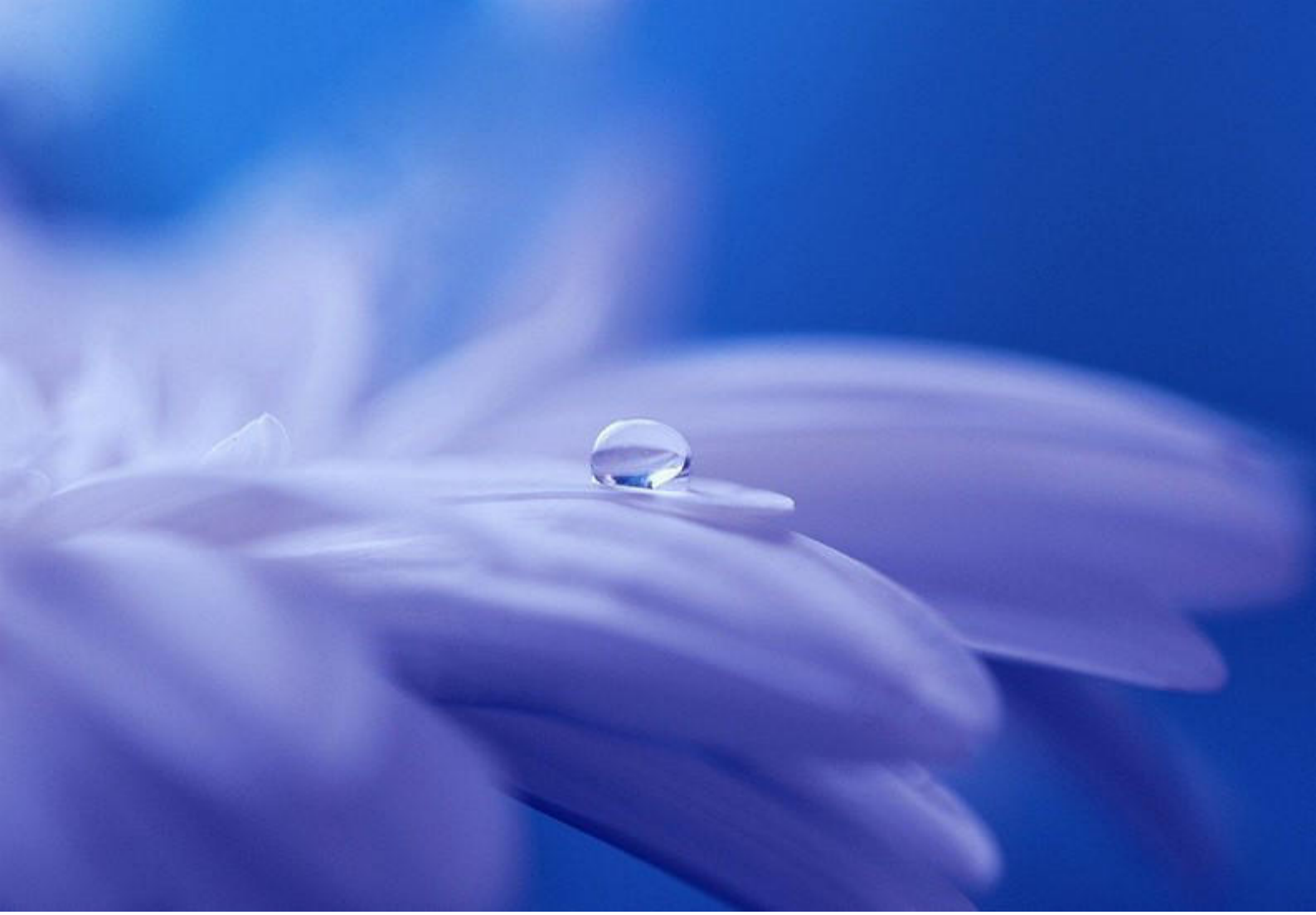

Application Note AN-T-131

水中的钙、镁和总硬度

Automated determination using the Cu-ISE and two different titrants

Water hardness is often determined photometrically using two different indicators and while performing the determination at two different pH values. This requires significant time to accurately adjust the pH. The determination itself is subjective, as the color change is determined by the analyst and not by an analytical device, which can cause differences between different analysts.

This application note introduces a more robust option to easily assess calcium, magnesium, and total hardness in water by using the Cu-ISE and two different titrants. Sample preparation is identical for both analyses and can therefore be automated without any issues. The Cu-ISE is also easy to handle. Additionally, the analysis is no longer subjective and both the precision and repeatability of the results are improved.

This application is demonstrated on tap water from Herisau, Switzerland. It contains quite a high amount of calcium and magnesium ions naturally.

No sample preparation is required for this analysis. For the analysis itself, approximately 100 mL tap water is needed for each application.

EXPERIMENTAL

The analyses are carried out on an 815 Robotic USB Sample Processor XL in combination with a 907 Titrando and the ***tiamo***™ software. For indication, a Cu-ISE in combination with a Long Life ISE reference electrode is used.

Two determinations need to be performed. During the first titration with EDTA, the sum of calcium and magnesium is measured, whereas with the second titration with EGTA, only the calcium is analyzed. From this difference, the magnesium hardness can be calculated. A small amount of either a Cu-EDTA or Cu-EGTA solution is added for the indication of the equivalence point in both titrations.

