Application Note AN-D-002

# 酒中的子

## Streamlining beverage analysis with ion chromatography

Beverage analysis methods must be fast and robust to fulfill many quality control regulations. Optimal product quality is critical for consistent taste and other sensory characteristics in mass produced beverages.

In the case of beer, the ionic composition heavily influences the taste. For example, potassium chloride salts lead to a bitter, astringent, and soapy taste while magnesium sulfates form more sweet-sour flavors. Therefore, analytical control of anions and cations in beer is essential to guarantee the quality and meet consumer needs.

Major anions in beer are precisely determined with ion chromatography (IC) and suppressed conductivity detection, while cations are quantified with non suppressed conductivity. With a two-channel system, cations and anions can be determined simultaneously for the same sample. To reduce manual preparation steps, beer samples are automatically filtered with Inline Ultrafiltration. Features like automatic calibration and logical sample dilution streamline such beverage analyses and ensure the fast analysis of samples in high-throughput laboratories.

Beer samples from different providers (e.g., Warsteiner™) were automatically diluted and filtered through a 0.22 m membrane in the Ultrafiltration cell (**Figure 1**). Analyte concentrations outside of the calibration range are diluted with an optimal dilution factor and analyzed again with logical dilution, a feature of the chromatographic software MagIC Net. Hence, the results always fit within the calibration range.

After Inline Sample Preparation is performed, the sample is injected into two analytical channels that simultaneously analyze cations and anions under **isocratic elution** conditions (**Table 1**). Conductivity is a universal and sensitive detector to determine all relevant ions present in the beer sample. The MagIC Net software offers time-saving reliable calibration from a single standard solution by injecting increasing volumes on to the separation column (MiPT – Metrohm intelligent Partial Loop Injection Technique). This avoids pipetting errors during standard preparation. Furthermore, samples can be injected with the most suitable injection volume. Together with logical dilutions, sample concentrations in the range 1:10,000 can be analyzed reliably. High accuracy of results is achieved by an optimal fit for the calibration points (feature: high-low calibration).

