DETERMINATION OF INORGANIC CATIONS IN WINES, BRANDIES, BRANDY ALCOHOLS, AND WINEMAKING RAW MATERIALS

INTRODUCTION

The method enables fast determination of inorganic cations: ammonium, sodium, potassium, calcium, and magnesium in the samples of wines, brandies, brandy alcohols, and raw materials by capillary electrophoresis.

MEASURING METHOD

Capillary electrophoresis (CE) method for the determination of inorganic cations is based on their differential migration in a narrow quartz capillary under the influence of the applied electric field. Identification and quantitative determination of cations is performed in the indirect mode by measuring the UV absorbance at 254 nm wavelength.

CONCENTRATION RANGES

Range of measurable concentrations for all cations is **1–100 mg/l**. If the concentration of one or several cations is higher than the upper limit of this range, it is acceptable to dilute the sample by distilled water, however by no more that 20 times.

CONFIRMATION OF THE AUTHENTICITY OF WINES, WINE MATERIALS, BRANDY, AND COGNAC SPIRITS

Determination of inorganic cations and subsequent comparison of the resulted data with that of standard samples of wines, wine materials, brandies and brandy alcohols enables the confirmation of the authenticity of the studied sample.

Range of concentrations of inorganic cations typical for wines, wines materials and brandy alcohols of the South of Russia (*Yakuba et al., 2002*)

Cations	Concentration range, mg/l	
	Wine and wine materials	Brandies and brandy alcohols
Ammonium	1–80	< 1.5
Potassium	400–1100	0.5–40
Sodium	10–90	10–40
Magnesium	30–150	0.5–5
Calcium	30–180	1–5

In case if the upper limit of the range for any of cations is exceeded, the wine or wine material can be considered as authentic but with a tendency to become feculent within the warranty time. If the amount of potassium is less than 400 mg/l, the sample is considered as diluted by water–ethanol mixture. Decreased concentrations of other cations may be caused by the features of manufacturing process. Wine must be considered as fully false if cations' concentrations are less than 10 mg/l. Brandy and brandy alcohols must be considered as fully false, if the samples don't contain the inorganic cations.

EQUIPMENT AND REAGENTS

The following equipment and reagents are used in measurements:

- CAPEL® Capillary electrophoresis system with high voltage unit of positive polarity
- Cation standard solutions (1 mg/l for each cation)
- Distilled water
- Tartaric acid
- Benzimidazole
- 18-Crown-6
- Sodium hydroxide
- Hydrochloric acid

Reagents must be of analytical grade or better.

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

Preparation should include the following steps:

- sampling and sample pre-treatment
- preparation of solutions
- calibration of the CE system
- capillary conditioning

Sampling is done according to the existing protocol. The sample volume must be not less than 50 ml. Analysis must be performed within 24 hours after sampling. Prior to analysis all samples must be centrifuged at 6000 rpm for 5 min.

Calibration of the CE system is done by measuring the signal of the standard solutions. The stability of calibration is controlled prior to the sequence of analysis by performing the analysis of one of the calibration solution.

MEASUREMENT PROCEDURE

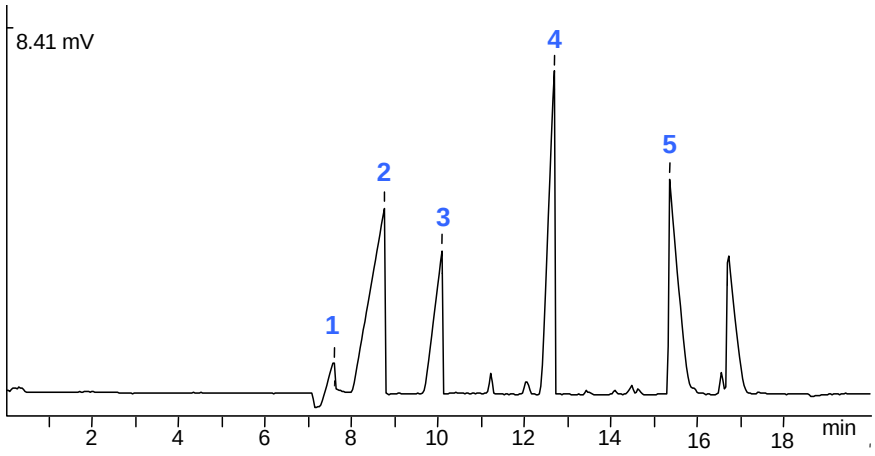
No less than two aliquot specimens should be analyzed for each sample. Sample dilution must be done prior to analysis if the measured concentrations of cations are higher then the upper limit of the calibration.

DATA PROCESSING

Data analysis is done by the Chrom&Spec® software. Results are expressed as a customized report where concentrations of all analyzed cations in mg/ml are listed.

EXAMPLE OF REAL ANALYSIS

Sample: wine sample (Krasnodar region, Russia)
Buffer: 4.2 mmol tartaric acid,
3.3 mmol 18-crown-6,
10 mmol benzimidazole
Capillary: L_{EFF}/L_{TOTAL} 50/60 cm,
ID 75 µm
Injection: 150 mbar x sec
Voltage: +10 kV
Detection: 254 nm, indirect



Measurement results:
1 – Ammonium (21 mg/l)
2 – Potassium (518 mg/l)
3 – Sodium (37 mg/l)
4 – Magnesium (52 mg/l)
5 – Calcium (79 mg/l)