Determination of Carbonate anions in Water

- Simple and intuitive analysis
- Reliable performance
- Efficient system for daily ion analysis
- Method modification

Ion exchange chromatography (IEC) with conductivity detection is the most useful simultaneous determination method for common anions such as halides, nitrate, nitrite, phosphate, sulfate and for some organic acids. But there are some limits in the separation or/and detection of carbonic acid (H_2CO_3) with the IEC. On the other hand, accurate determination of carbonic acid (or other inorganic carbon species, e.g., carbon dioxide, hydrogen carbonate and carbonate) is very important in water purification, environmental and biological research. Water is used so widely in many fields, such as drinking water, power plants, heating systems, and oil fields. Carbonic acid together with other anions in water will erode the pipelines or form scale in the pipelines, which may reduce the instrument efficiency. So, it is important to analyze these anions before resolving these problems.

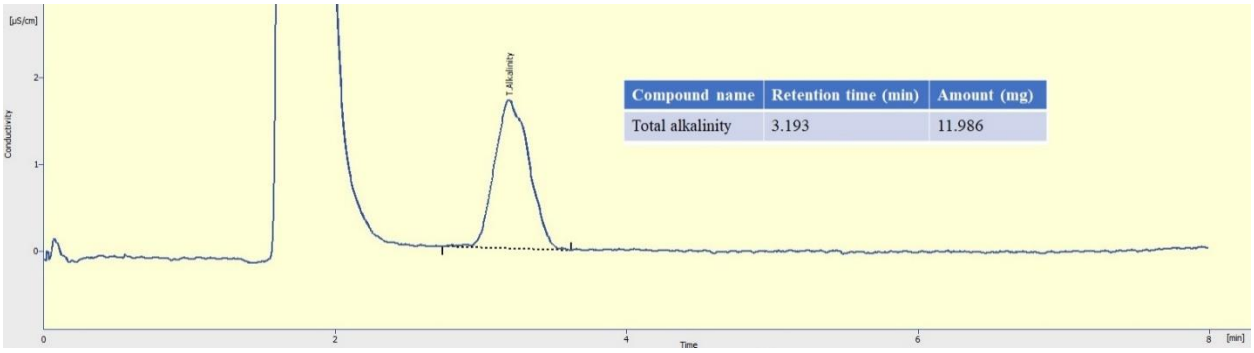
The insufficient detection sensitivity in IEC is a limit for the determination of low-level carbonic acid in the environment water samples due to the weak acidity of carbonic acid and the higher background conductivity of eluent. Suppressed IEC with higher sensitivity cannot be used to detect carbonic acid because carbonates are usually applied as the eluent. Non suppressed IEC is able to separate carbonic acid, but the acidic eluents used commonly depress the detection sensitivity of carbonic acid by suppressing its ionization. Furthermore, on an IEC column, simultaneous separation of carbonic acid and other anions coexisting in the environmental water samples is difficult because the retention of carbonic acid is almost the same with weak acid anions such as fluoride and much weaker than the retention of multivalent anions such as sulphates. Among this, ion-exclusion chromatography (IEC) provides a more useful technique for the separation of organic and inorganic weak acids[1].

Ion-exclusion chromatography (IEX) is defined as a technique used to separate weak acids, amino acids, sugars, alcohols and other substances on an ion-exchange column. Because of Donnan exclusion (a pseudo-semi-permeable membrane around the ion-exchange resin), ionic material is excluded from the ion-exchange resin and passes quickly through the column. Non-ionic substances are not excluded and partition between the aqueous mobile phase and occluded water within the resin beads. Because of differing partitioning effects and van der Waals forces, non-ionic solutes are retarded by the column and separated. As an illustration of an ion-exclusion separation, inorganic and organic acids may be chromatographed on a cation-exchange resin. The strongest acids elute at the column void volume because they are highly ionized and are repelled

[1] Analytical sciences 2005, 21, 121

by the immobilized negative charge of the resin. Weaker acids exist largely in the unionized molecular form and are separated by partitioning between the mobile phase and the occluded solvent. When coupled with direct spectrophotometric detection at low wavelength, ion-exclusion chromatography yields excellent separations and relatively clean chromatograms for a wide variety of very complex sample matrices, such as urine, plasma, foods and beverages, and pharmaceuticals[2].

The **Alkalinity Analyser** from **ISS** is a specialized instrument designed to detect and quantify carbonate anions in Water.



Compound name	Retention time (min)	Amount (mg)
Total alkalinity	3.193	11.986

Fig.1 Carbonate in tap water using ion exclusion chromatography

[2] Principles and Practice of Modern Chromatographic Methods, 2004, 1-34