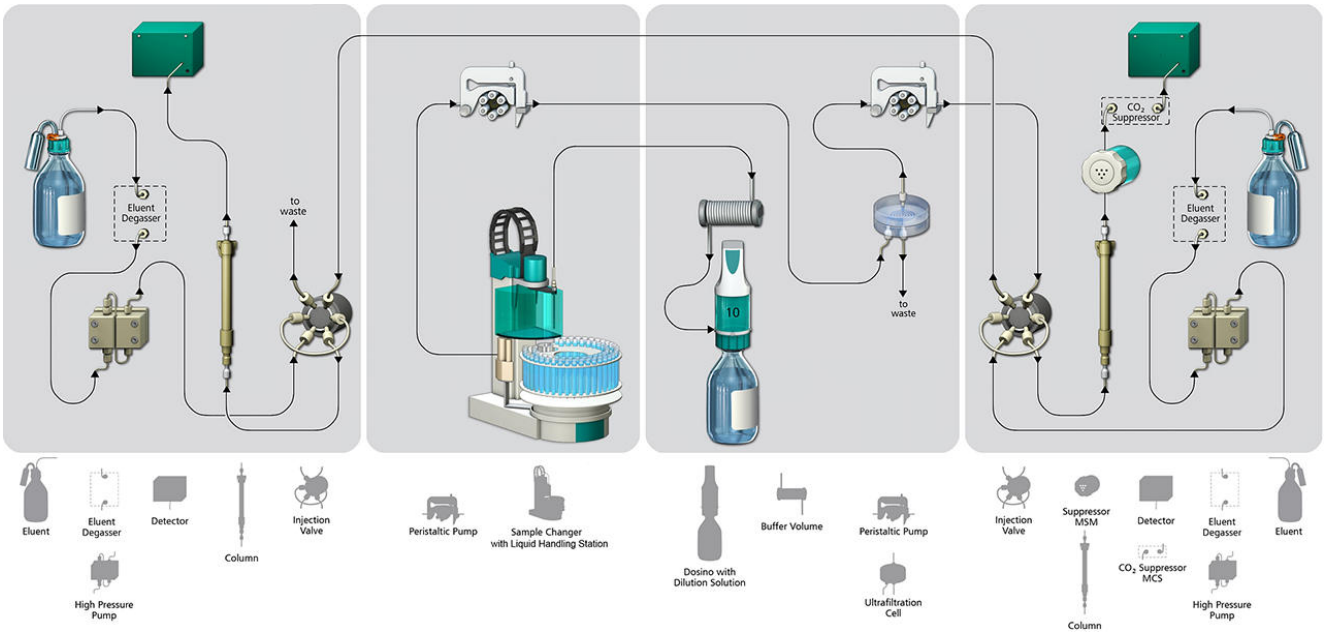


**Figure 1.** One autosampler (including filtration and dilution equipment) prepares the sample for two analysis channels such that anions and cations are determined in parallel from the same sample. The IC for cation analysis is displayed on the left side, and the IC used for anion analysis is shown on the right side.

**Table 1.** Measuring conditions for the determination of anions and cations in beer with ion chromatography.

| Method parameter | Anions | Cations |
|---|---|---|
| Column | Metrosep A Supp 10 - 100/4.0 | Metrosep C 6 - 150/4.0 |
| Eluent | 4 mmol $Na_2CO_3$ + 6.0 mmol/L $NaHCO_3$ + 5.0 µmol/L $NaClO_4$ | 2.3 mmol $HNO_3$ + 1.7 mmol/L dipicolinic acid |
| Flow rate | 0.7 mL/min | 0.9 mL/min |
| Temperature | 30 °C | 35 °C |
| Injection | 20 µL | 20 µL |
| Detection | Suppressed conductivity | Non-suppressed conductivity |

## RESULTS

Potassium was identified as a major cation in all beer samples, while the concentration of other cations (e.g., $Na^+$, $Ca^{2+}$, and $Mg^{2+}$) was lower than 100 mg/L (**Figure 2**). The results reveal the effect of $K^+$ in beer, as it provides a bitter and astringent taste. Other ions such as ammonium (eluting between $Na^+$ and $K^+$) can also be determined.

Chloride, phosphate, nitrate, and sulfate were the main anions detected in beer (**Figure 2**). Sulfite, a common preservative, can be determined next to other anions in the same run (retention time approximately 11 minutes).

