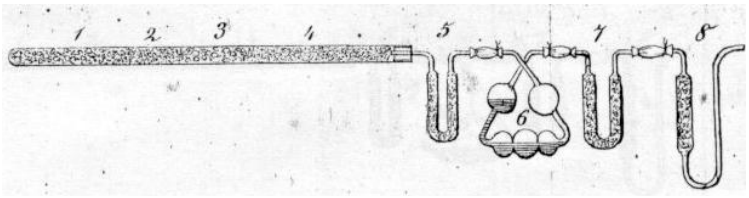
DUMAS Method

The Dumas method in analytical chemistry is a method for the quantitative determination of nitrogen in chemical substances based on a method first described by Jean-Baptiste Dumas over a century and a half ago (1831).

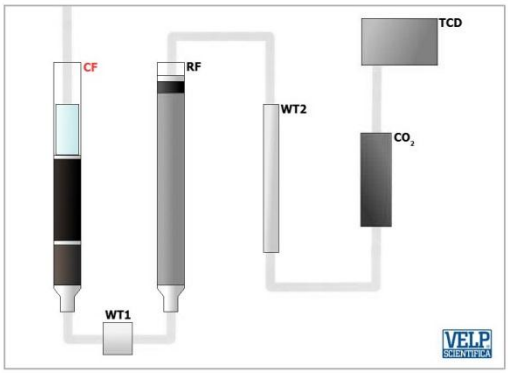


The first Dumas apparatus, 1831

An automated instrumental technique has been developed which is capable of rapidly measuring the total nitrogen concentration of food samples and is beginning to compete with the Kjeldahl method as the standard method of analysis for nitrogen content for some foodstuffs, and more.

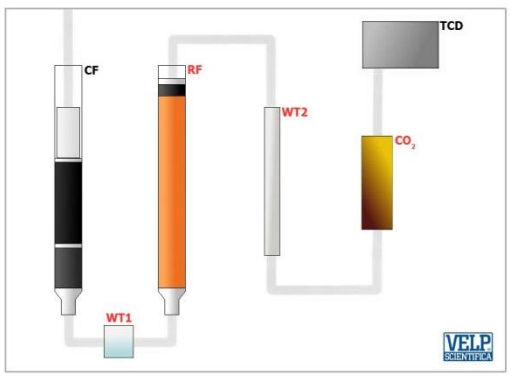
The method has three steps:

- **Combustion**: once the sample is weighed and purged of any atmospheric gases, it is heated in a high-temperature furnace and rapidly combusted in the presence of pure oxygen at about 1,000 ºC. This leads to the release of substances such as carbon dioxide, water, nitrogen dioxide and, above all, nitrogen as several oxides (N_yO_x).



CF - Combustion Furnace
We pass from a solid/liquid sample to a gas containing NO_X, H_2O, CO_2 and residual O_2 with He as carrier

- **Reduction and Separation**: the combustion products are collected and allowed to equilibrate. The gas mixture is passed over hot copper to remove any oxygen and convert nitrogen oxides into molecular nitrogen. The sample is passed through traps that remove water and carbon dioxide.



WT1 - Water Trap 1
A physical water trap - **DriStep™** - removes ≥ 99% of water and saves copper in RF

RF - Reduction Furnace
NO_x is reduced to N_2 and residual O_2 is trapped

WT2 - Water Trap 2
Chemical desiccant removes residual H_2O

CO_2 - Auto-regenerating Adsorbers
Adsorption and desorption of CO_2

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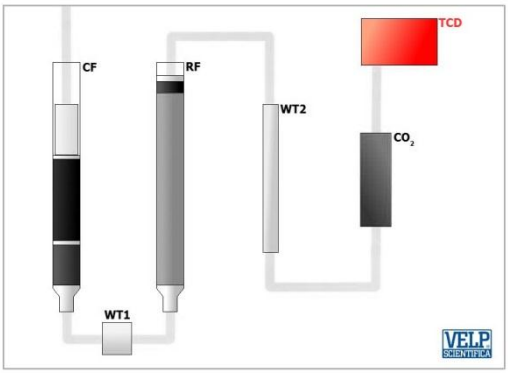
- **Detection**: the measured signal from the thermal conductivity detector for the sample can then be converted into nitrogen content.



TCD - Thermal Conductivity Detector
LoGas™ determines nitrogen content without the need for a reference gas

Dumas benefits

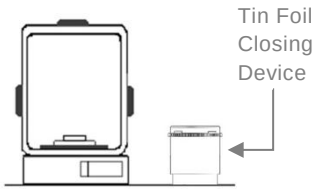
The Dumas method has the advantages of being easy to use and automate. It is also considerably faster than the Kjeldahl method, taking a few minutes per analysis, as compared to the hour or more for Kjeldahl. It also does not make use of toxic chemicals or eco-unfriendly catalysts. Also, as with Kjeldahl, it does not give a measure of true protein, as it registers non-protein nitrogen in addition. Also, as with Kjeldahl, different correction factors are needed for different proteins because they have different amino acid sequences with varied nitrogen content. No memory effect.

Initial calibration of the instrument

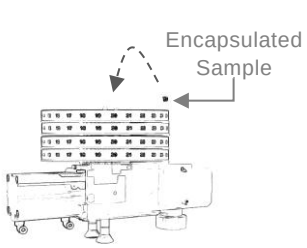
Any instrument must first be calibrated by analyzing a material that is pure and has a known nitrogen concentration, such as EDTA, Aspartic Acid, Acetanilide, Urea, Atropine, etc. A good calibration curve requires 5-6 standard points. These should represent different standard quantities (in mg) to create a range (in mg of nitrogen).

Care during sample preparation

The small sample size raises the risk of obtaining an unrepresentative sample. For this reason, if using the Dumas technique, is strongly recommended to perform an efficient homogenization of the sample, in order to obtain and analyze a representative sample.



Sample Weighing
and Tin Foil Closing



Autosampler
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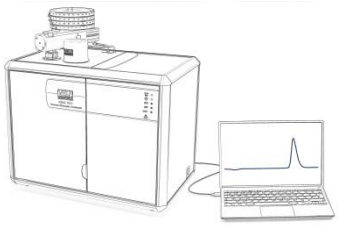

Protein/Nitrogen
Determination

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