



Determination of chlorite, chlorate and bromate in tap water

Introduction:

At present, the disinfectants used for drinking water disinfection mainly include liquid chlorine, chlorine dioxide and ozone. Chlorite is a by-product of chlorine dioxide disinfection, chlorate is a non-by-product brought by chlorine dioxide raw material, and bromate is a disinfection by-product of ozone. These compounds may cause certain harm to human body.

GB/T 5749-2006 hygienic standard for drinking water stipulates that the limits of chlorite, chlorate and bromate are 0.7, 0.7 and 0.01mg/L respectively.

A high-capacity anion exchange chromatographic column can be used to simultaneously determine chlorite, chlorate and bromate in drinking water by ion chromatography with large volume direct injection.

Keywords: Chlorite, chlorate , bromate.

Instruments and equipment

Ion chromatograph: CIC-D150
Qingdao Shenghan Chromatography Technology Co., Ltd

Ultra pure water machine: UPT-I-20L
Sichuan youpu Chaochun Technology Co., Ltd



Requirements

Reagents

All reagents used are superior grade pure or better, Purchase certified standard solutions ClO_2^- , Br^- , ClO_3^- standard solutions (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 1.

Table 1: Deionized water specification.

Specification	
Ions Resistivity	$\geq 18.25 \text{M}\Omega \cdot \text{cm}$
Organics-TOC	<10ppb
Iron/Transition Metals	<1ppb
Pyrogens	<0.03Eu/mL

Particulates (>0.2μm)	<1unit/mL
Colloids-Silica	<10ppb
Bacteria	<1cfu/mL

Sample preparation

The samples were sequentially overactivated by Ag pretreatment column, Na pretreatment column, and 0.22 μ M filter membrane and then injection analysis. (Activation method of Ag and Na pretreatment column: pass 10 ml of deionized water, place it for 10 minutes) Please note that the first 2ml of samples passing through the filter membrane should be discarded, and the remaining samples injected for analysis.

Chromatographic conditions

Eluent:4.5 mM Na₂CO₃+0.8 mM NaHCO₃
 Flow rate: 1.0 mL/min
 Injection volume: 500 μL
 Guard column:IonPac AG 23
 Column: IonPac AS 23
 Column oven temperature: 30℃
 Conductivity cell temperature: 35℃
 Suppressor current:75 mA

Table 2: 4.5 mM Na₂CO₃+0.8 mM NaHCO₃
 Configuration method

Name	Weight or volume
Na ₂ CO ₃	0.4770 g
NaHCO ₃	0.0672 g
Constant volume	1 L

Calibration curve

Standard chromatogram,As shown in below:

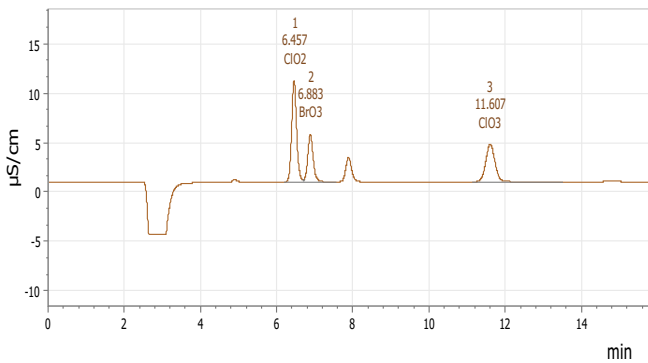


Figure 1. Chromatogram of chlorite, bromate and chlorate standard sample.

