DETERMINATION OF INORGANIC CATIONS IN WATER SAMPLES

INTRODUCTION

The method allows determination of ammonium, lithium, sodium, potassium, magnesium, calcium, and strontium and barium cations in samples of natural, potable and wastewater by the capillary electrophoresis method.

MEASURING METHOD

The capillary electrophoresis method for evaluation of cations concentration is based on differential migration and separation of cations in electric field due to the difference in their electrophoretic mobility. Identification and quantitative determination of the analyzed cations is performed by indirect detection measuring UV absorption at 254 nm wavelength.

CONCENTRATION RANGES

Ranges of measurable concentrations for analyzed cations are given in the table.

Cations	Samples	Measurement range, mg/l
Ammonium	Potable, natural and waste water	0.5–5000
Lithium		0.015–2.0
Sodium		0.5–5000
Potassium		0.5–5000
Magnesium		0.25–2500
Calcium		0.5–5000
Strontium		0.5–50.0
Barium		0.05–5.0

Injection of samples with sodium concentrations above 200 mg/l results in distortion of ammonium and potassium peaks' shapes, which, however, does not influence quantitative evaluation of their concentrations.

EQUIPMENT AND REAGENTS

The following equipment and reagents are used in measurements:

- The CAPEL® Capillary Electrophoresis System with high-voltage positive polarity;
- Reference cation standard solutions: K (1 mg/ml), NH_4^+ (1 mg/ml), Na (1 mg/ml), Li (1 mg/ml), Mg (1 mg/ml), Ca (1 mg/ml), Sr (1 mg/ml), Ba (1 mg/ml);
- Distilled water;
- Tartaric acid, Analytical Grade;
- Benzimidazole, High Purity Grade;
- 18-Crown-6, Analytical Grade;
- Sodium hydroxide, Ultra Pure Grade;
- Hydrochloric acid, Ultra Pure Grade.

Data acquisition, collection, processing and output are performed using a personal computer running under WINDOWS® 98/ME/NT/2000/XP operating system with installed Chrom&Spec® software package for acquisition and processing of chromatography data.

PREOPERATIONAL PROCEDURES

Preoperational procedures include: sampling and preparation of samples, capillary conditioning, preparation of auxiliary and calibration solutions and calibration of the CAPEL® Capillary Electrophoresis System.
Samples of natural, potable or waste water should be collected in compliance with ISO 5667 Standard. Volume of the sample should be at least 100 ml. The taken sample (no less than 50 ml) should be filtered through a cellulose-acetate filter; the first portion of the filtrate must be discarded. The sample must be analyzed within 24 hours.

The system is calibrated by measuring signals of calibration solutions. Stability of the calibration characteristics is checked directly before sample measurement by recording an electrophoregram of one of the calibration mixtures.

MEASUREMENT PROCEDURE

No less than two specimens should be analyzed for each sample queued. If the measured cation concentrations exceed the upper limit of the calibration curve, it is necessary to pre-dilute the sample with distilled water.

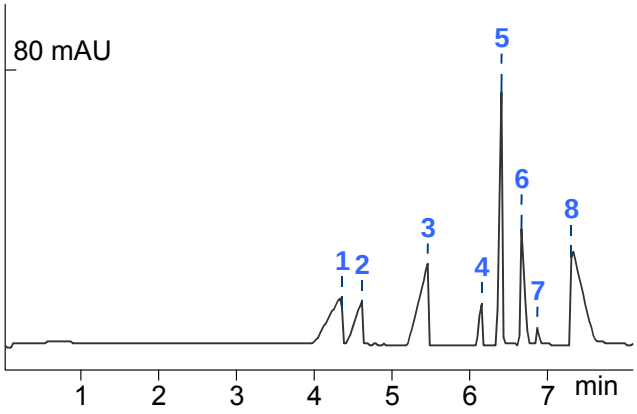
DATA PROCESSING

Chrom&Spec® software outputs a report of concentrations (in mg/l) of analyzed cations of NH_4^+, Li, Na, K, Mg, Ca, Sr, and Ba in the analyzed solution.

EXAMPLE OF REAL ANALYSIS

Buffer: 6 mM Benzimidazole,
2.5 mM Tartaric acid,
2.0 mM 18-Crown-6
Capillary: L_{EFF}/L_{TOTAL} 50/60 cm,
ID 75 µm.
Injection: 150 mbar*s.
Voltage: +13 kV
Detection: 254 nm, indirect

Sample: test solution
1 – NH4 (50 mg/l)
2 – K (50 mg/l)
3 – Na (50 mg/l)
4 – Li (2,0 mg/l)
5 – Mg (25 mg/l)
6 – Sr (50 mg/l)
7 – Ba (5,0 mg/l)
8 – Ca (50 mg/l)



Sample: waste water, diluted 1:3
Measurement results:
1 – K (13,86 мг/дм^3)
2 – Na (183 мг/дм^3)
3 – Mg (54,40 мг/дм^3)
4 – Sr (0,99 мг/дм^3)
5 – Ca (128 мг/дм^3)