample is added with a syringe. After weighing, wait a few seconds until the sample has formed a gel with the Super-Absorber. After that, the tin foil can be sealed and the sample can be placed in the transfer tray.

➔ **App note:** Depending on the sample matrix, the sample weight can be reduced to increase the lifetime of the consumables.

Calibration

The selected calibration must cover the working range. For a recommended sample weight, a calibration of 1 mgN to 10 mgN carried out with EDTA is usually sufficient. The minimum requirement for the correlation factor R2 is a value ≥ 0.9999 .

Exemplary results for solid fertilizer samples - Humus

Sample amount [mg]	Nitrogen (N) [%]	Average nitrogen content [%]	Standard deviation nitrogen content [%]
80.230	2.425	2.427	0.073
80.243	2.427		
80.242	2.526		
80.114	2.455		
80.404	2.429		
80.430	2.301		

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Exemplary results for liquid fertilizer samples – Fertilizer NPK (5-3-7)

Sample amount [mg]	Nitrogen (N) [%]	Average nitrogen content [%]	Standard deviation nitrogen content [%]
53.373	5.141	5.117	0.015
53.726	5.123		
50.739	5.110		
56.213	5.106		
54.956	5.097		
50.873	5.122		

Conclusion

In modern agriculture, the most effective use of fertilizers is crucial. To achieve high productivity and a low impact on the environment, fertilizers must be optimized in the composition of their nutrients. In order to determine the nitrogen content in fertilizer samples, the DUMATHERM with its chemical-resistant components is particularly well suited. In combination with the application optimized for nitrogen determination in fertilizers, the nitrogen content can be determined reliably and accurately in all fertilizers.

For detailed information or other applications please contact:

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