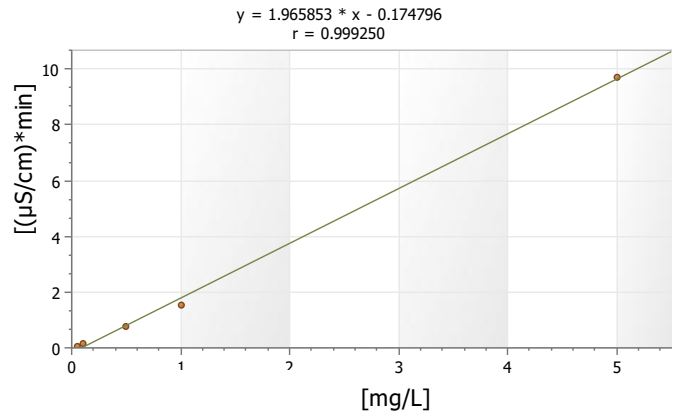


Figure 2. Chlorite ion linearity

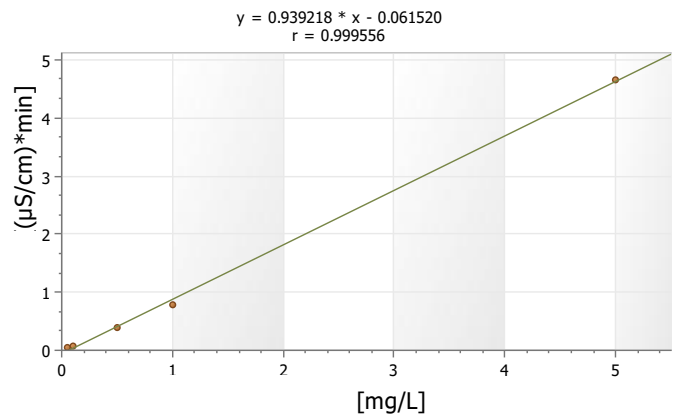


Figure 3. Bromate ion linearity

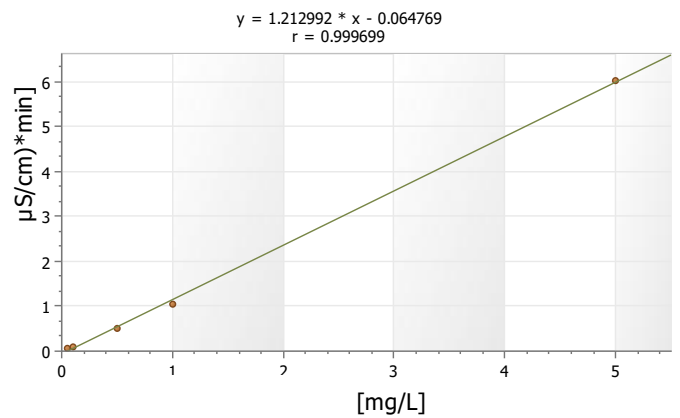


Figure 4. Chlorate ion linearity

Sample detection

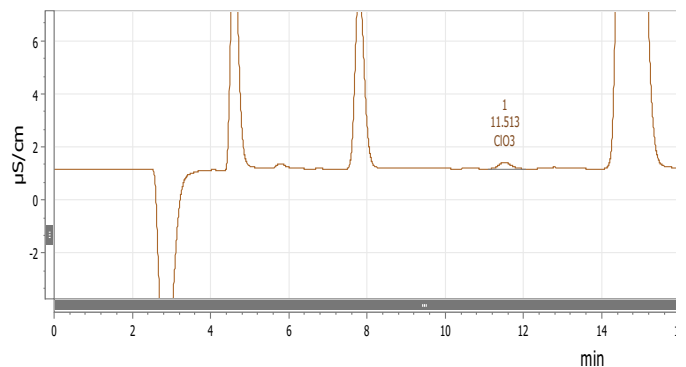


Figure 5. Chromatogram of tap water sample

Table 3. Sample test results

Compound	Retention time [min]	Concentration [mg/L]	Area [($\mu\text{S}/\text{cm}$) $\cdot\text{min}$]	Peak height [$\mu\text{S}/\text{cm}$]	Separation	Tailing factor
ClO ₂	ND	ND	ND	ND	ND	ND
BrO ₃	ND	ND	ND	ND	ND	ND
ClO ₃	11.513333	0.086648 mg/L	0.088443	0.247118	0.000000	1.168675

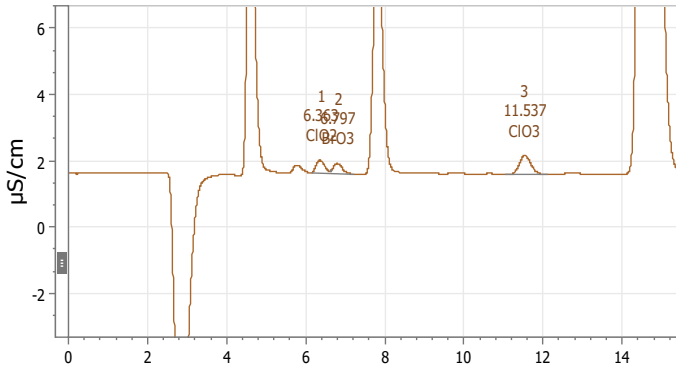


Figure 6. Chromatogram of standard added to tap water sample

Table 4. Results of standard added to tap water

Compound	Retention time [min]	Concentration [mg/L]	Area [($\mu\text{S}/\text{cm}$) $\cdot\text{min}$]	Peak height [$\mu\text{S}/\text{cm}$]	Separation	Tailing factor
ClO ₂	6.363333	0.068675	0.093836	0.371927	1.048005	1.258576
BrO ₃	6.796667	0.103905	0.076244	0.301615	9.820346	1.442076
ClO ₃	11.536667	0.192692	0.196684	0.575646	0.000000	1.128959

Results and calculations

Concentration (mg/L)			
Aion	ClO ₂ ⁻	Br ⁻	ClO ₃ ⁻
Sample	ND	ND	0.09
RSD%	/	/	1.40

Note: ① The test results will be different between different methods and different laboratories. ② only examines the feasibility of the test method and the stability of the results. Others are for reference only.

Feasibility analysis and conclusion

Through the above experiments, it is proved that the detection method has good separation and is suitable for the determination of the content of the components to be measured in the sample.