



Determination of total fluorine, chlorine, bromine, sulfate and iodine in plastic particles

Introduction:

The halogenated flame retardant used in plastic products is an excellent flame retardant with good flame retardancy, therefore, it is widely used in the production of plastic products. However, the halogenated flame retardants contain highly migratory and toxic organic chlorides, organic bromides, and other substances, which can cause harm to human health and the natural environment. Therefore, establishing a fast and convenient method for detecting the halogen content in plastic products is of great significance for quality monitoring, recycling, and processing of plastic products.

Detection items (Table 1):

Anion	F ⁻	Cl ⁻	Br ⁻	SO ₄ ²⁻	I ⁻
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Keywords: Ion chromatography, Halogen, Plastic

Instruments and equipment

- **Ion chromatograph:** CIC-D120+
- **Ultra pure water machine:** ECO-S15

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Requirements

Reagents

Unless otherwise specified, all reagents used are superior grade. F⁻, Cl⁻, Br⁻, SO₄²⁻ and I⁻ 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:

Table 3:

Instrument	CIC-D120 ⁺
Eluent	3.0 mM Na ₂ CO ₃ + 6.0 mM NaHCO ₃
Flow rate	1.6 mL/min
Injection volume	200 μL
Analytical Column	SH-AC-4
Column oven temperature	35°C
Conductivity cell temperature	35°C
Suppressor current	50 mA

Sample preparation

Weigh an appropriate amount of sample into the oxygen bomb crucible, add an appropriate amount of absorption liquid into the oxygen bomb, fill oxygen for several times after sealing and ignite, then transfer the absorption liquid to the Volumetric flask, add an appropriate amount of Ultrapure water to constant volume, and pass 0.22 μ M filter membrane for ion chromatography testing.

Table 4:Sample preparation table

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Sample	Weight (g)	Volume(mL)	diluent	Ions
1#	0.1964	100.0	NaOH	F ⁻ , Cl ⁻ , Br ⁻ , I ⁻
2#	0.2317	100.0	H ₂ O ₂	SO ₄ ²⁻

Standard chromatogram

Standard chromatogram, As shown in below:

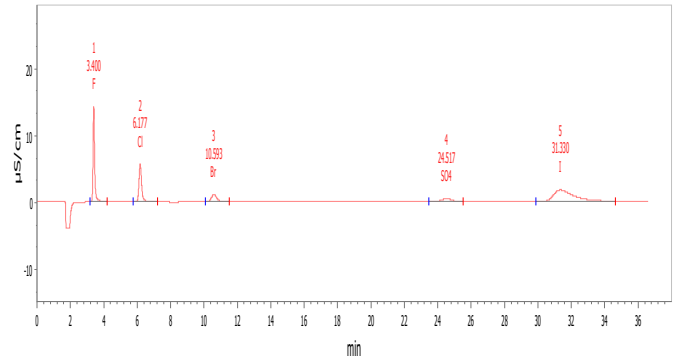


Figure 1. Chromatogram of standard sample.

Table 5 :Standard sample ion data

Ions	Time [min]	Concentration [mg/L]	Area [(μS/cm)*min]
F ⁻	3.4000	1.000	1.610551
Cl ⁻	6.17667	1.000	1.058636
Br ⁻	10.593333	1.000	0.433661
SO ₄ ²⁻	24.516667	0.500	0.349747
I ⁻	31.3300	10.00	2.540032

Blank chromatogram

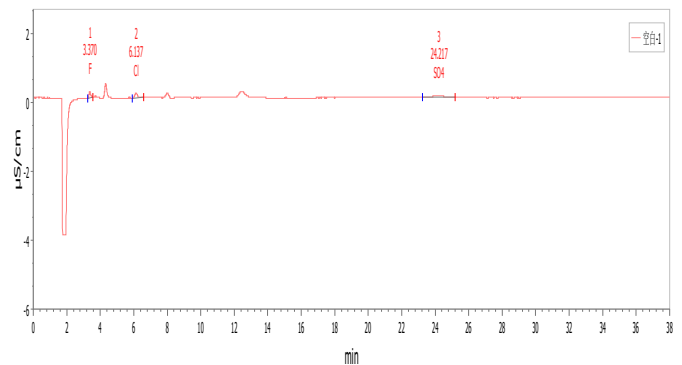


Figure 2. Chromatogram of blank

Sample chromatogram

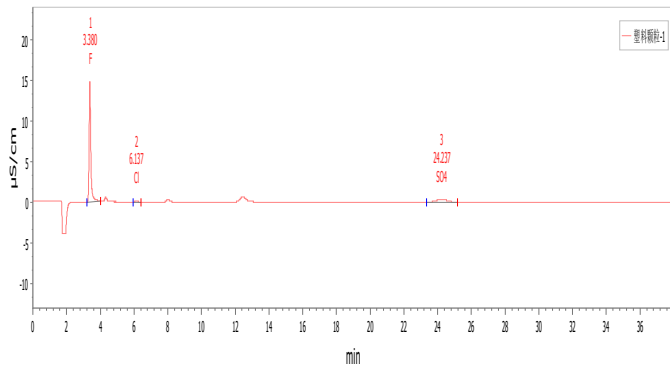


Figure 3. Chromatogram of sample 1#

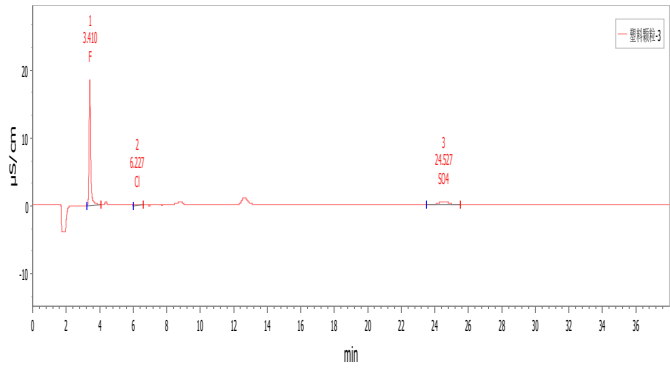


Figure 4. Chromatogram of sample 2#

Results and calculations

Table 6: Sample test result (mg/kg)

Ions	F ⁻	Cl ⁻	Br ⁻	SO ₄ ²⁻	I ⁻
Sample	532.0	ND	ND	73.29	ND

Remarks: ① Blank space has been deducted from the test results; 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.