

HIRANUMA APPLICATION DATA	Automatic Titrator	Data No.	H6	Mar. 16, 2026
SODA PULP INDUSTRY	Determination of sodium chloride in sodium hypochlorite			

1. Abstract

Sodium hypochlorite is produced by having sodium hydroxide absorb chlorine gas. Produced sodium hypochlorite contains residual alkali (sodium hydroxide, sodium carbonate) and sodium chloride generated by the degradation of hypochlorous acid. The residual alkali is determined by neutralization titration, and sodium chloride is determined by precipitation titration. This report introduces an example of the determination for sodium chloride in the sodium hypochlorite with potentiometric titration as the following procedure: the titration for the total chlorine component (sodium hypochlorite + sodium chloride) is performed first. After that, sodium hypochlorite (available chlorine) is titrated by another method. Finally, sodium chloride is determined by the subtraction of sodium hypochlorite from the total chloride component.

The total sodium chloride (total chloride component) is determined according to the following formula (1) and (2): add hydrogen peroxide into a sample to degrade sodium hypochlorite, and generate sodium chloride as described in formula (1). Titrate with nitric acid standard solution until the pH goes down to 2 ~ 3. After the solution is acidified, determine the total sodium chloride with silver nitrate standard solution by precipitation titration as formula (2).



Regarding the determination of available chlorine, free iodine generated by the addition of potassium iodide as described in formula (3) is determined with sodium thiosulfate standard solution by redox titration as shown in formula (4).



2. Configuration of instruments and reagents

(1) Configuration

- Main unit : Automatic Titrator COM series
- Option : One buret, one buret head
- Electrodes : <For total sodium chloride>
 - Glass electrode GE-101B
 - Silver combination electrode AGR-811Z (Double junction type)
- <For available chlorine>
 - Platinum electrode PT-301
 - Reference electrode RE-201Z

(2) Reagents

<For total sodium chloride>

Titrant : 0.2 mol/L Silver nitrate standard solution,
0.1 mol/L Nitric acid standard solution

Additive : 3 % Hydrogen peroxide solution

<For available chlorine >

Titrant : 0.2 mol/L Sodium thiosulfate standard solution

Additive : 10 % Potassium iodide solution
2 mol/L Acetic acid solution

3. Measurement procedure

(1) Measurement for total sodium chloride

- (i) Dispense 0.5 mL of sample into a 100 mL beaker with micropipette.
- (ii) Add 50 mL of DI water.
- (iii) Add 5 mL of 3 % hydrogen peroxide solution and degrade sodium hypochlorite.
- (iv) Immerse the electrodes (GE-101B/AGR-811Z) into sample solution.
Titrate with 0.1 mol/L nitric acid standard solution and adjust the pH to 2 ~ 3.
- (v) Titrate with 0.2 mol/L silver nitrate standard solution.

(2) Measurement for available chlorine

- (i) Dispense 0.5 mL of sample into a 100 mL beaker with micropipette.
- (ii) Add 50 mL of DI water.
- (iii) Add 10 mL of 10 % potassium iodide solution.
- (iv) Add 10 mL of 2 mol/L acetic acid solution.
- (v) Immerse electrodes (PT-301/RE-201Z) and titrate with 0.2 mol/L sodium thiosulfate standard solution.

4. Measurement conditions and results

Examples of titration conditions

(1) Measurement for total sodium chloride

(i) pH adjustment with 0.1 mol/L nitric acid standard solution

Cndt No.	1	ConstantNo.	1	Mode No.	4
Method	Set	Size	0.5 mL	Pre Int	0 sec
Buret No.	1	Blank	0 mL	Del K	9
Amp No.	1	Molarity	0.1 mol/L	Del Sens	0 mV
D. Unit	pH	Factor	1.004	Int Time	3 sec
S-Timer	5 sec	K	0.00	Int Sens	3 mV
C.P. mL	0 mL	L	0.000	Brt Speed	2
Direction	↓	Unit	mL	Pulse	40
T Timer	0 sec	Formula	D		
D.P. mL	0 mL	Decimal Places	3		
End Point	3.0 pH	Auto In Pram.	Non		
Over mL	0.0 mL				
Max.Vol.	20 mL				

(ii) Titration with 0.2 mol/L silver nitrate standard solution

Cndt No.	2	ConstantNo.	2	Mode No.	8
Method	Auto	Size	0.5 mL	Pre Int	0 sec
Buret No.	2	Blank	0 mL	Del K	5
Amp No.	2	Molarity	0.2 mol/L	Del Sens	0 mV
D. Unit	mV	Factor	1.000	Int Time	5 sec
S-Timer	5 sec	K	58.44	Int Sens	3 mV
C.P. mL	0 mL	L	0.000	Brst Speed	2
T Timer	0 sec	Unit	%	Pulse	40
D.P. mL	0 mL	Formula	(D- B)*K*F*M/(S*10)		
End Sens	100	Decimal Places	4		
Over mL	0.2 mL	Auto In Pram.	Non		
Max. Vol.	20 mL				

