



DETERMINATION OF IONIC COMPOSITION OF WATER IN BREWING PROCESSES BY CAPILLARY ELECTROPHORESIS

INTRODUCTION

Determination of ionic composition of water is an important factor in brewing processes, as inorganic ions affect fermentation and, as a result, the taste of the finished product. Determination of ionic composition of water has been usually performed using ion chromatography (IC). In recent years, capillary electrophoresis (CE) has been shown to provide fast and reliable results for these measurements.

MEASUREMENT METHOD

The capillary electrophoresis method for determination of inorganic ions' concentrations is based on differential migration and separation of ions (cations and anions) in the electric field due to different electrophoretic mobility. Identification and quantitative determination of the analyzed ions is performed by indirect detection by measuring the UV absorption.

MEASUREMENT RANGE

Ranges of measurable concentrations for analyzed cations and anions are presented in the table.

Anions	Measurement range, mg/L	Cations	Measurement range, mg/L
Chloride	0.5–20000	Ammonium	0.5–5000
Fluoride	0.1–25	Barium	0.05–5.0
Nitrate	0.2–100	Calcium	0.5–5000
Nitrite	0.2–100	Lithium	0.015–2.0
Phosphate (as hydrophosphate)	0.25–100	Magnesium	0.25–2500
Sulfate	0.5–20000	Potassium	0.5–5000
		Sodium	0.5–5000
		Strontium	0.5–50.0

If the mass concentration of an ion in an analyzed sample exceeds the upper limit of the measurement range, it is allowed to dilute the sample.

EQUIPMENT AND REAGENTS

The "CAPEL[®]" capillary electrophoresis system with high-voltage positive and negative polarity is used in measurements.

Data acquisition, collection, processing and output are performed using a personal computer running under "WINDOWS[®] 2000/XP" operating system with installed dedicated software package for acquisition and processing of chromatography data.

All reagents must be of analytical grade or better.

EXAMPLES OF REAL ANALYSES

Anions content

Buffer: chromate, with DEA and CTA-OH

Capillary: L_{EFF}/L_{TOTAL} 50/60 cm, ID 75 µm

Injection: 300 mbar x sec

Voltage: – 17 kV

Detection: 254 nm, indirect

Sample: potable water

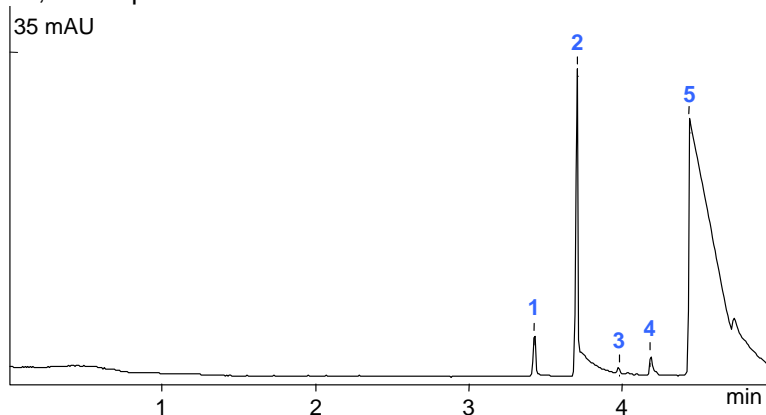
1 – chloride (4.35 mg/L)

2 – sulfate (27.5 mg/L)

3 – nitrate (0.85 mg/L)

4 – fluoride (0.65 mg/L)

5 – hydrocarbonate

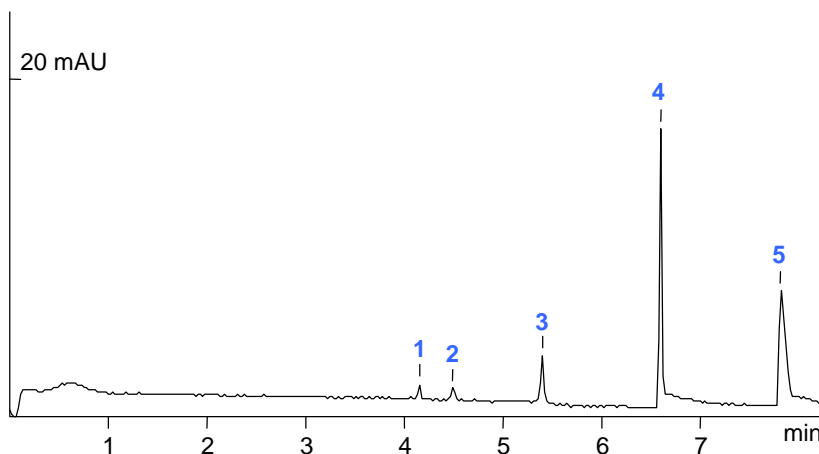




Cations content

Buffer: benzimidazole solution, with tartaric acid and 18-crown-6
Capillary: L_{EFF}/L_{TOTAL} 50/60 cm, ID 75 µm
Injection: 150 mbar x sec
Voltage: + 13 kV
Detection: 254 nm, indirect

Sample: potable water
1 – ammonium (0.5 mg/L)
2 – potassium (1.20 mg/L)
3 – sodium (1.81 mg/L)
4 – magnesium (3.38 mg/L)
5 – calcium (6.07 mg/L)



Other beer components, which can be determined by capillary electrophoresis method are as follows:

- Organic acids (formic acid, acetic acid, and others),
- Hop and beer bitter acids,
- Amino acids,
- Vitamins (B group, ascorbic acid),
- Amines,
- Preservatives and coloring agents in finished products

ADVANTAGES OF CAPILLARY ELECTROPHORESIS

Compared with ion determination in beer samples by IC method, capillary electrophoresis has several advantages:

- High separation efficiency
- Low analysis cost
- Absence of an expensive chromatographic column
- Short analysis time

The contents on this paper are subject to change without notice.