Application Note AN-T-133

Chloride in milk and milk powder

Fully automated determination according to ISO, IDF, and AOAC standards

To maintain product quality, the sodium chloride content in dairy products must be monitored and not exceed the limits defined by the respective public health authorities. The chloride content in food correlates with the salt content, its determination is therefore described in various norms and standards. However, preparation of such samples is time consuming, as it includes a chloride extraction with warm water. Whole milk powders in particular are difficult to handle as an inhomogeneous dispersion of fat in the titration suspension occurs.

In order to reduce the workload, increase sample throughput, and eliminate the matrix challenges posed by high fat products, this Application Note presents a fully automatic potentiometric titration of chloride with silver nitrate in milk and milk powder based on ISO 21422, IDF 242, AOAC 2015.07, AOAC 2015.08, and AOAC 2016.03.

SAMPLE AND SAMPLE PREPARATION

The method is demonstrated for different milk and milk powders: toddler and whole milk powder, milk, salted dairy beverage (e.g., ayran, doogh), and protein shake. All samples are well-mixed before use.

EXPERIMENTAL

This analysis is performed on an automated system consisting of an OMNIS Advanced Titrator and an OMNIS Sample Robot S equipped with a dProfitrode and a dAg-Titrode.

Warm water is added to a reasonable amount of sample. For samples with high fat content, some isopropanol is additionally added. The pH is adjusted with nitric acid to below pH 1.5. The sample is titrated with standardized silver nitrate until after the equivalence point. For automated rinsing of electrodes and burets, isopropanol is used.

Figure 1. OMNIS Sample Robot S, OMNIS Dosing Module and OMNIS Advanced Titrator equipped with dProfitrode and dAg-Titrode for the determination of chloride content.

RESULTS

The analysis demonstrates acceptable results and well-defined titration curves. The results are displayed in Table 1.

Table 1. Mean chloride content of various milk and milk powder products determined with an automated OMNIS system (n = 6).

	Chloride content in mg/100 g sample	SD(rel) in %
Whole milk powder	832.9	0.2
Toddler formula powder milk based	293.7	0.3
Salted dairy beverage	411.8	0.2
Protein shake	88.4	2.7
Organic milk	99.3	0.5

CONCLUSION

Titration is a precise and reliable method to determine the chloride content in dairy products according to various international standards.
Utilization of an OMNIS Sample Robot allows a fully automated determination of up to four samples in parallel, freeing up valuable time of the operator and thus increasing the productivity in the lab. The OMNIS system offers the opportunity to customize the system according to your needs, and expand it for other required titration applications on dairy products, such as the Ca / Mg content or acidity.

Internal reference: AW TI CH1-1264-112018

CONTACT

Metrohm AG
Ionenstrasse
9100 Herisau
info@metrohm.com

CONFIGURATION

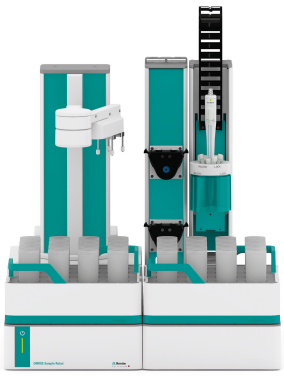
OMNIS Advanced Titrator without stirrer

Innovative, modular potentiometric OMNIS Titrator for endpoint titration and equivalence point titration (monotonic/dynamic). Thanks to 3S Liquid Adapter technology, handling chemicals is safer than ever before. The titrator can be freely configured with measuring modules and cylinder units and can have a stirrer added as needed. If required, the OMNIS Advanced Titrator can be additionally equipped for parallel titration with a corresponding software function license.

- Control via PC or local network
- Connection option for up to four additional titration or dosing modules for additional applications or auxiliary solutions
- Can be supplemented with magnetic stirrer and/or rod stirrer
- Various cylinder sizes available: 5, 10, 20 or 50 mL
- Liquid Adapter with 3S technology: Safe handling of chemicals, automatic transfer of the original reagent data from the manufacturer

Measuring modes and software options:

- Endpoint titration: "Basic" function license
- Endpoint and equivalence point titration (monotonic/dynamic): "Advanced" function license
- Endpoint and equivalence point titration (monotonic/dynamic) with parallel titration: "Professional" function license



OMNIS Sample Robot S Pick and Place

OMNIS Sample Robot S with a "Peristaltic" (2-channel) pump module and a Pick&Place module in addition to extensive accessories for the direct transition to fully automatic titration. The system provides space in two sample racks for 32 sample beakers of 120 mL each. This modular system is supplied completely installed and can thus be put into operation in a very short time.

The system can also be extended upon request to include two additional peristaltic pumps and another Pick&Place module, thus doubling the throughput. If additional workstations are required, then this Sample Robot is already able to be expanded to become an L-sized OMNIS Sample Robot, thus enabling samples from seven racks to be processed in parallel on up to four Pick&Place modules and quadrupling the sample throughput.

OMNIS Dosing Module without stirrer

Dosing module for connection to an OMNIS Titrator for extending the system to include an additional buret for titration/dosing. Can be supplemented with one magnetic stirrer or rod stirrer for use as separate titration stand. Freely selectable cylinder unit with 5, 10, 20 or 50 mL.

dAg Titrode

Digital, combined silver ring electrode for OMNIS with a pH glass membrane as reference electrode.
This maintenance-free electrode is suitable for precipitation titrations where the pH value remains constant (titrant silver nitrate), e.g. of

- Chloride, Bromide, Iodide
- Sulfides
- Hydrogen sulfide
- Mercaptans
- Cyanides

This electrode is stored in distilled water.
dTrodes can be used on OMNIS Titrators.

Profitrode (length 12.5 cm)

Combined pH electrode with double-junction construction, installation length 11.3 cm. This electrode is suitable for pH measurements/titrations of samples:

- that contaminate the reference system of the electrode (e.g., galvanic baths, samples containing sulfides)
- for which potassium chloride c(KCl) = 3 mol/L cannot be used as reference electrolyte (e.g., reaction of potassium or chloride with sample)

The electrode is equipped with a flexible ground-joint diaphragm which is insensitive to contamination and which can be replaced when needed.

When c(KCl) = 3 mol/L is used as bridge electrolyte, storage in storage solution is recommended.
The bridge electrolyte can be easily replaced with a suitable electrolyte (e.g., potassium nitrate c(KNO_3) = 1 mol/L (6.2310.010)), storage in the used bridge electrolyte.
The Profitrode is available in other lengths under the following article numbers:
- 6.0255.110: Length 17.8 cm
- 6.0255.120: Length 31.0 cm