The SPRINT™ – A New Method for Routine Protein Analysis in Meat Products using iTAG

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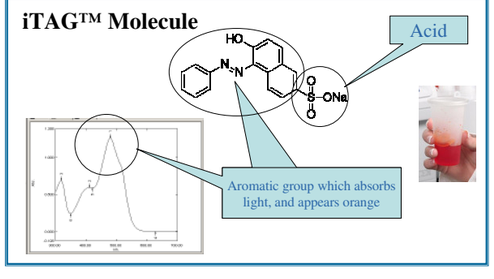
Summary

A fast and new substitution of the well known Kjeldahl protein determination is presented. Several sausages and meat products were analyzed by using the Sprint analysis instrument. Optimizations regarding the originally weighted-in quantity and the time of homogenisation were performed to meet the requirements of reliable analysis data. Results were compared to established methods with respect to correctness, precision and variance. Validation of analysis results was performed according to the quality standard ISO/IEC 17025 using the exel macro „Validata". The method showed notably good correlation with the established ones and has proved superior concerning analysis time and precision.

Introduction

The determination of protein plays a substantial role in food manufacture, testing laboratories and governmental agencies. The standard Kjeldahl protein test used in the food industry measures the total amount of nitrogen in a sample. The protein content is calculated using empirical factors. Protein contains nitrogen, and additionally there can be naturally occurring nonprotein sources of nitrogen in a food product. Further the Kjeldahl method uses heating sulphuric acid and a copper catalyst at high temperatures for hours, requires extensive laboratory safety procedures an produces hazardous waste. The SPRINT™ rapid protein analyzer offers an alternative. It is based on a direct measurement of protein content that ignors nonproteinogenic nitrogen. This advantage is the result of a technique known as protein tagging, which has been in use in the bioscienic field for years [2]. The SPRINT uses iTAG™, a proprietary solution that has an acidic group that readily attaches to the basic groups found on these amino acids [1] [2]. It has an associated structure featuring an extensive aromatic character, and readily absorbs light at 483 nm [3]. The combination of these two structures creates an agent that stoichiometrically binds to the basic aminoacids and is easily detected using ordinary absorption spectroscopy.

In our laboratory we investigated various products by using this method. The samples included various types of meat including sausages (boild sausage, cooded sausage, raw sausage etc), pork, beef, turkey, ready meats, soy products, cheese and also different types of milk and milk products.



Material and Methods

Approximately 1 g is transferred into a disposable cup and weighed on an analytical balance. The cup is placed in the analyser along with a disposable filter. The system dispenses iTAG solution into the cup and homogenizes the sample. The protein binds with the reagent solution, forming an insoluble complex. A portion of the solution is cleaned through the disposable filter into the colorimeter and analyzed at 483 nm.

Sprint analyzer, iTAG solution, disposable filter and special cups (CEM Corp.); External balance, CryoMill (Retsch)

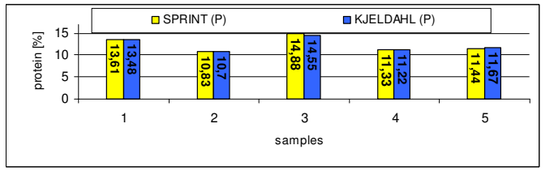
Results and Discussion

In the context of this research project the protein content in various sausage, raw meat, soy products and convenience meat products were examined. We present here data from different product groups.

Sausage (cooked, boiled etc).— For three different matrices (boiled sausage, cooked sausage and raw sausage) optimizations of sample amount and time and strengh of homogenisation were examined. Dependent on the protein content the weighted varied from 0,3 to 1 gram. The homogenization time was 90 seconds. The settling time for all three types of sausage was set at 90 seconds.

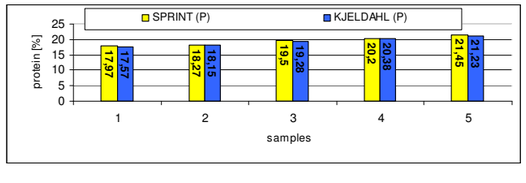
boiled sausage. — The protein content of this kind of sausage is approximately 10 - 15 percent. Optimal sample weight was found to be between 0,8 to 0,9 gram. By using these parameters 5 different sausages were analyzed and compared on to the standard technique. As shown in figure 1, the results obtained by the Sprint system showed good correlation with the reference methods.

