

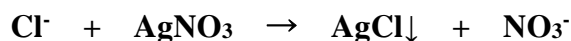
Environment

# Quantitative determination of chloride ions in tap water

## 1. Abstract

Quantitative determination for chloride ions in tap water is stipulated in *Standard Methods for the Examination of Water*, and *Standard Methods of Analysis for Hygienic Chemists*, etc. A small amount of chloride ion is contained in natural water, it is said to increase due to contamination of domestic drainage, industrial drainage, and farming drainage, etc. *Standard Methods for the Examination of Water* adopts ion exchange chromatograph method and Mohr method (titration method) as the chloride quantitative determination method. The detection limit for ion exchange chromatograph method is 0.2 mg/L. Mohr method is generally applied for samples including chloride ions in mg/L or more. This report introduces the Mohr method with precipitation titration, which quantifies chlorides by potentiometric titration with silver indicator electrode instead of the color indicator titration described in *Standard Methods for the Examination of Water*.

100 mL of the sample water is collected and acidified with nitric acid for potentiometric titration with silver nitrate titrant.



## 2. Configuration of instruments and reagents

### (1) Configuration of instruments

Main unit	: Hiranuma Automatic Titrator	COM Series
Electrode	: Silver combination electrode	AGR-811Z (Double Junction Type)

\*The following electrodes are also usable.

- AGR-801Z (Silver reference combination electrode)
- Combination of AG-311 (Silver indicator electrode) and MS-231Z (Silver reference electrode)
- Combination of AG-311 and RE-241Z (Double junction type silver reference electrode)

\*Remark

The general reference electrode (RE-201Z) cannot be used for this titration because KCl inner solution might come out to sample solution and it causes measurement error.

The inner electrodes of AGR-801Z and MS-231Z contain mercury (I) sulfate. When these electrodes are disposed, please ask the specialized industrial waste disposal operator.

### (2) Reagents

Titration	: 0.01 mol/L Silver nitrate standard solution
Additive solution	: Diluted nitric acid (1:5, v/v)

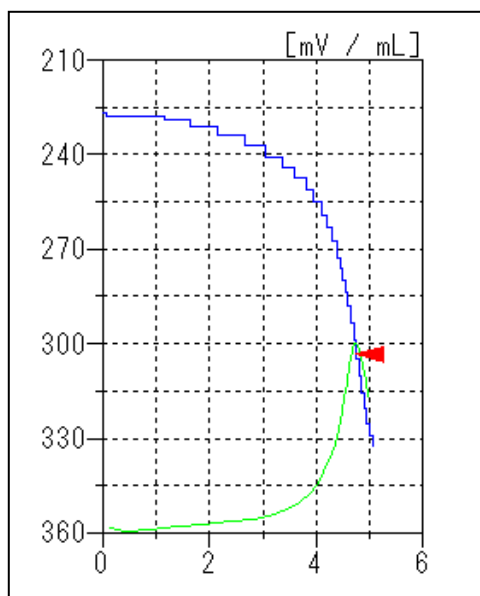
## 3. Measurement procedure

- (1) Dispense 100 mL of sample into a 200 mL beaker with volumetric pipette.
- (2) Add 1 mL of diluted nitric acid.
- (3) Immerse electrode and start titration with 0.01 mol/L silver nitrate standard solution.

## 4. Measurement conditions and results

### Example of titration condition

Cndt No.	1	ConstantNo.	1	Mode No.	8
Method	Auto	Size	100 mL	Pre Int	0 sec
Buret No.	1	Blank	0 mL	Del K	5
Amp No.	2	Molarity	0.01 mol/L	Del Sens	0 mV
D. Unit	mV	Factor	1.010	Int Time	5 sec
S-Timer	5 sec	K	35.45	Int Sens	3 mV
C.P. mL	0 mL	L	0	BrT Speed	2
T Timer	0 sec	Unit	PPM	Pulse	40
D.P. mL	0 mL	Formula	(D-B)*K*F*M*1000/S		
End Sens	70	Digits	3		
Over mL	0.3 mL	Auto In Pram.	Non		
Max.Vol.	20 mL				



Example of titration curve

### Measurement results

Number of Measurement	Size (mL)	Titrant Volume (mL)	Chloride ion (ppm)
1	100	4.739	16.968
2	100	4.741	16.975
3	100	4.737	16.961
		Avg.	16.97 ppm
Statistic calculation		SD	0.0070 ppm
		RSD	0.04 %

## 5. Note

### (1) Measurement

The chlorides in tap water was accurately determined by Mohr method with potentiometric titration instead of color indicator titration.

### (2) pH of sample

When the sample contains hydroxide ion or carbonate ion, they react with silver nitrate titrant and generate silver hydroxide or silver carbonate. It slightly causes positive error on titration for chloride ion. Therefore this titration is generally performed at acidic pH adjusted to pH 2 ~ 3 by nitric acid.

Keywords: Tap water, Chloride ion, Precipitation titration, Silver electrode, Nitric acid