



Application Note AN-T-074

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.

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 Titrande, 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**.

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

Parameter	Mean	SD(rel) in %
Conductivity	524.7 $\mu\text{S}/\text{cm}$	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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