Figure 1: Comparison of sprint and kjeldahl technique for boiled sausages:



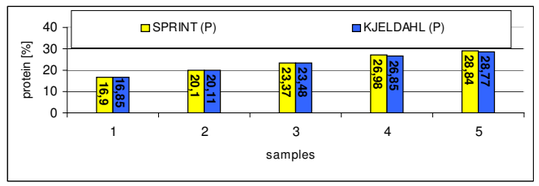
cooked sausage. — The protein content of this special kind of sausage is between 17 and 22 percent. For this protein content a sample weight of 0,7 to 0,8 gram was found to be optimal. As shown in figure 2, results obtained by the sprint method are in good correlation with standard methods.

Figure 2: Comparison of sprint and kjeldahl technique for cooked sausages:



raw sausage. — The protein content of this special kind of sausage is between 16 and 29 percent. The weighted in quantity ranged from 0,4 to 0,5 gram.
The rough fibrous character of the samples initially caused problems because of homogenity issues. This problem could be solved by using the CryoMill (Retsch) for sample pre-treatment. As shown in figure 4, results obtained by the sprint method are in good correlation with standard methods.

Figure 4: Comparison of sprint and kjeldahl technique for raw sausages:



milk and milk products. — All sorts of milk products (milk, yoghurt, pot etc.) and cheese were examined. The protein content ranged from 1 to 11 percent for milk products and 16 to 30 percent for cheese products. A weighted in quantity of 1,5 to 2,2 gram for milk products and 0,7 to 0,8 gram for cheese products was used. A homogenization time of 90 seconds and a settling time of 90 seconds was found to be optimal in this case.
By using these parameters 5 different milk products and 5 different cheese places were analyzed and compared to the standard technique. As shown in figure 4 and 5, the results obtained by the Sprint system showed good correlation with the reference method.

Figure 4: Comparison of sprint and kjeldahl technique for milk products:

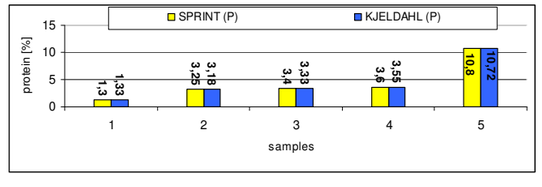
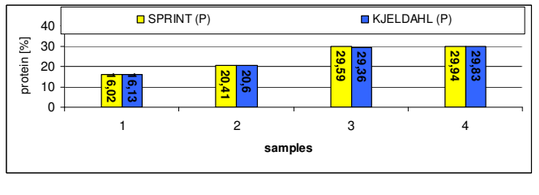
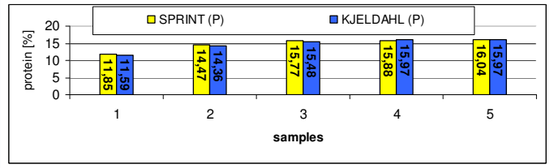


Figure 5: Comparison of sprint and kjeldahl technique for cheese:



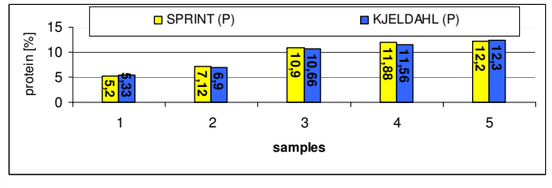
ready cooked meats. — Analyzing the protein content with Sprint™ a good agreement could be accomplished also here. At first, an optimal originally weighted in quantity could be determind of 1 to 1,2 gram. The homogenization and the settling time is the same as in the other methods. If one compares the analysis with the data of Kjeldahl, a good agreement to be found also here (figure 6).

Figure 6: Comparison of sprint and kjeldahl technique for ready cooked meats:



soy meat products. — Depending on different protein content an originally weighted quantity is used here from 1 to 1,2 gram. The homogenization time is only 90 seconds and the settling time is 90 seconds.
By using these parameters 5 different soy products were analyzed and compared to the standard technique. Satisfactory agreement was obtained (figure 7)

Figure 7: Comparison of sprint and kjeldahl technique for soy products:



Conclusion

The results show good agreement of the sprint method with the standard kjeldahl protein determination. The SPRINT method is much faster and easier to execute. The three types of sausage, ready cooked meat, milk products etc. can be easily determined. SPRINT is a new method technology and iTAG is completely nontoxic.

The analyzer is an important development in protein testing and is capable to become the method of choice for the next decades.

References

(1) Reprinted from American Laboratory, October 2008
(2) Proteinbestimmung mit iTAG – Steuerung der laufenden Produktion, 2008, Sengutta, DMW 17, 635 - 636
(3) Taschenbuch der Chemie, Thieme Verlag, 2006