Supelco®
Analytical Products

Application Note

Chloride in Meat and Sausage Products

Photometric determination using the iron(III)/mercury thiocyanate method after extraction

Introduction

Sodium chloride is one of the most widely used additives in meat and sausage production, where it contributes to flavor, texture, protein solubilization, water-holding capacity, and microbial stability. Beyond its technological roles, salt levels in processed meats are also of public health importance, as excessive sodium intake is strongly associated with hypertension, cardiovascular disease, and other chronic health conditions.[1] The World Health Organization (WHO) has consistently emphasized the need to reduce dietary sodium intake, and the meat industry has been under increasing regulatory and consumer pressure to monitor and reduce salt levels in processed products.[2] Accurate determination of sodium chloride is therefore essential not only for product quality but also for compliance with labeling requirements and dietary health guidelines.

Although the analytical target is sodium chloride, official reference methods quantify chloride ions as the marker for salt content. The Association of Official Analytical Chemists specifies chloride determination as the standard approach, with AOAC 971.27 (Chloride in Meat Products) and related methods providing validated protocols for this purpose.[3] Chloride determination remains the regulatory benchmark for salt analysis in meat and sausage products, ensuring consistency and comparability across laboratories.[2,3]

Spectrophotometric determination of chloride offers a practical alternative to classical titrimetric methods such as the Mohr and Volhard procedures. Compared with titration, spectrophotometric assays provide improved sensitivity, reduced sample handling, and faster throughput, making them highly suitable for routine laboratory and industrial quality control. Their use enables accurate monitoring of sodium chloride addition in meat matrices, thereby ensuring compliance with food safety regulations, supporting product standardization, and contributing to ongoing efforts to reduce dietary sodium exposure.[2,3]

Experimental

Method

After aqueous extraction and Carrez clarification the chloride ions from the sample react with mercury(II) thiocyanate to form slightly dissociated mercury(II) chloride. The thiocyanate released in the process in turn reacts with iron(III) ions to form red iron(III) thiocyanate that is determined photometrically.

Measuring Range

Spectroquant® Chloride Cell Test (**1.14730**)	Test kit	5–125 mg/L Cl^-
	Method	1.65–41.25 g/kg NaCl
Spectroquant® Chloride Test (**1.14897**)	Test kit	2.5–250 mg/L Cl^-
	Method	0.825–82.5 g/kg NaCl

Applicable Sample

Meat and Sausage Products

Reagents, Instruments and Materials

Reagents & Test Kits

- Spectroquant® Chloride Cell Test (**1.14730**) or
- Spectroquant® Chloride Test (**1.14897**)
- Sodium hydroxide solution 1 mol/L (**1.09137**)
- Carrez Clarification Kit (**1.10537**)
- Water for analysis (**1.16754**)

Instrument(s) & Devices

For the measurement one of the following Spectroquant® photometers is necessary

- Spectroquant® VIS Spectrophotometer Prove 100 plus (**1.73026**)
- Spectroquant® UV/VIS Spectrophotometer Prove 300 plus (**1.73027**)
- Spectroquant® UV/VIS Spectrophotometer Prove 600 plus (**1.73028**)
- Spectroquant® Colorimeter Move 100 (**1.73632**)

This application note pertains to the above listed photometers and all discontinued instruments from the Spectroquant® Nova and Prove series.

Software for Data transfer

- Optional Spectroquant® Prove Connect to LIMS software package (**Y.11086**) to transfer your data into an existing LIMS system.

Instrument Accessories

- Rectangular cells 10 mm (**1.14946**)

Note: Rectangular cells are only necessary if the Spectroquant® test **1.14897** is used.

Other Reagents and Accessories

- Standard laboratory glassware (e.g. Erlenmeyer flasks) and pipettes
- Analytical balance
- Ultra Turrax
- pH-Meter
- Heating bath
- Folded filters

Analytical Procedure

Sample preparation

In an Erlenmeyer flask weigh, exactly as to 1 mg, 10 g of the sample and mix with about 80 mL water for analysis. With the Ultra-Turrax homogenize the mixture for 60 s. With 50 mL hot water for analysis rinse the shaft of the homogenizer into the flask, adding it to the mixture. Then adjust the pH-value of the solution to 7–7.2 with sodium hydroxide solution 1 mol/L, using the pH-meter, and heat for 15 minutes in a bath of boiling water, while occasionally shaking.

After cooling down to room temperature quantitatively transfer the prepared sample into a 200 mL volumetric flask and successively mix it with 2 mL Carrez solution 1 and 2 at a time. With rich in connective tissue products use 4 mL Carrez solution 1 and 2 respectively. Shake after each addition. Then fill up to volume with water and, after mixing, filter through a folded filter. Discard the first filtrate, dilute the residual clear filtrate 1:10 with water for analysis in the volumetric flask and use it for determination (=pretreated sample).

Using Cat. No. 1.14897: Procedure and measurement

For more information on the measurement see the packaging insert of the test

Procedure (Measuring range 2.5–25.0 mg/L Cl^-)

- Pipette 5.0 mL pretreated sample in a test tube.
- Add 2.5 mL reagent Cl-1 with a pipette and mix.
- Add 0.50 mL reagent Cl-2 with a pipette and mix.
- **Leave to stand for exactly 1 min (reaction time)**, then fill the sample into a 10 mm cell, and measure **immediately** in the photometer.

