Application solution of mineral water determination by ion chromatography

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Foreword

The mineral water is a kind of water which is spontaneously gushing from the deep underground or collected by drilling and contains a certain amount of minerals, trace elements or other components and is not polluted in a certain area and takes preventive measures to prevent pollution.The eight limit indexes stipulated in the national standard include lithium, strontium, zinc, selenium, iodide, metasilicic acid, free carbon dioxide and total soluble solids. One or more of the limit indexes must be met in mineral water.

Standard introduction

The national compulsory standard GB 8537-2008 "Drinking Natural Mineral Water" sets clear requirements for the classification, requirements, inspection methods, inspection rules, marks, packaging, transportation and storage of natural mineral water products for drinking.The standard is mandatory.Among them, "5.2: Water Quality Requirements-Sensory Requirements, Physicochemical Requirements (Boundary Index, Limit Index, Pollutant Index), Microbial Requirements" and "8.1.1: Marking Requirements" clearly require the detection of certain ions and set of boundary Index.For example,8.1.1 states clearly that "the limit index for the product to meet the standard, the total soluble solid content and the content range of the main cations (K +, Na +, Ca2 +, Mg2 +)","when the fluorine content is greater than 1.0mg/L, the word "fluorine" should be marked".The detection index related to ion chromatography are mainly as follows in this standard.

- Boundary Index：Li^{+}≥0.2 mg/L；I^{-}≥0.2 mg/L
- Limit Index：BrO_3^{-}＜0.01mg/L；NO_3^{-}＜45mg/L；F^{-}<1.5mg/L
- Pollutant Index：NO_2^{-}＜0.1mg/L

The national compulsory standard GB 8538-2016 "National Food Safety Standard for the Determination of Drinking Natural Mineral Water" isthe matching standard of GB 8537-2008.The ions detected in this standard by ion chromatography are respectively:

- Anions:F^{-}、Cl^{-}、NO_3^{-}、NO_2^{-}、$SO_4$2-
- I^{-} (Amperometric detector）(Ion chromatography is the only method)
- Cations:Li^{+}、Na^{+}、K^{+}、Mg^{2+}、Ca^{2+}
- BrO_3^{-} (Ion chromatography is the only method)

Application case

Case N0.1：The Determination of Bromate(gradient elution of OH- system)

Ozone is an effective bactericidal and bacteriostatic method for packaging water. Ozone containing a certain concentration in the product is good for controlling microbial indicators.Bromate is a compound formed by the gradual oxidation of bromine ions in natural water by ozone.The concentration of bromate mainly depends on the concentration of bromide ion, ozone and the contact time between ozone and water.Ion chromatography is the preferred method for the determination of inorganic anions. In GB 8538-2016, ion chromatography is the only method for the determination of bromate radical (BrO_3^-).

Under the experimental conditions, 2ppb bromate can be directly sampled and analyzed. The linear correlation coefficient of 5-100ppb bromate is 0.9998, which is meet content determination request of bromate in natural mineral water, packaged drinking water and drinking water.

Recommended configuration conditions

- IC type:CIC-D160(built-in eluent generator)
- Analysis column:SH-AC-11
- Guard column:SH-G-1
- Eluent:NaOH gradient elution
- Flow rate:1.0mL/min

Table1 Gradient elution concentration settings reference

Time (min)	Concentration(mM)
0.0-20.0	13.0
20.0-22.0	40.0
22.0-32.0	40.0
32.0-34.0	13.0
34.0-40.0	13.0

