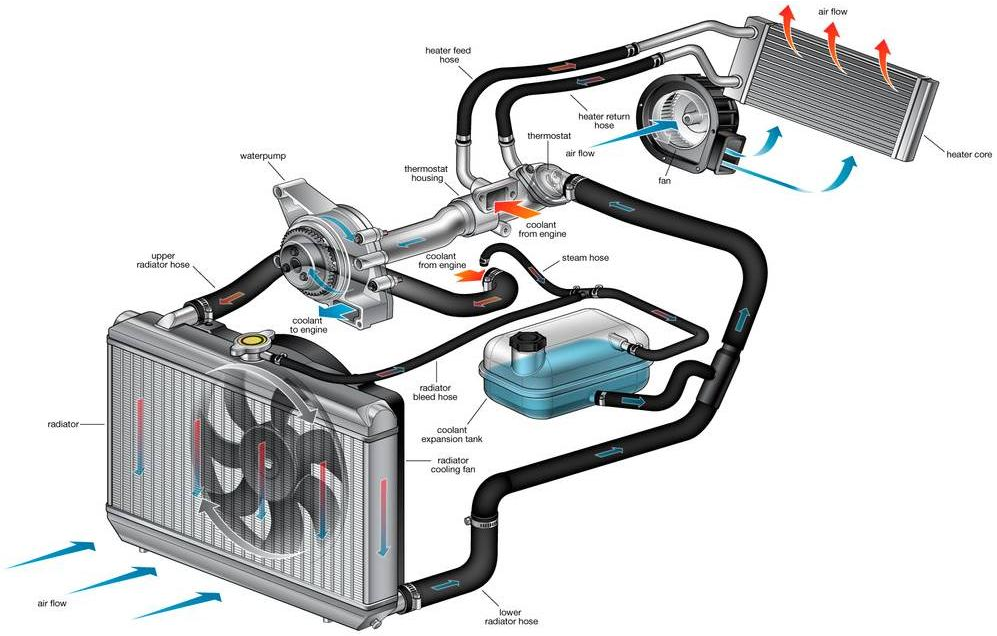

Detection of anions in engine coolant

Introduction:

The coolant mainly consists of water, antifreeze, corrosion inhibitor, defoamer, etc. The addition of antifreeze can effectively control the freezing point of coolant products and prevent the water tank from freezing or even cracking. The function of corrosion inhibitors is to prevent corrosion of metal pipelines in the cooling system, in order to avoid coolant leakage or loss. Commonly used corrosion inhibitors include silicate, nitrite, nitrate, acid salt, benzoate, diacid salt, etc. There are also some substances in the coolant that can accelerate the corrosion of metal pipelines in the cooling system, such as chloride ions, which have a strong corrosive effect and can activate stainless steel, easily inducing pitting and even perforation on the aluminum surface.

Detection items (Table 1):

Anion	Cl^-	NO_2^-	SO_4^{2-}

Keywords: Ion chromatography, Anion,engine coolant

Instruments and equipment

- **Ion chromatograph**: CIC-D160$^+$
- **Ultra pure water machine**:ECO-S15

Qingdao Shenghan Chromatograph Technology Co., Ltd

Requirements

Reagents

Unless otherwise specified, all reagents used are superior grade. Cl^- , NO_2^- , SO_4^{2-} anions standard solution (1000 mg/L)

Deionized Water

When preparing standard samples manually or diluting real samples, please use ASTM filtration and deionization requirements that meet the specifications listed in the table 2.

Table 2: Deionized water specification.

Specification	
Ions Resistivity	≥18.25MΩ·cm
Organics-TOC	<10ppb
Iron/Transition Metals	<1ppb
Pyrogens	<0.03Eu/mL
Particulates（>0.2μm）	<1unit/mL
Colloids-Silica	<10ppb
Bacteria	<1cfu/mL

Chromatography conditions (Anions):

Table 3: Anions analysis conditions

Instrument	CIC-D160⁺
Eluent	0-10 min，10 mM KOH 10-20 min，10-40 mM KOH 20-35 min，40 mM KOH 35-40 min，10 mM KOH
Flow rate	1.0 mL/min
Injection volume	25 μL
Analytical Column	IonPac AS19
Column oven temperature	35℃
Conductivity cell temperature	35℃
Suppressor current	100 mA

Sample preparation

Accurately weigh 3.0g of samples 1 and 2, place them in a 100mL volumetric flask, 1.0g of samples 3 and 4, place them in a 10mL volumetric flask, add water to volume, mix well, and perform machine detection.

Simultaneously test the blank control of pure water in the volumetric flask of the configured sample..

Standard chromatogram

Standard chromatogram, As shown in below:

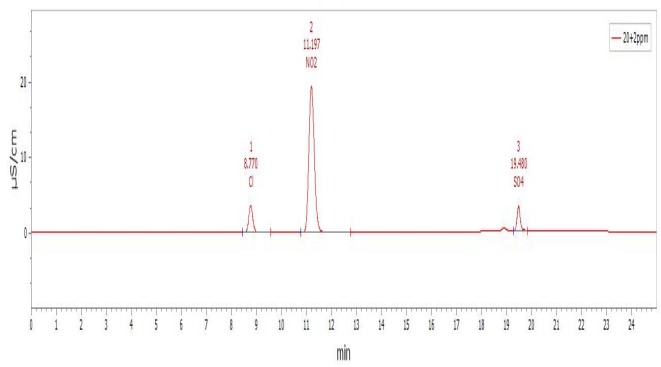

Figure 1. Chromatogram of standard sample.