(2) Measurement for available chlorine (Calculation of sodium chloride concentration)

(i) Titration with 0.2 mol/L sodium thiosulfate standard solution

Cndt No.	3	ConstantNo.	3	Mode No.	5
Method	Auto	Size	0.5 mL	Pre Int	0 sec
Buret No.	1	Blank	0 mL	Del K	5
Amp No.	2	Molarity	0.2 mol/L	Del Sens	0 mV
D. Unit	mV	Factor	1.002	Int Time	3 sec
S-Timer	5 sec	K	35.45	Int Sens	3 mV
C.P. mL	0 mL	L	0.000	Brst Speed	2
T Timer	0 sec	Unit	%	Pulse	40
D.P. mL	0 mL	Formula	(D- B)*K*F*M/(S*10)		
End Sens	200	Decimal Places	4		
Over mL	0.3 mL	Auto In Pram.	Non		
Max. Vol.	20 mL				

(ii) Calculation of sodium chloride concentration

Cndt No.	4	ConstantNo.	4
Method	Calc	Size	0.5 mL
		Blank	0 mL
		Molarity	0.2 mol/L
		Factor	0
		K	14.80 ※1
		L	0.8243 ※2
		Unit	%
		Formula	K-CA*L
		Decimal Places	4
		Auto In Pram.	Non

※1 Input the result of total sodium chloride.

※2 Conversion coefficient from available chlorine to sodium chloride (58.44(NaCl)/70.9(Cl₂))

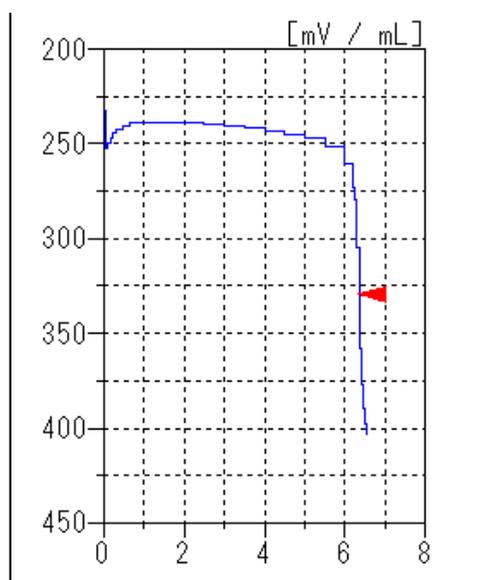
Measurement results

(1) Results of total sodium chloride

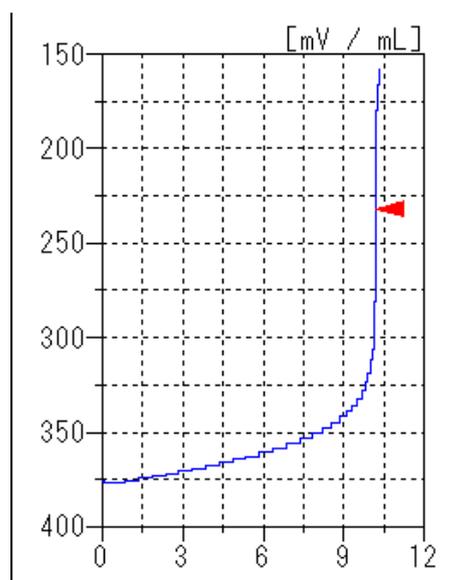
Number of Measurement	Size (mL)	Titrant Volume (mL)	Total sodium chloride Concentration (%)
1	0.5	6.329	14.795
2	0.5	6.324	14.783
3	0.5	6.339	14.818
		Avg.	14.80 %
		SD	0.02 %
Statistic calculation		RSD	0.12 %

(2) Results of available chlorine (Calculated results of sodium chloride concentration)

Number of Measurement	Size (mL)	Titrant Volume (mL)	Available chlorine Concentration (%)	Sodium chloride Concentration (%)
1	0.5	10.174	14.456	2.884
2	0.5	10.223	14.525	2.827
3	0.5	10.276	14.601	2.765
Average			14.52 %	2.83 %
Statistic calculation			Standard deviation	0.07 %
			Coefficient of variation	0.50 %
				2.11 %



Measurement for total sodium chloride



Measurement for available chlorine

Examples of titration curves

5. Note

1) Measurement for total sodium chloride

Residual sodium hypochlorite could cause measurement error. Addition of excess hydrogen peroxide is required to degrade sodium hypochlorite completely.

2) Measurement for available chlorine

The following tips can improve measurement accuracy.

- i) Weigh a sample size quickly because available chlorine is unstable.
- ii) Titrate free iodine immediately because the iodine generated by addition of potassium iodide is easy to volatilize. Addition of plenty potassium iodide is required because the volatilization of iodine depends on the concentration of added potassium iodide.

Keywords: Sodium hypochlorite, Sodium chloride, Residual alkali, Available chlorine, Precipitation titration