Sample test chromatogram

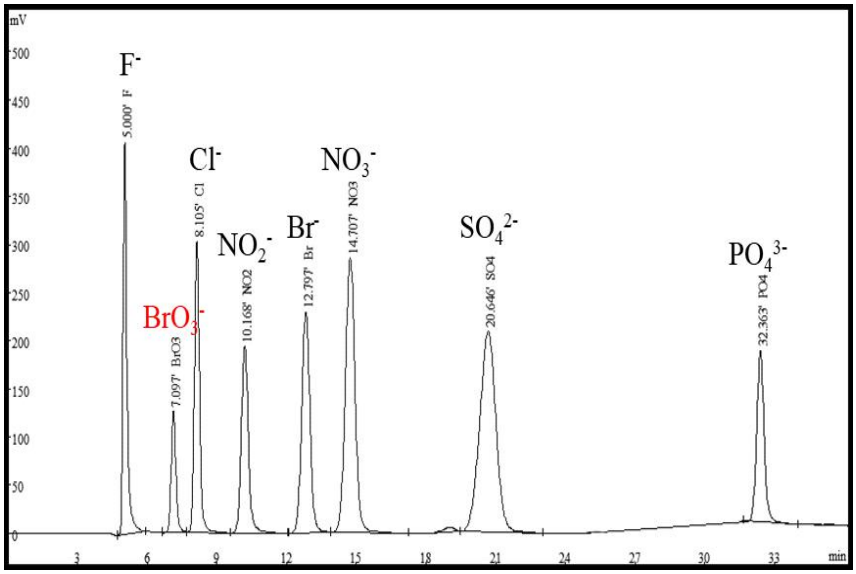

Table1　Gradient elution chromatogram of 7 kinds of common anions and bromate radical

Case No.2:The Determination of iodide ion(amperometric detector)

Iodine is one of more than ten kinds such as iron, zinc, silicon, strontium, fluorine, copper, boron, bromine, iodine, lithium, selenium, chromium, molybdenum, germanium, cobalt and vanadium of trace elements that human body is necessary and beneficial to the body.Although these trace elements are mainly derived from food, most of the trace elements in water are in the form of ions and are easily absorbed by the human body.Due to the influence of plant fiber and phytic acid, the absorption of trace elements in food is mostly less than 30%, while the absorption rate of trace elements dissolved in water is as high as 90%, and people drink more water than the amount of food a day, so it is important to supplement the deficiency by drinking water.

Recommended configuration conditions

- IC type:CIC-D160(built-in eluent generator)
- Analysis column:SH-AC-17
- Guard column:SH-G-1
- Eluent:20mMNaOH
- Flow rate:1.5mL/min
- Detector:Amperometric detector

Sample test chromatogram

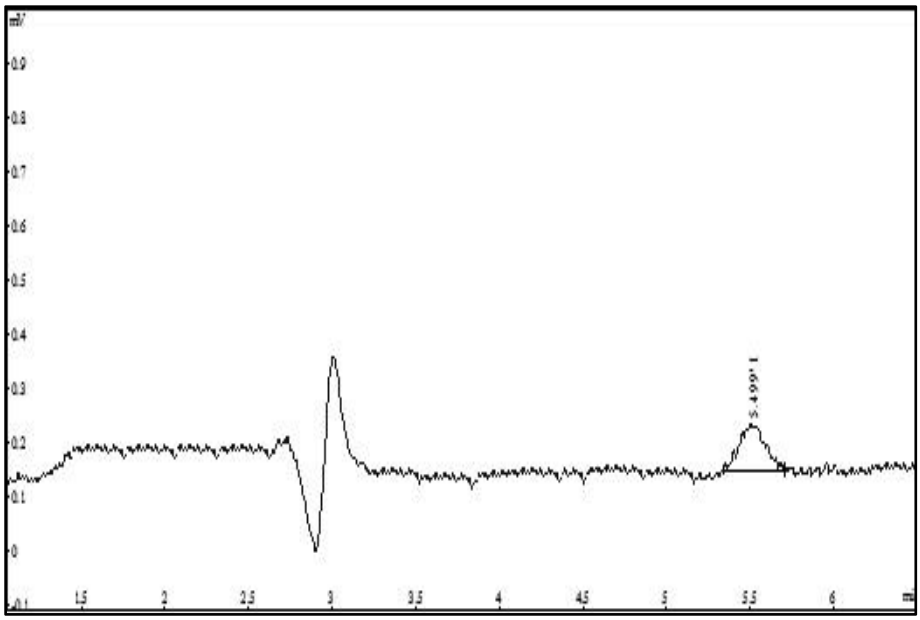

Table2 5ppb iodine ion chromatogram by direct injection

Case No.3：Determination method development of metasilicic acid radical

Metasilicic acid exists only in natural mineral water. It can effectively maintain the balance of electrolyte and physiological function, promote bone development and soften blood vessels.Mineral water with high content of metasilicic acid can keep skin glossy, fair and tender.