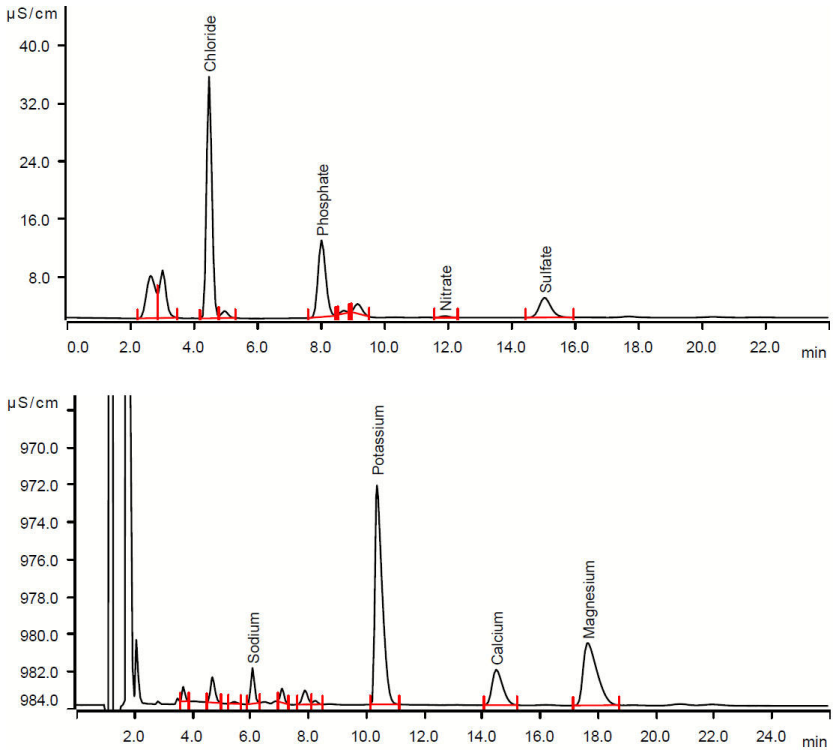


**Figure 2.** Analysis of a Warsteiner Pils sample (10-fold dilution) containing chloride (229 mg/L), phosphate (352 mg/L), nitrate (5 mg/L), and sulfate (60 mg/L) as major anions (top), and sodium (13 mg/L), potassium (365 mg/L), calcium (53 mg/L), and magnesium (56 mg/L) as major cations (bottom).

## CONCLUSION

Ion chromatography is a robust and straightforward analytical technique to monitor beer production and to control its quality. Beverage samples are automatically diluted and filtered prior to analysis to protect the analytical system. All essential anions and cations are simultaneously quantified in one analysis run. Features like logical dilution further save time and reduce manual work.

Internal reference: AW IC BE6-0113-092015

## CONTACT

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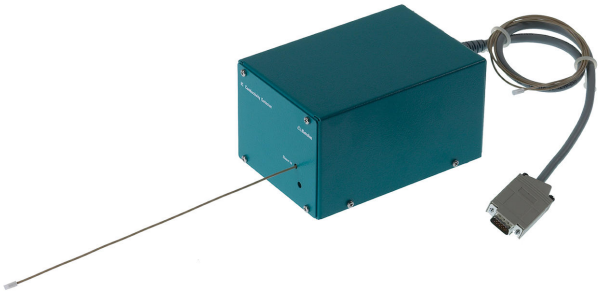
## CONFIGURATION

### 930 Compact IC Flex Oven/SeS/PP/Deg

930 Compact IC Flex Oven/SeS/PP/Deg 是智能型 Compact 子色器,有**柱加炉**、**序列抑制**和**蠕**用于抑制器再生,以及内置的**脱气装置**。器可使用各分和方法。典型的用范:

- 子或子定,序列抑制法及



### IC Conductivity Detector

用于智能型子色的智能型高性能器。不凡的温度定性,受保的器端子板内的整个信号理程以及新一代的 DSP(数字式信号理)均能保量的准性。功于工作范,无需行范更(也不是自行)。

### Metrosep A Supp 10 - 100/4.0

Metrosep A Supp 10 - 100/4.0 分柱基于高容量聚乙/二乙共聚物,其粒大小 4.6 µm。分柱具有基数高、性大的特点。无需添加有机改性便可在淋洗液中可靠地分硫酸和硫酸。此外,分柱具有柱温、流速和淋洗液成活性高的属性。

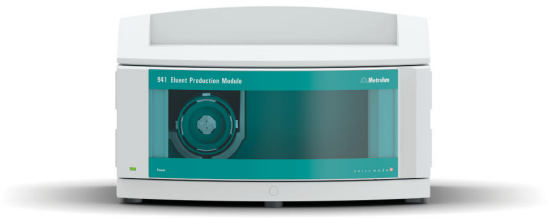
它固、性价比越且分效率好,同其所需的色分析中,些特点使 Metrosep A Supp 10 - 100/4.0 成可通用的子分柱。

### Metrosep C 6 - 150/4.0

高容量的 C 6 材料使分柱 Metrosep C 6 - 150/4.0 成在度差很高的正常保留内分准子的解决方法。可用此柱定含量很高的用水。

### 858 Professional Sample Processor

858 Professional Sample Processor 可理体在500 µL 至 500 mL 之的品。行品移,既可以使用 850 Professional IC System 上的蠕、也可通 800 Dosino 来行。



### 941 Eluent Production Module

941 Eluent Production Module ，, MagIC Net


### 800 Dosino

800 Dosino ,/


### MSM A

,MSMIC

858 Professional Sample Processor800 Dosino
741 Magnetic Stirrer