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## Introduction

Ion chromatography is a well-established analytical technique and is mainly used for the analyses of inorganic ions and small organic ions in aqueous samples. With regarding anion analysis, there are two major eluent systems: carbonate solution and hydroxide solution. Between the two, the hydroxide system is advantageous in achieving lower background level than carbonate system does, especially when used with a suppressed current detector.

Our newly developed an IC column, Shodex™ IC SI-36 4D, is compatible with hydroxide eluents. It provides improved selectivity for sulfite and sulfate ions. In addition to the analysis of standard inorganic ions such as fluoride, chloride, nitrite, bromide, nitrate, sulfate and phosphate ions, sulfite ion can also be separated within 30 min in an isocratic elution mode.

Features of the Shodex™ IC SI-36 4D and its applications are summarized in this poster.

## Shodex™ IC SI-36 4D

### Product Specifications

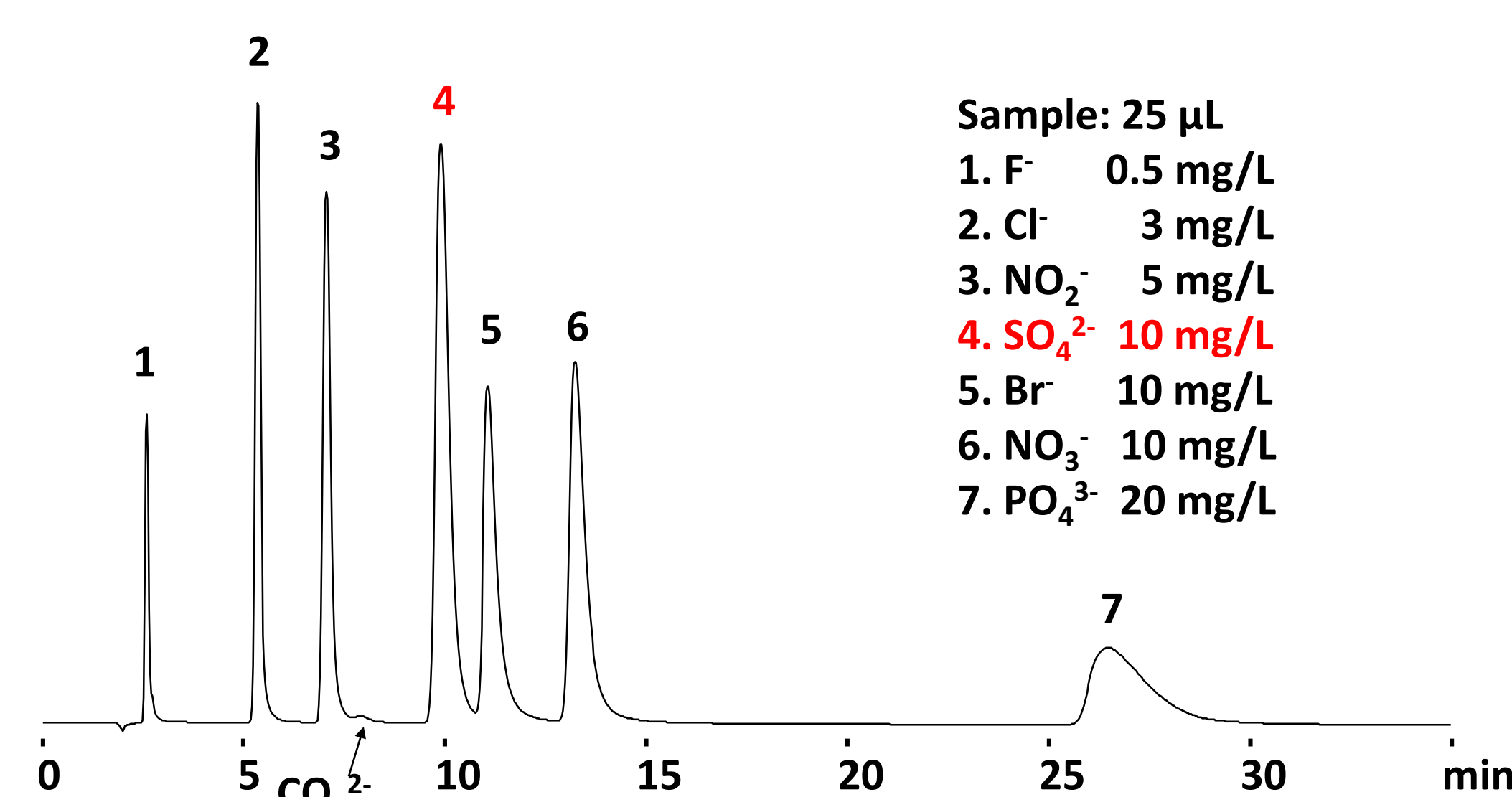
Packing material : Poly vinyl alcohol particle with quaternary ammonium group  
Housing : PEEK  
Usable temp. : 20 – 60 °C  
Usable pH range : 3 – 14  
Max flow rate : 0.9 mL/min  
Max pressure : 20 MPa