Recommended configuration conditions

- IC type:CIC-D160
- Analysis column:SH-AC-3

- Guard column:SH-G-1
- Eluent:3.6m MNa_2CO_3
- Flow rate:0.6mL/min

Sample test chromatogram

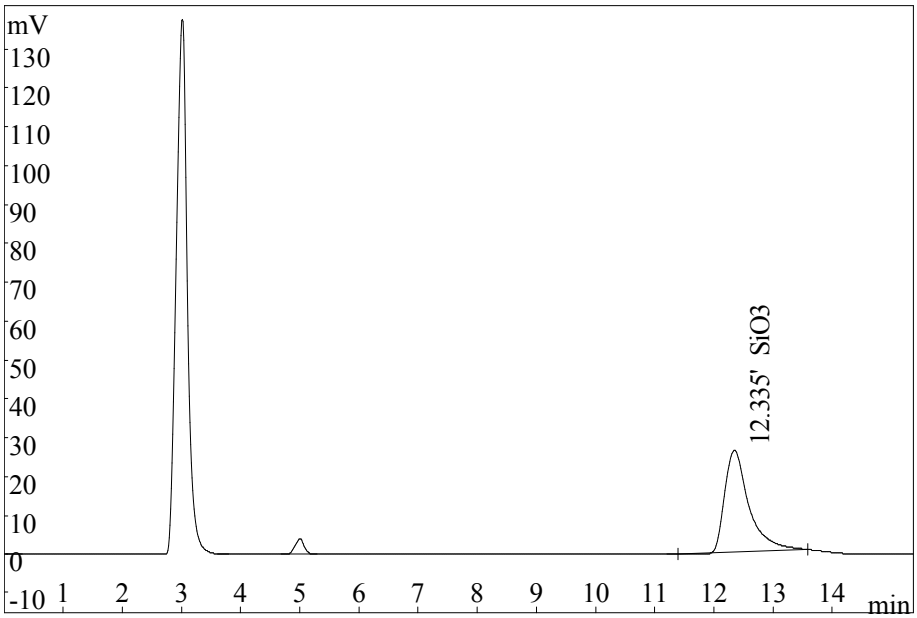

Table3 metasilicic acid radical text chromatogram

Case No.4：Common anions determination(F^-,Cl^-,NO_3^-,NO_2^-,SO_4^{2-})

Fluoride in drinking water exceeds 1.0mg/L, which is very harmful to human health.Drinking high fluoride water is the most fundamental and important factor leading to fluorosis.The total daily intake of fluoride per person is about 3.0-4.5mg, of which 60-70% of fluoride comes from drinking water. The absorption rate of fluoride in drinking water can be as high as 90%.When calcium deficiency in dietary or low nutrition state, the absorption rate of fluorine can be enhanced. The symptoms of fluorosis are also related to the content of drinking high fluoride water.

Recommended configuration conditions

- IC type:CIC-D160(built-in eluent generator)
- Analysis column:SH-AC-11(IC column of OH^- system)
- Guard column:SH-G-1
- Eluent:16mMNaOH
- Flow rate:1.0mL/min
- Detection method :suppressed conductivity detection

Sample test chromatogram

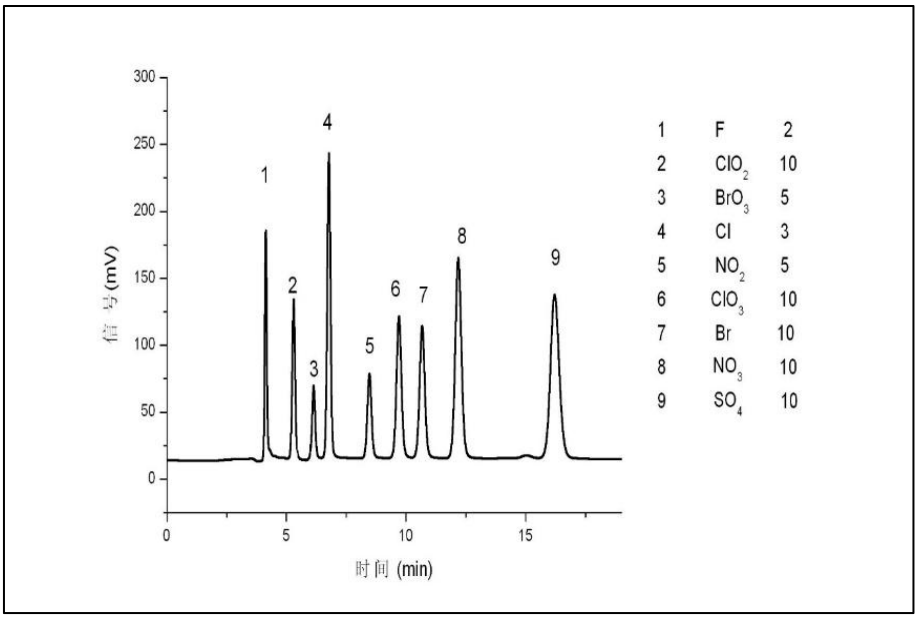

Table4 Common anions text spectrogram

Case No.5 Common cations determination(Li+,Na+,K+,Mg2+,Ca2+)

