

Calcium, magnesium, and total hardness in water

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.

SAMPLE AND SAMPLE PREPARATION

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

EXPERIMENTAL

The analyses are carried out on an 815 Robotic USB Sample Processor XL in combination with a 907 Titrande and the *tiamo*TM 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.

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

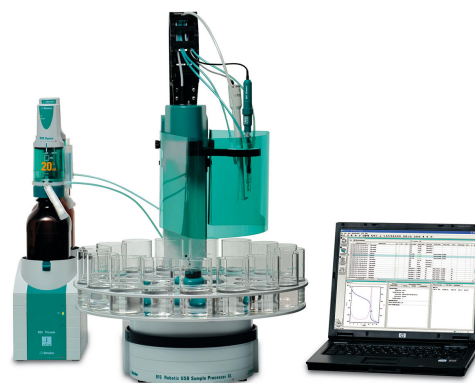


Figure 1. Titrande system consisting of an 815 Robotic USB Sample Processor XL in combination with a 907 Titrande.

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

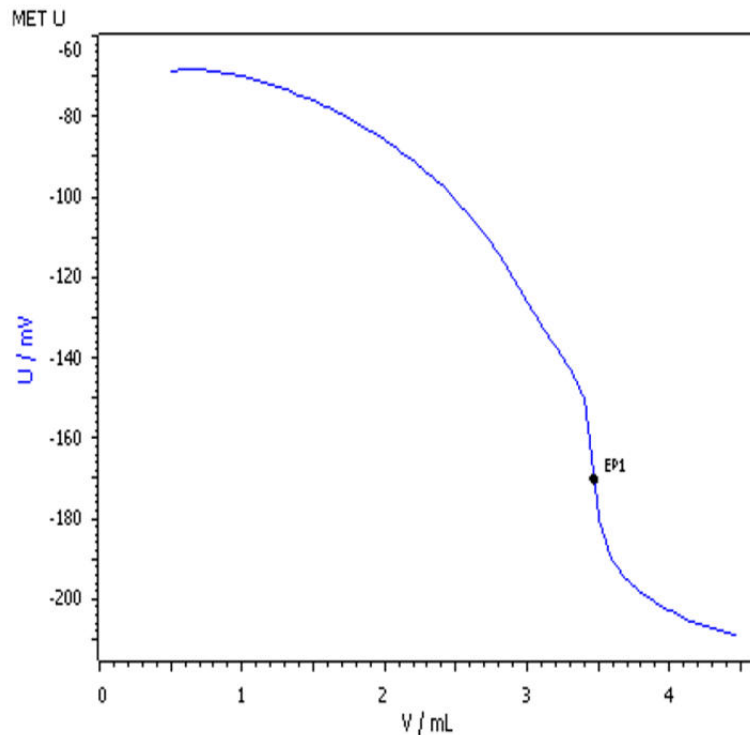


Figure 2. Example titration curve with EDTA for the total hardness determination in a sample of Herisau tap water.

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.

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CONFIGURATION



907 Titrando

用于使用个量接口和 Dosino 加液元位分析和容量·休滴定法滴定的高端滴定。

- 多四套 800 Dosino 加液系
- (DET)、等量(MET)和点滴定(SET),和 pH-STAT 滴定(STAT)、·休容量滴定(KFT)
- 智能“iTrode”
- 使用子性量(MEAS CONC)
- 控的加液功能,LQH
- 用于其他拌器或加液器系的四个 MSB 接口
- USB 接口
- 使用 OMNIS-Software、*tiamo*件或 Touch Control
- 如果需要,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 包括一个工作站和台内置的隔膜,可用于自理大量常品系列以及完成品前理或并列理流程。可再接多三台加液器用来行 LQH 加液理。

由于其用范很广,因此必根据具体用来合的品、拌器、滴定、机械臂和 Swing Head 以及品容器并独。通 Touch Control 通 "stand alone" 控制。有以下 PC 控制用件品可供: 滴定件 *tiamo*TM、色分析件 MagIC Net、伏安法件 *viva* 或 OMNIS。



Cu

具有晶体膜的性质。

ISE 必搭配参比使用,并且用于:

- Cu^{2+} 的子量(10^{-8} 至 0.1 mol/L)
- 小品体的子量(最小浸没深度 1 mm)
- 用 CuEDTA 行合滴定

得益于 EP 材的固/不易破碎的塑料杆,感器可以承受高的机械荷。

使用随供的抛光套件,可以松清和更新表面。



LL ISE

双系的/化参比。

参比特用于:

- 自化用
- 子量
- 表面活性滴定

染不敏感的磨光隔膜提供了定和具有重性的解流出。

此外,参比解保了更好的信号定性。 $c(\text{KCl}) = 3 \text{ mol/L}$ 的传感器作中解交付,但是可以根据具体用途自由其行和更。