IC SI-36 4D uses potassium hydroxide aqueous solution for the analysis of anions.

With an anion exchange column that uses carbonate aqueous solution, sulfate ion elutes after phosphate ion.

However, with SI-36 4D, sulfate ion elutes before monovalent bromide ion.

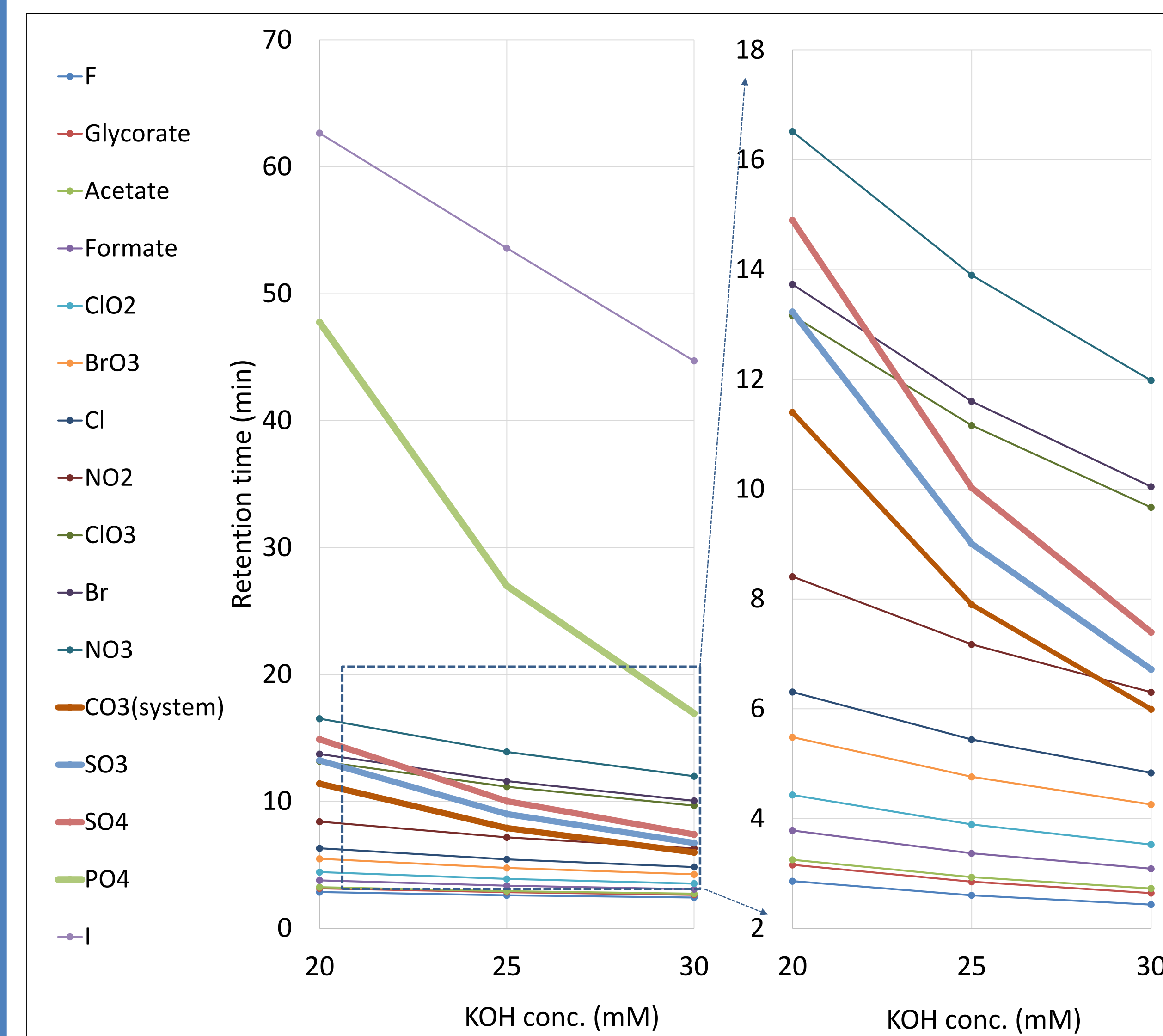
### Analysis of Standard Anions



Column : Shodex IC SI-36 4D (4.0 mm I.D. x 150 mm)  
Eluent : 25 mM KOH aq.  
Eluent source : Dionex™ EGC 500 KOH  
Flow rate : 0.7 mL/min  
Detector : Suppressed-conductivity  
Column temp. : 30 °C

## Effects of KOH Concentration

### Retention Times of Inorganic Anions and Organic Acids



Column : Shodex IC SI-36 4D (4.0 mm I.D. x 150 mm)  
Eluent : 20, 25, 30 mM KOH aq.  
Eluent source : Dionex™ EGC 500 KOH  
Flow rate : 0.7 mL/min  
Detector : Suppressed conductivity  
Column temp. : 30 °C

Sample: 25 µL  
Inorganic anions  
1 µg/mL each (in H<sub>2</sub>O)  
Organic acids  
10 µg/mL each (in H<sub>2</sub>O)