Lithium can improve hematopoietic function and improve the immune function of human body.Lithium can regulate central nervous activity, calm nerves, tranquilize nerves and control nervous disorders.Lithium can replace sodium to prevent cardiovascular diseases.

Recommended configuration conditions

- IC type:CIC-D160
- Analysis column:SH-CC-3
- Guard column:SH-G-1
- Eluent:5.0mM MSA
- Flow rate:1.0mL/min

Sample test chromatogram

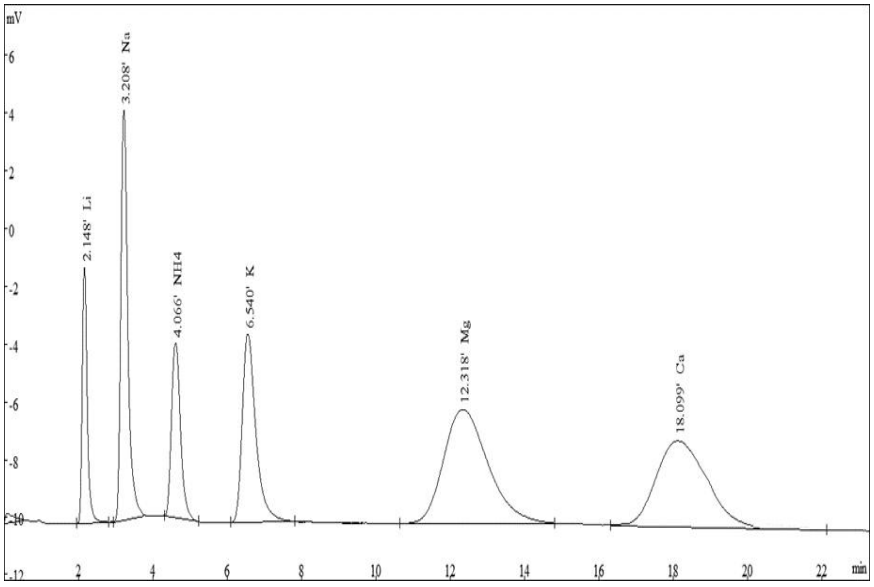

Table5 Common cations text spectrogram

Product presentation

CIC-D160 IC

CIC-D160 ion chromatograph is the first hydrogen-oxygen ion chromatograph made in China. It is equipped with bipolar conductance detector which greatly improves the detection ability, stability of the instrument, and brings the best usage experience to the users.Its built-in eluent generator can generate the required concentration of eluent on line by pure water and possesses the function of gradient elution which can determines complex samples which isocratic elution cannot.Now It is widely used in the environment, food, chemical industry, power, electronics, mining and metallurgy and other fields.

■Built-in eluent generator:No need to configure the eluent and possesses the function of gradient elution;

■Built-in circulating 3D constant temperature technology which ensure the accuracy and reliability of the experimental data;

■Built-in low-pressure degassing technology to eliminate bubble interference for more stability;

■Self-regenerating electrolytic micro-membrane suppressor which pressure resistance is high, dead volume is small, and responsive signal is high;

■Equipped with intelligent automatic injection system for large sample volumes, which features automatic dilution to save labor and time;

■Observatory intelligent workstation which is configured with integrated control, compatibility for a variety of instruments, and customized images.

■ Perfect after-sale support to solve the worries of users.

Ion Chromatographic Column

AS the first domestic developer and manufacturer of Ion chromatographic colum, Sheng Han have the technology of the development and production of three kinds of Ion chromatographic column including ion exchange chromatographic column, ion exclusion chromatographic column and ion pair chromatographic column. At the same time, Sheng Han have also successfully developed and produced hydroxyl system of Ion chromatographic column in large scale ranking second in the world, which broken the monopoly of imported brands in the high-end ion chromatographic column field more than ten years.The use of domestic ion chromatography can reduce the cost of operation and maintenance of users by about 35%.