

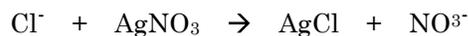
AQUACOUNTER Application Sheet	COM series	DATA No. G2	1st edition
Metal	Quantification of trace chlorine ion (Cl <sup>-</sup> ) in copper sulfate solution		

## 1. Measurement outline

Trace chlorine ion (Cl<sup>-</sup>) is quantified in solutions containing copper sulfate in high concentration.

For quantification of chlorine ion in copper sulfate solution, precipitation titration with silver nitrate titrant is generally used. While the indicator method and potentiometric method are the possible end point detection method, potentiometric method is used for this sample since the concentration of copper sulfate is high which makes the point of color change for the indicator unclear. However, potential change on potentiometric titration curve near the end point becomes smaller and end point detection becomes more difficult as the concentration of copper sulfate becomes higher.

This section introduces an example of potentiometric titration using a silver electrode with a special treatment.



## 2. Reagents and Electrodes

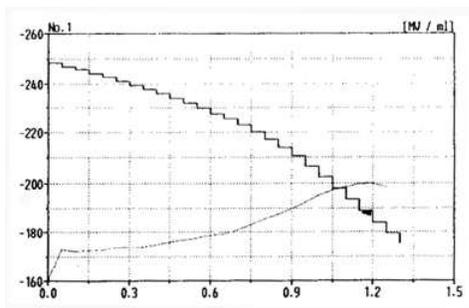
(1) Reagents	Titrant	0.01mol/L AgNO <sub>3</sub> titrant
(2) Electrodes	Indicator electrode	Silver indicator electrode AG-311 to IE jack (P/N E231245-A) *The special processing described in 5. Outline is required.
	Reference electrode	Silver reference electrode MS-231 to RE jack (P/N D231243-A)

**3. Measurement conditions example (for COM-1600S)**

<b>Master File No.1</b>	
<b>Condition file: 1</b>	
Method	AUTO
Amp No.	2
Buret No.	1
Meas Unit	mV
S-Timer	5 sec
CP	0 mL
DP	0 mL
End Sens	200
Over mL	0 mL
Max Vol	20 mL
Mode No.	5
Unit	ppm
Blank	0
Factor	Titer of the titrant
Molarity	0.01
K	35.453
Formula	$(D-B) \times F \times K \times M \times 1000 / S$

<b>Mode No.5</b>	
Pre Int	0 sec
Del K	5
Del Sens	0 mV
Int Time	3 sec
Int Sens	3 mV
Brst Speed	2
Pulse	40

**4. Measurement example**



**Measurement results on trace chlorine ion**

Sample No.	Sample volume (mL)	Titration value (mL)	Concentration (ppm)
1	25	1.153	16.557
2	25	1.153	16.643
3	25	1.159	16.643
4	25	1.157	16.615
5	25	1.162	16.686
<b>Avg.</b>			<b>16.629 ppm</b>
<b>Std. Dev.</b>			<b>0.048 ppm</b>
<b>C.V.</b>			<b>0.29 %</b>

## 5. Outline

About indicator electrode

What is most important in the measurement of this sample is the sensitivity of the indicator electrode. The potential change at the end point is small for normal silver electrodes in titration of chlorine ion in samples that contain copper sulfate in high concentration, and automatic titration of end point may be difficult in many cases. Favorable results can be obtained by using a silver electrode with the following preprocessing for this purpose:

- (1) Polish the surface of the silver electrode with cleanser or sodium bicarbonate.
- (2) Soak platinum electrode (PT-301) and the previously described silver electrode (AG-311) in hydrochloric acid of about 0.5mol/L. Connect the silver electrode via a resistance of 1k $\Omega$  on the anode of a D size battery. Meanwhile, connect the platinum electrode to the cathode of the D size battery. Conduct electrolysis under this condition. Black or dark brown film of silver chloride will be formed on the surface of silver electrode by electrolysis. Rinse with water and soak in purified water for 24 hours to use in titration. It is recommended that the above process be conducted again when the titration curve condition deteriorates and the potential change near the end point decreases.

### Key words

Chlorine ion, precipitation titration, copper sulfate solution

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