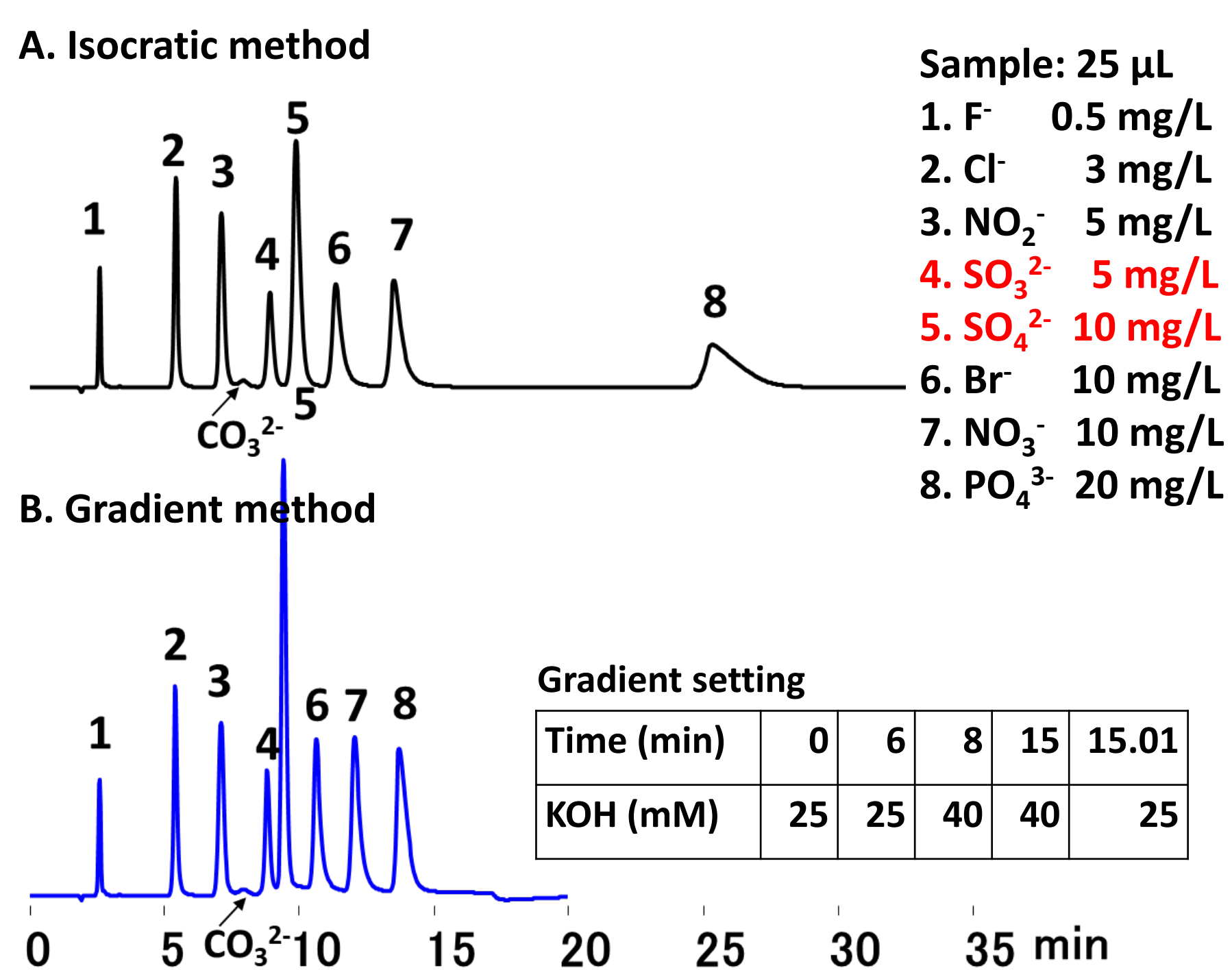
Concentration of potassium hydroxide in eluent influences retention of all anions in different degree.

In general, the higher the concentration of potassium hydroxide, the faster the elution of anions.

Among all, retentions of phosphate, sulfate, sulfite and carbonate ions were significantly shortened by increasing the potassium hydroxide concentration

