

Nitrogen & protein determination in meat

SpeedDigester K-439, Kjell Line and MultiDist:

Nitrogen and protein determination in meat according to the Kjeldahl method with Kjeldahl tablets and H₂O₂

1. Introduction

An easy and reliable method for the determination of total nitrogen and protein in various meat types, according to Kjeldahl is introduced below. The samples are digested using the SpeedDigester K-439 using Kjeldahl Titanium Tablets in combination with H₂O₂. A steam distillation protocol followed by a suitable boric acid titration is performed with the MultiKjel together with the Metrohm Eco Titrator. Coupling the new MultiKjel system and the Eco Titrator results in excellent performance with ease and speed of the analysis.

2. Experiment

Sample:

Kochschinken 20-01d LVU (13.677 ± 0.2132 g/100 g), Salami (labelled protein content 24 %), Bratwurst (Grill sausage) (labelled protein content 12%)

Equipment:

MultiKjel coupled with Metrohm EcoTitrator (11K36531210), BasicKjel (1K36521110), EasyKjel (11K36511020)

Procedure:

Weigh homogenized samples and reference substance in a nitrogen free paper boat. Add 15 ml Conc. H₂SO₄ and 2 Titanium Kjeldahl tablets. (For H₂O₂ assisted digestion refer to Table 1) Distillation parameters are as presented in Table 2. (For detailed procedure please refer to AN753/2021)

Table 1. Digestion parameters on SpeedDigester K-439

Step	Standard Kjeldahl digestion		H ₂ O ₂ assisted accelerated digestion	
	Temperature [°C]	Time [min]	Temperature [°C]	Time [min]
Preheating	350	0	400	0
1	420	10	420	10
2	490	90	450	10
3	-	-	490	45
Cooling	-	35	-	35
Total Time	-	135	-	90

Table 2. Distillation and titration parameters on Kjell Line

Parameter	After standard Kjeldahl digestion	After H ₂ O ₂ assisted digestion
H ₂ O Volume	60mL	50mL
NaOH Volume	63mL	45mL
Distillation Time	180s	180s
Titration Type	Boric Acid Titration	Boric Acid Titration
H ₃ BO ₃ Volume	60 mL (4%)	60 mL (4%)
Sensor type	Potentiometric (pH)	Potentiometric (pH)
Endpoint pH	4.65	4.65
Titrant	H ₂ SO ₄ 0.1mol/L	H ₂ SO ₄ 0.1mol/L

3. Results

The results correspond well to the certified reference values with low relative standard deviations All measured recovery rates for reference standard Glycine were within specifications (Recoveries ≥ 98 %, RSD ≤ 1 %, n=3).

Table 3: Determined protein contents (rsd in brackets, n=5).

Product	Labelled protein content [g/100 g]	Protein content [g/100 g]	Digestion method	Kjel Line instrument
Kochschinken (cooked ham)	13.677±0.213	13.699 (0.58%)	Standard Kjeldahl	MultiKjel
Salami	24	28.950 (0.81%)	Standard Kjeldahl	MultiKjel
Bratwurst (grill sausage)	12	11.371 (0.50%)	Standard Kjeldahl	MultiKjel
Kochschinken (cooked ham)	13.677±0.213	13.845 (0.56%)	H ₂ O ₂ assisted	MultiKjel
Bratwurst (grill sausage)	12	11.362 (0.87%)	Standard Kjeldahl	BasicKjel
Bratwurst (grill sausage)	12	11.940 (0.21%)	Standard Kjeldahl	EasyKjel

4. Conclusion

The determination of nitrogen and protein in meat-products using the SpeedDigester K-439 and Kjell Line systems provides reliable and reproducible results. These results correspond well to the certified reference-values with low relative standard deviations. On coupling with Eco-Tirator, MultiKjel systems offer easy automation without any manual handling after distillation and titration. Distillation with BasicKjel/EasyKjel followed by separate titration provides a cost-friendly alternative with equally quantitative results. Digestion time can be reduced to half by H₂O₂ assisted digestion protocol.

5. References

Kjeldahl Optimizer App, AN753/2021, Operation Manual Kjell Line, Operation Manual Dist Line