Blank chromatogram

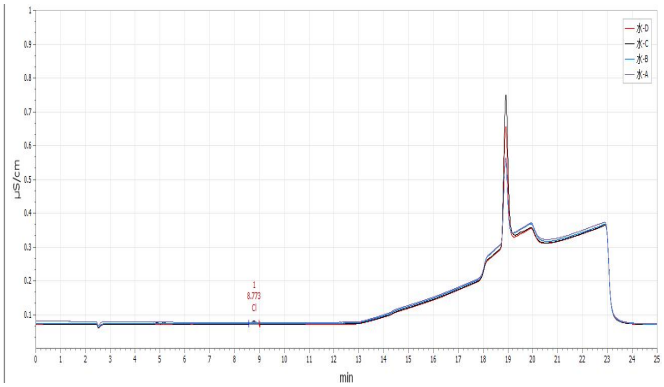

Figure 2. Chromatogram of blank

Sample chromatogram

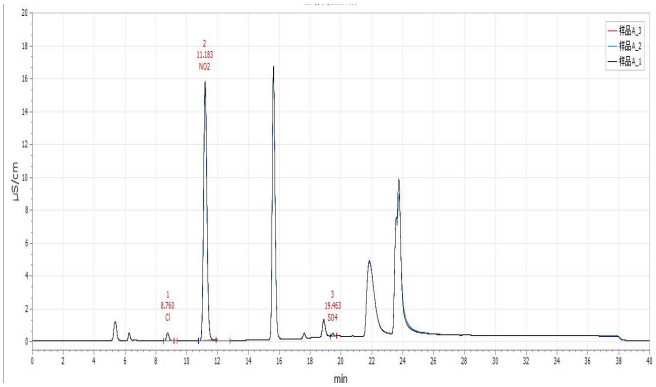

Figure 3. Chromatogram of sample 1#

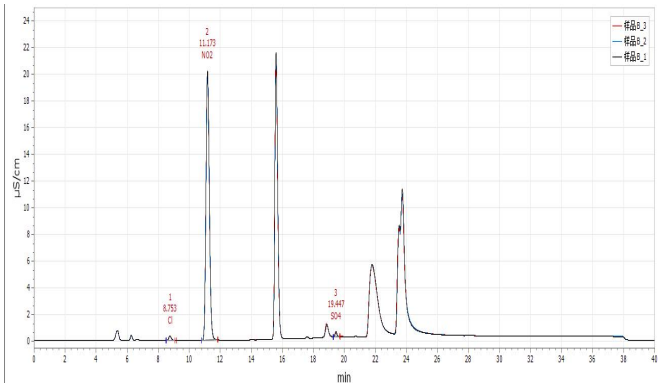

Figure 4. Chromatogram of sample 2#

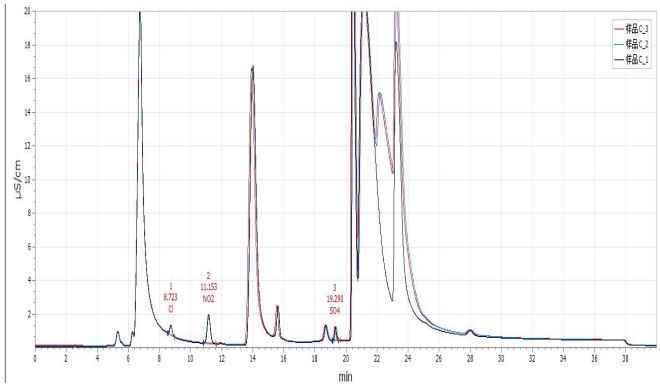

Figure 5. Chromatogram of sample 3#

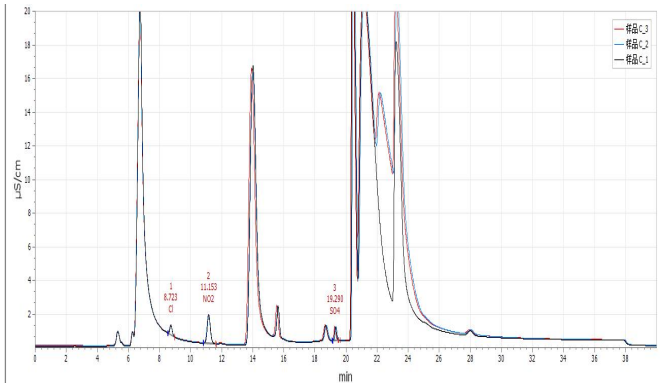

Figure 6. Chromatogram of sample 4#

Results and calculations

Table 4: Sample test result (Anions)

Sample	Concentration（mg/L）		
	Cl^-	NO_2^-	SO_4^{2-}
1#	9.48	541.26	4.3
2#	6.77	693.51	8.63
3#	3.23	16.63	5.44
4#	2.59	2.82	3.65

Remarks: ① The measured value has been deducted from the blank value; ② There may be differences in testing results between different methods and laboratories.

Feasibility analysis and conclusion

The above experiments prove that the detection method has good resolution and is suitable for the determination of the content of the components to be measured in the sample.