Conductivity, pH value, alkalinity, and hardness in tap water

Fully automated determination including sample preparation

The analysis of tap water plays an important role to assess the water quality or to identify its possible contamination. Parameters such as conductivity, pH value, alkalinity, and water hardness are routinely analyzed.

In this application note, a fully automated system is presented which allows the determination of several parameters according to various standards within one analysis. These include conductivity (ISO 7888, EN 27888, ASTM D1125, EPA 120.1), the pH value (EN ISO 10523, ASTM D1293, EPA 150.1), alkalinity (EN ISO 9963, ASTM D1067, EPA 310.1), and Ca/Mg content (ISO 6059, ASTM D1126, EPA 130.2). Additionally, the system transfers the required sample volume into an external titration vessel for the analysis, reducing manual sample preparation. Furthermore, all sensors can be automatically calibrated and the titer of each titrant can also be determined.

This high degree of automation minimizes errors and guarantees outstanding reproducibility by freeing up valuable time for operators.

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SAMPLE AND SAMPLE PREPARATION

The method is demonstrated for a tap water sample. No sample preparation is required as the system automatically transfers the defined sample volume to the external titration cell after conductivity measurement.

EXPERIMENTAL

This analysis is carried out automatically on an 815 Robotic USB Sample Processor XL in an external titration vessel which is equipped with an iAquatrode plus and a combined Ca-ISE. The samples are poured into beakers and then placed onto the rack. First, the conductivity measurement is performed directly in the beaker using a 5-ring conductivity measuring cell with integrated temperature sensor. Afterwards a sample aliquot is transferred into the external titration vessel, the pH measurement is taken, and then the alkalinity titration is performed using standardized HCl solution. Then, the pH value is adjusted via addition of TRIS buffer, and the sample is titrated with standardized EDTA titrant until after the second equivalence point. Finally, cleaning of the titration vessel and sensors is carried out automatically.

The pH electrode and the conductivity measuring cell are calibrated prior to the analysis.

Figure 1. 815 Robotic USB Sample Processor XL with external titration vessel, 905 Titrando, and 856 Conductivity Module equipped with iAquatrode plus, combined Ca-ISE and 5-ring conductivity measuring cell for the analysis of tap water.

RESULTS

The system enables reproducible results for all analyzed parameters. The overall analysis time for one sample is less than 15 minutes. All results are summarized in Table 1.

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Table 1. Analyzed parameters for tap water (n = 10).

Parameter	Mean	SD(rel) in %
Conductivity	524.7 µ S/cm	0.82
pH value	7.81	0.54
p-value	N/A	N/A
m-value	5.8 mmol/L	0.12
Calcium	88.8 mg/L	0.22
Magnesium	19.9 mg/L	1.4
Total hardness	3.9 mmol/L	0.4

CONCLUSION

The high degree of automation for water analysis allows an increase in sample throughput, minimizes errors, and guarantees outstanding reproducibility. As the presented system includes sample preparation capabilities, the sample only needs to be placed in a beaker onto the rack, and the system runs all analyses (conductivity, pH value, alkalinity, and water hardness) autonomously.

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CONFIGURATION

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 tiamoTM、色分析件 MagIC Net、伏安法件 viva 或 OMNIS。

856 Conductivity Module

率量模作有 Titrando 系的展或作《独立》与 900 Touch Control 一起使用。通 856 Conductivity Module 模即可定和温度也可定溶解固体和度。它支持最新技的五。
 Conductivity Module 有 2 个 USB 接口,用于接打印机、条形取器或自器,以及 4 个 MSB 接口用于接拌器或 Dosino。
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。

905 Titrando

用于使用 Dosino 加液系通个量接口位分析滴定的高端滴定。
  - 多四套 800 Dosino 加液系
  - 等当点滴定(DET)、等量等当点滴定(MET)和点定滴定(SET)
  - 使用子性量(MEAS CONC)
  - 控的加液功能,LQH
  - 用于外拌器或加液器系的四个 MSB 接口
  - 智能"iTrode"
  - 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

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5 c= 0.7 cm-1 Pt1000

池常数的 5 c = 0.7 cm^{-1} (指数),集成有温度探 Pt1000 和固定 (1.2 m),用于接到 856 率模上。

感器用于量中等的率(5 µS/cm 至 20 mS/cm),例如:

- 用水
- 地表水
- 水

iAquatrode Plus Pt1000

集成了感器数据存芯片和 Pt1000 温度感器的用于在子含量低的含水介(例如,用水、工用水)中行 pH 量/滴定的数字合 pH 。在些品中示出非常快的反。

固定磨口隔膜染不敏感。

当使用 c(KCl) = 3 mol / L 作中解,建在存溶液中存。

中解可以用不含子的解(例如,硝酸 c(KNO$_3$) = 1 mol/L (6.2310.010))代替。存在用的解中。

iTrodes 可用于 Titrando,Ti-Touch 或 913/914 米。

Ca

聚合物膜的合式性。

 ISE 用于:

- 水性溶液中 Ca2+ 的子滴定(5*10-7 至 1 mol/L)
- 合滴定()滴定(例如:定水硬度)

得益于固/易碎的聚丙塑料杆和高分子膜片,感器可以承受高的机械荷。

使用的参考解液 c(NH$_4$NO$_3$) = 1 mol/L。

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