Procedure (Measuring range 10–250 mg/L Cl^-)

- Pipette 1.0 mL sample solution in a test tube.
- Add 2.5 mL reagent Cl-1 with a pipette and mix.
- Add 0.50 mL reagent Cl-2 with a pipette and mix.
- **Leave to stand for exactly 1 min (reaction time)**, then fill the sample into a 10 mm cell, and measure **immediately** in the photometer.

Measurement

- **The color of the measurement solution remains stable for only a short time**.
- It is recommended to zero the method for each new working day. To do this, open the method by inserting the barcode, tap the <Settings> button and select the <ZERO ADJUSTMENT> menu item. Fill the same cell which will be used for the sample measurement with distilled water. After prompting, insert the filled rectangular cell into the cell compartment. The zero adjustment is performed automatically. Confirm the performance of the zero-adjustment procedure by clicking on <OK>.
- After the zero adjustment, fill the measurement sample into the same or a matched rectangular cell and insert the cell into the cell compartment. The measurement starts automatically.
- Read off the result in mg/L from the display.

Hint: The above written measurement description is only valid for the Spectroquant® Prove (plus) series photometer. If a Nova 60A or a Move 100 is used, please consult the corresponding instrument manual for more details on how to perform the measurement.

Using Cat. No. 1.14730: Procedure and measurement

For more information on the measurement see the packaging insert of the test.

Procedure

- Pipette 0.50 mL reagent Cl-1K into a reaction cell, close the cell, and mix.
- Add 1.0 mL pretreated sample with a pipette, close the cell, and mix.
- Measure the sample **immediately** in the photometer.

Measurement

- It is recommended to zero the method each new working day. To do this, open the method, either by manually selecting the method or by inserting a barcoded cell. Tap the <Settings> button and select the <ZERO ADJUSTMENT> menu item. After prompting, insert the 16 mm zero cell through the corresponding opening. The zero adjustment is performed automatically. Confirm the performance of the zero-adjustment procedure by clicking on <OK>.
- After the zero has been performed, insert the barcoded Spectroquant® round cell through the corresponding opening, ensuring that the white position mark on the cell is aligned with the positioning mark on the spectrophotometer. The measurement starts automatically.
- Read off the result in mg/L from the display.

Hint: The above written measurement description is only valid for the Spectroquant® Prove (plus) series photometer. If a Nova 60A or a Move 100 is used, please consult the corresponding instrument manual for more details on how to perform the measurement.

Calculation

Sodium chloride content in mg/kg
NaCl = analysis value in mg/L Cl^- x 330

Analytical quality assurance

Analytical Quality Assurance (AQA) is recommended before each measurement series.

To check the photometric measurement system (test reagent, measurement device, handling) and the mode of working, chloride standard solutions (see section 5 of the respective test kit instruction) or Spectroquant® CombiCheck 10 and 20 or 60, respectively can be used. Besides a **standard solution** with 25 mg/L Cl (CombiCheck 10) or, respectively, 60 mg/L Cl (CombiCheck 20), or respectively 125 mg/L Cl (CombiCheck 60) these articles also contain an **addition solution** for determining sample-dependent interferences (**matrix effects**).

To view additional notes, visit **SigmaAldrich.com/qa-test-kits**.

References

1. World Health Organization. Guideline: Sodium intake for adults and children. Geneva: WHO; **2012**
2. Piñeiro S, Fulladosa E, Gou P. Recent advances in sodium reduction strategies in meat products. Trends Food Sci Technol. **2022**;122:77-89. DOI:**10.1016/j.tifs.2022.01.010**
3. AOAC International. Official Method 971.27: Chloride in meat products. Official Methods of Analysis of AOAC International. 18th ed. Gaithersburg (MD): AOAC International; **2005**

Featured Products

Description	Cat. No.
Reagent and Test Kits	
Spectroquant® Chloride Cell Test	**1.14730**
Spectroquant® Chloride Test	**1.14897**
Instruments and Accessories	
Spectroquant® VIS Spectrophotometer Prove 100 plus	**1.73026**
Rectangular cells 10 mm	**1.14946**
Reagents	
Sodium hydroxide solution c(NaOH) = 1 mol/L (1 N) Titripur® Reag. Ph Eur, Reag. USP	**1.09137**
Carrez Clarification Kit reagent kit for sample preparation in food analysis, 5-fold	**1.10537**
Water for analysis EMSURE®	**1.16754**

Related Products

Description	Cat. No.
Instruments	
Spectroquant® UV/VIS Spectrophotometer Prove 300 plus	**1.73027**
Spectroquant® UV/VIS Spectrophotometer Prove 600 plus	**1.73028**
Spectroquant® colorimeter Move 100	**1.73632**
Instruments and Accessories	
Spectroquant® CombiCheck 10	**1.14676**
Spectroquant® CombiCheck 20	**1.14675**
Spectroquant® CombiCheck 50	**1.14696**
Spectroquant® Chloride standard solution, 10.0 mg/L Cl	**1.32229**
Spectroquant® Chloride standard solution, 50 mg/L Cl	**1.32230**

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