## Applications

### Separation Between Sulfite and Sulfate Ions

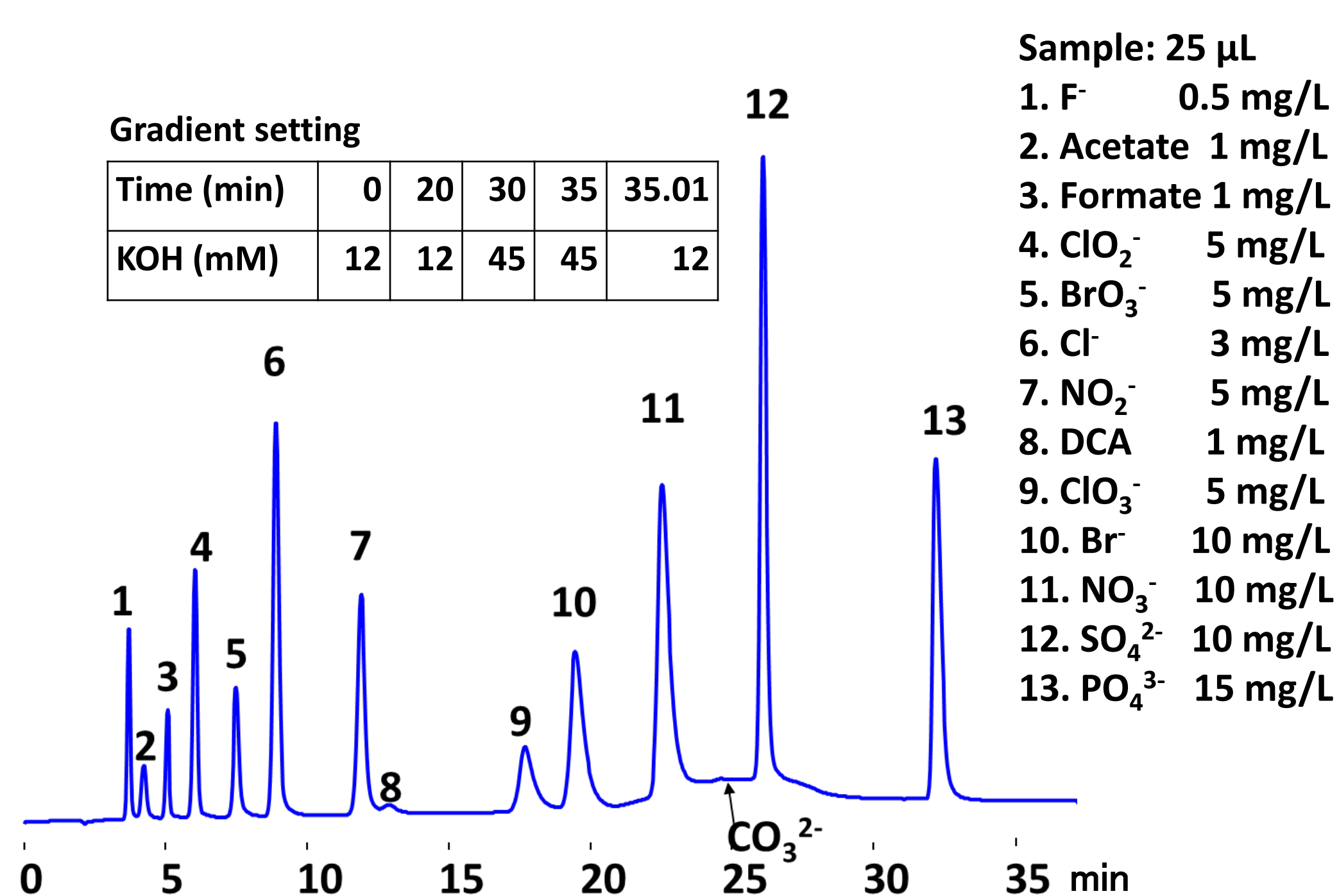


Column: Shodex IC SI-36 4D (4.0 mm I.D. x 150 mm)  
Eluent: A 25 mM KOH aq., B KOH gradient  
Eluent source: Dionex™ EGC 500 KOH  
Flow rate: 0.7 mL/min  
Detector: Suppressed-conductivity  
Column temp.: 30 °C

SI-36 4D does not require the use of an organic solvent to separate sulfite and sulfate ions.

Use of gradient method shortens the analysis time by completing the elution of phosphate ion in 15 minutes.