Figure 1. Titrando system consisting of an 815 Robotic USB Sample Processor XL in combination with a 907 Titrando.

RESULTS

Sharp titration curves with a large potential difference are obtained for both analyses. The results are reproducible as displayed in **Table 1**.

Table 1. Results of the determination of the total, the calcium and the magnesium hardness (n = 5).

	Mean value / mmol/L	SD(abs)/ mmol/L	SD(rel) in %
Total hardness	3.517	0.020	0.57
Ca hardness	2.547	0.012	0.47
Mg hardness	0.971	0.009	0.94

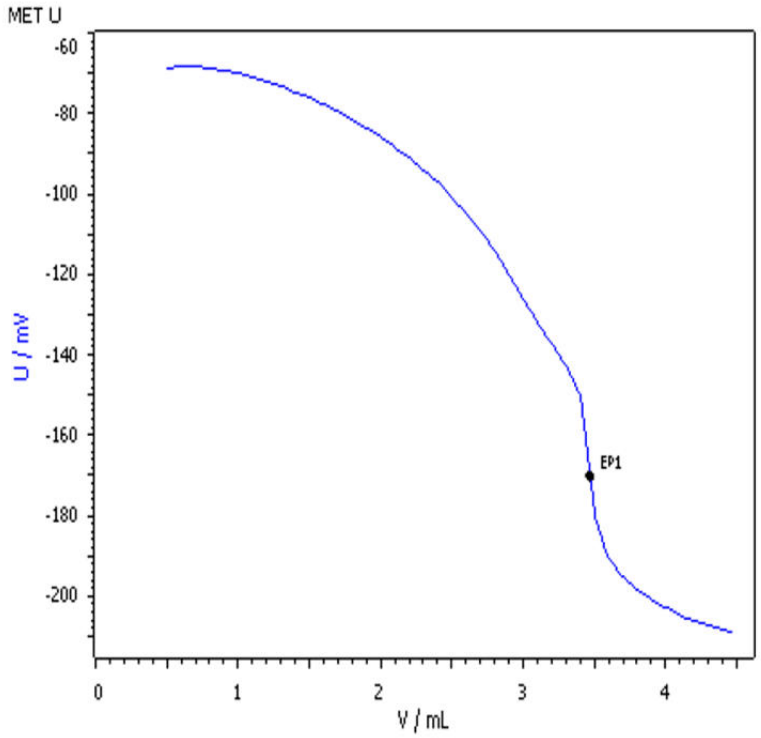

Figure 2. Example titration curve with EDTA for the total hardness determination in a sample of Herisau tap water.

CONCLUSION

This application shows the possibility of an objective, fast and reliable determination using the Cu-ISE. The Cu-ISE is easy to handle, and its surface can be easily polished as soon as performance decreases, resulting in a refreshed surface.

As both analyses are performed with the same instruments and electrodes, they are easily automated. The automation leads to precise and reproducible results. Even more time can be saved if the analyses are carried out on an OMNIS sample robot where parallel analyses are possible.

Internal reference: AW TI CH1-1163-022014

CONTACT

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CONFIGURATION

907 Titrando

用于使用两个测量接口和 Dosino 加液单元电位分析和容量卡尔·费休滴定法滴定的电位滴定仪。

- 多达四套 800 Dosino 加液系统
- 动态(DET)、等量(MET)和终点滴定(SET),酶和 pH-STAT 滴定(STAT)、卡尔·费休容量滴定(KFT)
- 智能电极“iTrode”
- 使用离子选择性电极测量(MEAS CONC)
- 带监控的加液功能,LQH
- 用于其他搅拌器或加液器系统的四个 MSB 接口
- USB 接口
- 使用 OMNIS-Software、*tiamo*-软件或 Touch Control
- 如果需要,满足 GMP/GLP 和 FDA 要求,比如 21 CFR 第 11 部分

815 Robotic USB Sample Processor XL (1T/2P)

Robotic USB Sample Processor XL 包括一个工作站和两台内置的隔膜泵,可用于自动处理大量常规样品系列以及完成复杂样品前处理或并列处理流程。还可再连接多达三台加液器用来进行 LQH 加液处理。

由于其应用范围很广,因此必须根据具体应用来选择合适的样品盘、搅拌器、滴定头、机械臂和 Swing Head 以及样品容器并单独订购。

通过 Touch Control 实现单机控制。 有以下 PC 控制用软件产品可供选择: 滴定软件 tiamoTM、色谱分析软件 MagIC Net、伏安法软件 viva 或 OMNIS。

Cu

具有晶体膜的铜选择性电极。

这种 ISE 必须搭配参比电极使用,并且适用于:

- Cu2+ 的离子测量(10-8 至 0.1 mol/L)
- 小样品体积的离子测量(最小浸没深度为 1 mm)
- 用 CuEDTA 进行络合滴定

得益于 EP 材质的坚固/不易破碎的塑料杆,该传感器可以承受较高的机械载荷。

使用随供的抛光套件,可以轻松清洁和更新电极表面。

LL ISE

带双结系统的银/氯化银参比电极。

该参比电极特别适用于:

- 自动化应用
- 离子测量
- 表面活性剂滴定

对污染不敏感的磨光隔膜提供了稳定和具有重现性的电解质流出。此外,参比电解质确保了更好的信号稳定性。c(KCl) = 3 mol/L 的传感器作为中间电解质交付,但是可以根据具体用途自由对其进行选择和更换。