Ion Chromatography-Mass Spectrometry (IC-MS)

- Survey analysis
- Anions / cations
- Trace to main components

Ion Chromatography offers a unique possibility to detect anions as well as cations. This involves the separation of ions in an aqueous solution using a special ion-exchange column. Both inorganic and organic ions can be analyzed. The highly sensitive technique delivers a quick and quantitative overview of groups of ions.

Philips Innovation labs

PHILIPS

A typical application

Ultra pure water is used in many processes. As the presence of ions can cause problems in different processes the water used is regularly analyzed.

To reach high sensitivities the sampled water is pre-concentrated on a concentrator column. When this column is introduced in the system, the ions from the concentrator column are stripped by the eluent. Subsequently the ions are separated in the analytical ion exchange column. After suppression and detection a chromatogram is obtained (Figure 1). The position of the peaks depends on charge and size of the ion and the chromatographic conditions. Quantitative information is obtained by comparing the peak areas with those of a calibration solution. Typical detection limits are given in table 1.

Philips Innovation labs
Material Analysis lab
offers a full range of analytical methods and expertise to support both research and manufacturing, serving customers by taking an integral, solution-oriented approach.

World-class expertise – working for you

For more information:
Phone: +31 40 27 40455
E-mail: innovationlabs@philips.com
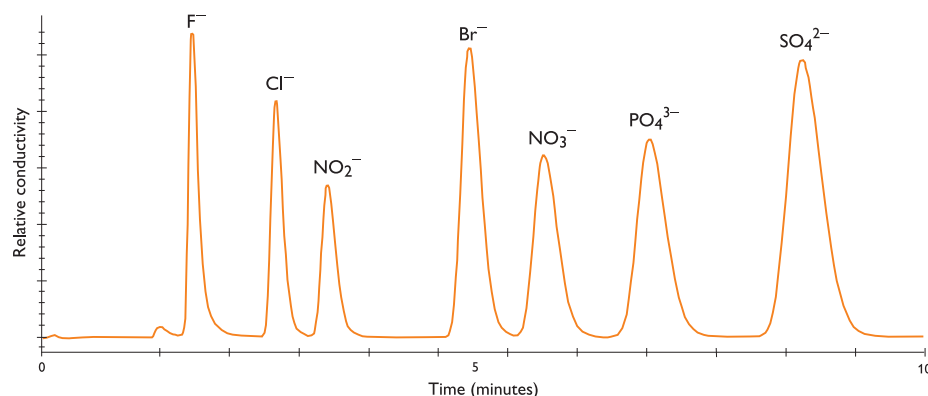www.innovationlabs.philips.com

Principle of technique

A sample is introduced into a mobile phase (eluent) via an injection loop or a concentrator column. A concentrator column strips ions from a measured volume of an aqueous sample, concentrating the analyte species and lowering the detection limits by 2-5 orders of magnitude. Subsequently, the sample is pumped with the eluent through an analytical ion-exchange column. The sample ions each have their characteristic affinity towards the mobile phase and ion-exchange materials. As a result the ions will travel with different velocities through the analytical column. The various ions are therefore separated in time and detected one by one with a conductivity, wavelength or mass spectrometer detector. Mass Spectrometry is increasingly used in combination with Ion Chromatography as it eliminates interferences and provides mass information. This makes it possible to analyze more complex samples. When the mass spectrometry data are analyzed using chemometric tools it is possible to quantify the final dataset.

Applications

- trace ions in ultra pure water
- air pollution (acid and basic vapours)
- leachable ions
- air samples of exhaust pipes, cleanrooms, ovens, production facilities
- saccharine, laurylsulfate in permalloy baths
- Cl and F in ceramic powders
- Cl, F and S in organic solids and liquids (packing materials, oils, thin layers)
- ions in galvanic baths, ELCO liquids, cooling liquids
- polyphosphates in cleaning baths

Table 1: detection limits of 5 ml water after pre-concentration.

ion	Detection limit in ng/ml (ppb)
Cl^-	0.005
NO_2^-	0.010
PO_4^{3-}	0.030
NO_3^-	0.030
SO_4^{2-}	0.010
Na^+	0.005
K^+	0.005

Characteristics

Information
- survey analysis of anions and cations

Sample type
- solids after dissolution, leaching, combustion (Wickbold or Schöninger) or pyrohydrolysis
- liquids
- gasses after absorption
- inorganic and organic materials

Sample quantity
- 1 mg solid, 1 ml liquid depending on concentration

Detection limit
- in liquids µg/ml - pg/ml
- in gasses pptv
- leaching below 10^{-12} molecules

Accuracy
- 3% relative

Precision
- 2% relative

Destructive
- yes

Routine analysis
- yes

Fig.1: Survey analysis of anions.

PHILIPS

Philips Innovation labs