### Simultaneous Analysis of Organic Acids and Oxyhalides

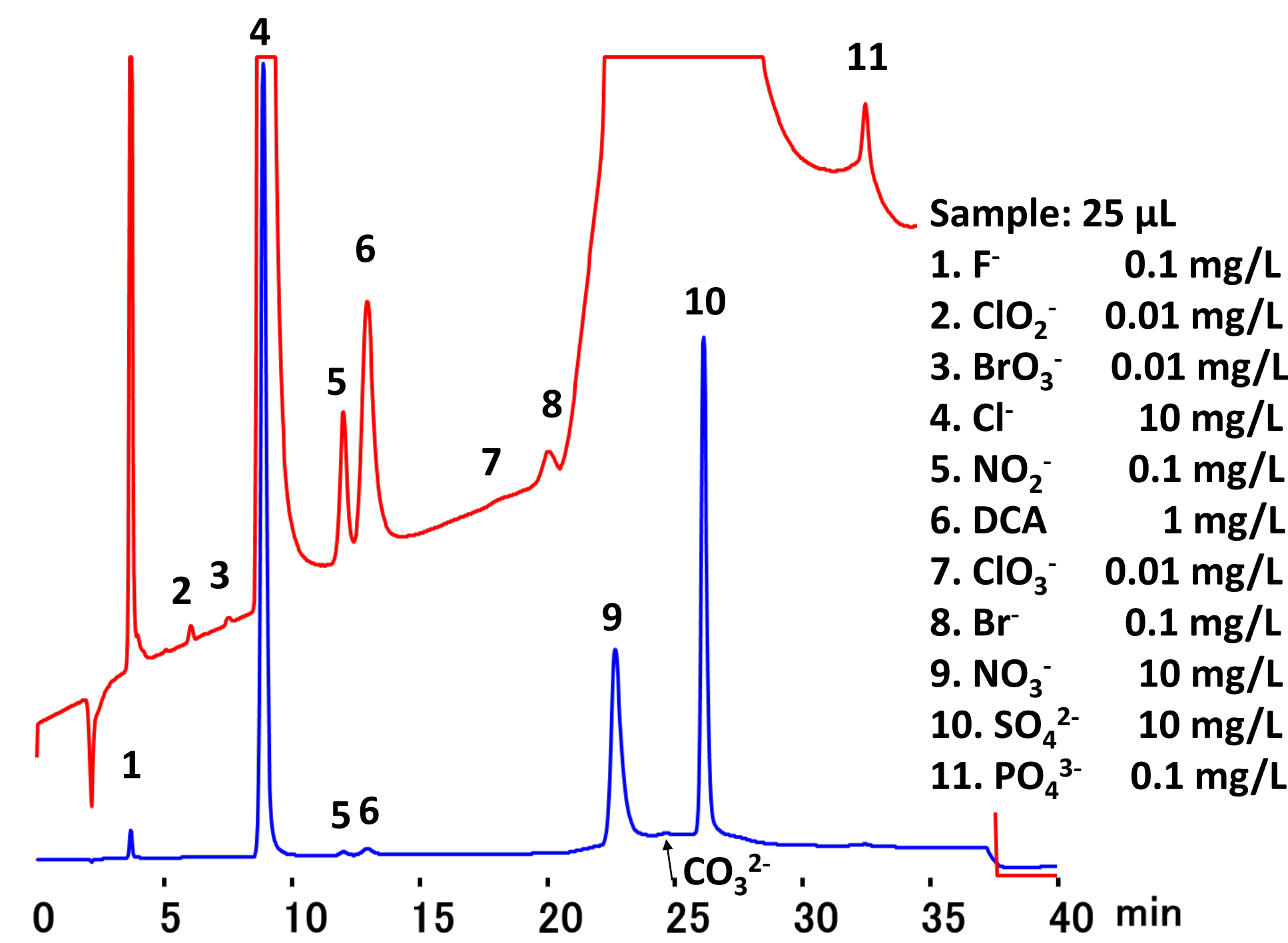


Column: Shodex IC SI-36 4D (4.0 mm I.D. x 150 mm)  
Eluent: KOH gradient  
Eluent source: Dionex™ EGC 500 KOH  
Flow rate: 0.7 mL/min  
Detector: Suppressed-conductivity  
Column temp.: 30 °C

By using a gradient condition, IC SI-36 4D analyzed standard inorganic anions, acetate, formate and oxyhalides simultaneously with high resolution.

Dichloroacetate (DCA<sup>-</sup>) as a surrogate substance can also be separated well.

### Analysis of Tap Water



Column: Shodex IC SI-36 4D (4.0 mm I.D. x 150 mm)  
Eluent: KOH gradient  
Eluent source: Dionex™ EGC 500 KOH  
Flow rate: 0.7 mL/min  
Detector: Suppressed-conductivity  
Column temp.: 30 °C

IC SI-36 4D is capable of detecting low concentration oxyhalides.

## Conclusions

Shodex™ IC SI-36 4D is compatible with hydroxide eluent and is capable of analyzing sulfite and sulfate in a single analysis.

Standard inorganic ions such as: fluoride, chloride, nitrite, bromide, nitrate, sulfate and phosphate ions; oxyhalides can also be simultaneously separated within 35 min under an optimized gradient elution method.

The developed methods can be the effective tools for analysis of water and other aqueous samples.

