Metrohm

Comprehensive and fully automated water analysis

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Summary

The analysis system described here combines titration, ion chromatography and direct measurement in a single analytical unit. It has been especially developed for automated drinking water analysis but can be adapted to suit any number of analytical requirements in food, electroplating or pharmaceutical industries. The emphasis has been placed on user-friendly operation, variable sample vessel volumes and protection of the samples from environmental interferences. A detailed description of the setup is given as are results obtained by analyzing tap water from Herisau (Switzerland) using TitrIC 4.

The problem

Water contamination is a widespread environmental problem. Every year some 700 million tons of waste enter the aqueous systems and thus reduce our already limited freshwater resources. Highly effective monitoring tools are required for assessing the occurrence, the fate, and the environmental impact of contaminants.

The system setup of TitrIC 4

The system consists of the following instruments:
- 881 Compact IC pro with sequential suppression
- 815 Robotic USB Sample Processor XL with sample rack 59 x 120 mL
- 809 Titrando
- 856 Conductivity Module
- 802 Rod stirrer
- 800 Dosinos

Flow sheet and characteristics of TitrIC 4
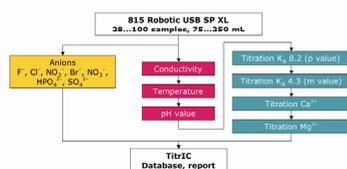
Direct measurement, titration and ion chromatography are incorporated in one system. The determination of ionic components in water samples includes direct measurement of temperature, conductivity and pH. The acid capacity and the concentration of calcium and magnesium are determined titrimetrically. Anions are quantified by ion chromatography.

Titration curves – tap water from Herisau
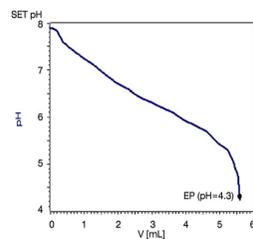
- Aquatrode Plus pH electrode
- 0.1 mol/L HCL for p and m values
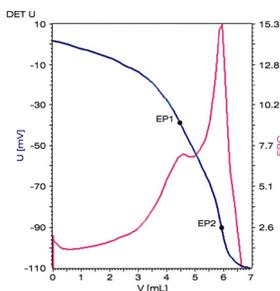
- Polymer membrane electrode Ca-ISE
- 0.05 mol/L EDTA for Ca/Mg titration
- 0.2 mol/L TRIS, 0.1 mol/L acetyl-acetone for Ca/Mg titration

	pH value	m value [mmol/L]	T [°C]	Cond. [µS/cm]	Ca²⁺ [mg/L]	Mg²⁺ [mg/L]
Mean valueᵃ	6.76	5.65	20.16	590.7	82.66	17.26
Standard deviation	0.01	0.01	1.34	9.2	1.11	0.40
RSD [%]	0.13	0.13	6.65	1.6	1.34	2.34

ᵃmean value of ten determinations

Chromatogram – tap water from Herisau

	Fluoride	Chloride	Nitrate	Sulfate
Mean valueᵃ [mg/L]	0.05	8.76	10.63	5.41
Standard deviation	0.01	0.03	0.04	0.02
RSD [%]	4.69	0.30	0.34	0.38

ᵃmean value of ten determinations
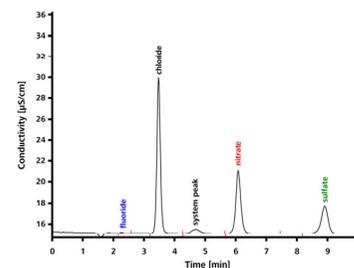
Column:	Metrosep A Supp 5 - 100/4.0
Eluent:	3.2 mmol/L Na₂CO₃/1.0 mmol/L NaHCO₃
Flow:	0.8 mL/min
Loop volume:	20 µL
Suppressor solutions:	100 mmol/L H₂SO₄/H₂O (ultrapure)

Data management with TitrIC

- The user-friendly software combines the ***tiamo***™ and MagIC Net™ software packages. Various methods and sequences can be freely combined.
- All results are centrally stored in a single Lims-compatible database.
- The software includes the unique possibility of calculating ion balances.
- The software can automatically perform a daily backup.

TitrIC means flexibility

TitrIC 6
- permits the direct measurement of temperature, conductivity and pH value as well as the titrimetric determination of p and m values.
- allows the ion chromatographic determination of all cations, including Ca and Mg, as well as of all anions.
- includes a Sample Processor with «DisCover» function for the automatic removal of covers from sealed sample vessels.

Common features
- Additional titrators can be added or existing titration methods modified.
- The range of ions to be determined can be easily extended.
- Different sample preparation techniques (dilution or ultra-filtration) can be integrated.

TitrIC 7
- allows the direct measurement of temperature, conductivity and pH value as well as the titrimetric determination of p and m values.
- facilitates the ion chromatographic determination of all cations, including Ca and Mg, as well as of all anions. Before the analysis, particle-containing samples are treated with Metrohm Inline Ultrafiltration to remove particles.