Determining protein contents with iTAG Sprint

The method most frequently used to determine the protein content of dairy products has so far been the Kjeldahl method, which is often specified as the Standard Method. For quite a while now, some customers have been trying to bypass the disadvantages of the Kjeldahl method by switching to alternatives such as Dumas or NIR. Determining the nitrogen content using Kjeldahl and Dumas methods covers the total nitrogen content of the sample, from which in turn the nitrogen share of the proteins is calculated. Problems arise in the case of adulterated foods or modified foods, as the melamine scandal in dog food and in baby milk in the years 2006 and 2009 showed. If the NIR method is used, extensive calibrations are necessary. Slight fluctuations in the sample composition can sustainably influence the measuring result.

The Kjeldahl method has been known since 1883 and includes time-consuming work steps. It takes a few hours to calculate the protein content. The work with boiling sulphuric acid cannot be described as pleasant either. In the first step, during pulping, the sample is boiled in an open flask with the addition of sulphuric acid. Here the carbon in the organic material is oxidised to CO_2 and sulphuric acid is reduced to SO_2. In the second step, water vapor distillation is carried out. In the third step, the amounts are determined. For the direct titration of Borate, an indicator mixture consisting of methyl red and methylene blue is often used, which changes color in the acid environment. The standard solution volume used can be converted into the nitrogen quantity of the sample.

The Dumas method was intended to bring about an improvement with regard to work safety and to shorten the time involved. This combustion method was developed in 1848 by Jean Dumas. Here the sample material is combusted at high temperatures and the resulting combustion gases are analyzed. Small weight components of solid or liquid samples are transformed into their oxides by the combustion at high temperatures and in the presence of catalysts. The resulting nitrogen oxides (NO_x) are converted (reduced) to elementary nitrogen with the aid of copper and the by-products, water and carbon dioxide, are separated completely. The remaining nitrogen is analyzed with a thermal conductivity detector. In this connection not inconsiderable quantities of copper (reduction agent) and catalyst are used, and furthermore many cost-intensive high-purity gases are required for the analysis.

The revolution with iTAG Sprint

It is indeed a kind of revolution when century-old methods are replaced by a fast, simple and safe method. The protein analysis in Sprint is carried out directly via the iTAG protein-tagging technology and is not adulterated by food additives. Furthermore, the use of dangerous and environmentally harmful chemicals is not necessary either.

Sprint - for quick determination of protein content

At the start of the analysis, the sample (milk, yoghurt, meat, sausage, flour, ready meal etc.) is weighed into a beaker and placed in the Sprint unit. The Sprint now passes a defined quantity of iTAG solution to the sample and the built-in homogenizer mixes the sample mixture thoroughly. During this process, the iTAG solution tags the characteristic molecule positions of the proteins. Tagging means selective binding of the dyestuff to the amino acids of the protein in the sample. This color reaction has been known for a good 30 years and possesses official AACC and AOAC approval.

The remaining iTAG solution is removed from the sample via a filter system and analyzed in the Sprint Unit on the basis of its characteristic coloring. At the same time the homogenizer in the Sprint is automatically cleaned and thus contamination with the next sample is prevented. After typically 2 to 3 minutes the analysis is completed. Only a little cleaning water, a few millilitres of the non-toxic iTAG solution and the sample beaker with the weighed-in sample and the filtering device are generated as waste.

Sample to be examined in the beaker

At the end of the analysis, the protein content is displayed on the screen and issued by the built-in printer. Now the unit is ready to determine the next protein content. For a high sample throughput, a number of Sprint units can be coupled together.

The results

Comparable results are an absolute prerequisite in a substitution method for the Kjeldahl standard method. Studies conducted with certified reference materials show that precisely this requirement is satisfied by the iTAG Sprint method. Furthermore, a distinct improvement of the precision data can be observed with iTAG Sprint. The following tables with measuring results show examples of the use of Sprint working with food samples.

Agreement between Kjeldahl and Sprint Results

Type of sample	Kjeldahl Protein [%]	Sprint Protein [%]
Low-fat dry milk powder	35.33	35.58
Milk	3.27	3.27
Soy milk chocolate flavour	2.08	2.12
Chocolate milk	3.27	3.27
Malt	7.94	7.84
NIST 1846 Infant formula	11.17	11.14
Chicken meat	11.33	11.39

Type of sample	Kjeldahl Protein [%]	Sprint Protein [%]
Chocolate ice cream	3.46	3.41
Whole egg	10.77	10.74
Sour cream	2.85	2.83
Yoghurt	3.46	3.46
Vanilla ice cream	3.11	3.13

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