Application Note AN-T-133

牛奶和奶粉中的氯化物

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

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CONFIGURATION

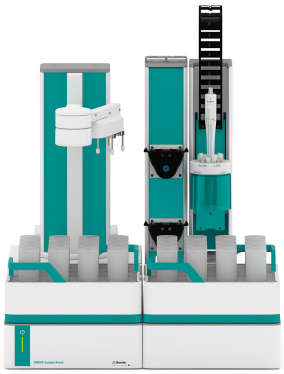
OMNIS Advanced Titrator

创新型、模块式电位分析 OMNIS Titrator 滴定仪,用于进行终点和等当点滴定(单一/动态)。由于采用 3S 试剂瓶适配器技术,处理化学品很安全。可以使用测量模块和计量管单元自由配置滴定仪,并在需要时扩展一台搅拌器。在需要时可以通过相应的软件功能许可证为平行滴定升级 OMNIS Advanced Titrator。

- 通过计算机或本地网络控制
- 可以为其他应用或辅助溶液另外连接四个滴定模块或加液模块
- 可以扩展磁力搅拌器和/或螺旋搅拌器
- 可提供不同大小的计量管:5、10、20 或 50 mL
- 采用 3S 技术的试剂瓶适配器:安全处理化学品,自动传输生产商的原始试剂数据

测量模式和软件选项:

- 终点设定滴定:“Basic” 功能许可证
- 终点和等当点滴定(单一/动态):“Advanced” 功能许可证
- 终点和等当点滴定(单一/动态),包括平行滴定:“Professional” 功能许可证



OMNIS Sample Robot S Pick and Place

OMNIS Sample Robot S 具有一个“蠕动”泵模块(2 通道)和一个 Pick&Place 模块以及大量附件,可直接进入全自动滴定。此系统具有两个样品盘位置,可用于 32 个 120 mL 的样品盘。此模块化系统供货时已完全安装完毕,因此可在极短时间内投入运行。

该系统也可根据需要扩展配备另外两台蠕动泵以及多加一个 Pick&Place 模块,由此使通量翻倍。如果需要更多工作台,则可将此 Sample Robot 扩展为 L 规格款型的 OMNIS Sample Robot,由此可使七个样品盘的样品在多达四个 Pick&Place 模块上并行处理,将样品通量扩大四倍。

OMNIS Dosing Module

用于与 OMNIS Titrator 滴定仪相连的加液模块,以扩展额外用于滴定/加液的滴定管。可以扩展磁力搅拌器和/或螺旋搅拌器,以作为单独的滴定台使用。可自由选择 5、10、20 或 50 mL 计量管单元。

dAg Titrode

带 pH 玻璃膜的 OMNIS 用数字组合式银环形电极,用作参比电极。

该免维护电极适用于 pH 值恒定的沉积滴定(硝酸银滴定剂),例如:

- 氯化物、溴化物、碘化物
- 硫化物
- 硫化氢
- 硫醇
- 氰化物

该电极存放在蒸馏水中。

dTrodes 可在 OMNIS Titratoren 上使用。

Profitrode 12.5 cm

带双结系统的组合 pH 电极,安装长度 11.3 cm。此电极适用于样品的 pH 测量/滴定,

- 污染传感器的参比系统(例如,浴液、含硫化物的样品)
- 其中氯化钾 c(KCl)= 3mol / L 不能用作参比电解质(例如,钾或氯化物与样品的反应)

此电极配备了可以抵抗污染的灵活磨口隔膜,如有必要可以更换。

当使用 c(KCl) = 3 mol / L 作为外参比液电解质时,建议在保存液中储存。

中间电解质可以用合适的电解质(例如硝酸钾 $c(KNO_3)$ = 1 mol/L (6.2310.010))代替。存储在用过的电解质中。

以下物品编号的 Profitrode 有更多长度的版本可供选购:

- 6.0255.110:长度 17.8 cm
- 6.0255.120:长度 31.0 cm