

USEPA¹ Silver Nitrate Buret Titration Method²

Method 8225
0 to 25,000 mg/L as Cl⁻
Buret Titration
Scope and Application: For water, wastewater and seawater.

¹ USEPA accepted for NPDES reporting when 0.0141 N silver nitrate standard solution is used.

² Adapted from *Standard Methods for the Examination of Water and Wastewater, (Standard Method 4500 Cl⁻ B)*.


Test preparation

Before starting the test:

Adjust highly acidic or alkaline samples to a pH between pH 7 and 9. Use pH paper to measure the pH. A pH meter will contaminate the sample.

To calculate the result as mg/L sodium chloride (NaCl): mg/L chloride x 1.65 = mg/L sodium chloride

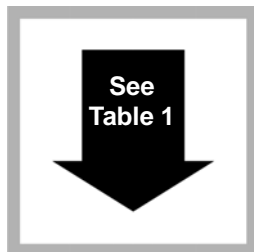
A small amount of silver nitrate is used to make the red-brown color in step 6. For most accurate results, follow the procedure using 100 mL of deionized water in place of the sample. Titrate this solution and note the volume of titrant required. For all samples, subtract this volume of titrant before calculating the mg/L chloride.

Collect the following items:

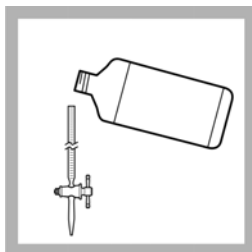
Description	Quantity
Chloride 2 Indicator Powder Pillow	1
Silver Nitrate Standard Solution (see Range-specific information)	1 bottle
Buret, Class A, 25-mL, with support stand	1
Erlenmeyer flask, 250 mL	1
Graduated cylinder	1

See [Consumables and replacement items](#) for reorder information.

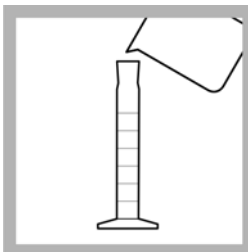
Buret titration



1. Select the sample volume and silver nitrate standard solution from [Range-specific information](#).



2. Fill a 25-mL buret to the zero mark with the Silver Nitrate Standard Solution.

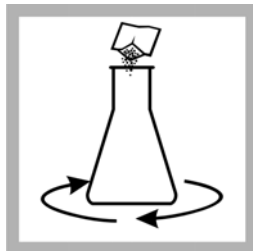


3. Use a graduated cylinder or pipet to measure the sample volume from [Range-specific information](#).



4. Transfer the sample into a 250-mL Erlenmeyer flask. If the sample volume is less than 100 mL, dilute to approximately 100 mL with deionized water.

Buret titration (continued)



5. Add the contents of one Chloride 2 Indicator Powder Pillow. Swirl to mix.

6. Titrate the sample while swirling the flask until the color changes from yellow to red-brown.

7. Calculate:

mL titrant used x multiplier = mg/L chloride as Cl⁻

Example: 100 mL of sample was titrated with the 0.0141 N silver nitrate solution and 15 mL of titrant was used to reach the endpoint.

The chloride concentration is: 15 x 5 = 75 mg/L as Cl⁻

Table 87 Range-specific information

Range (mg/L as Cl ⁻)	Sample volume (mL)	Silver nitrate concentration	Multiplier
0–125	100	0.0141 N	5
100–250	50	0.0141 N	10
200–500	25	0.0141 N	20
500–1250	100	0.141 N	50
1000–2500	50	0.141 N	100
2500–10,000	25	0.141 N	200
5000–25,000	10	0.141 N	500

Interferences

An interfering substance can mask the end point. A dilution can reduce the interference to a level at which the substance does not interfere. If an interference is suspected, use a smaller amount of fresh sample and repeat the test.

Interfering substances lists substances that can interfere with this test.

Table 88 Interfering substances

Interfering substance	Interference level
Bromide	Cyanide, bromide and iodide interfere directly and are titrated as chloride.
Cyanide	Cyanide, bromide and iodide interfere directly and are titrated as chloride.
Iodide	Cyanide, bromide and iodide interfere directly and are titrated as chloride.
Iron	Iron concentrations over 20 mg/L will mask the end point.
Orthophosphate	Orthophosphate concentrations over 25 mg/L will cause a precipitate to form.
Sulfide	To remove interference from sulfide, add one Sulfide Inhibitor Reagent Powder Pillow to approximately 125 mL of the sample, mix for one minute and filter through filter paper.
Sulfite	To remove interference from at least 10 mg/L sulfite, add 3 drops of 30% hydrogen peroxide to 100 mL of sample before starting the test.

Sample collection, preservation and storage

Collect samples in clean plastic or glass bottles. Samples can be stored in sealed containers.

Accuracy check

Use the standard additions method to find if the sample has an interference. Use the standard solution method to make sure that the user has followed the test correctly and that the reagents are good.

Standard additions method (sample spike)

Required for accuracy check:

- Chloride Voluette® Ampule Standard, 12,500-mg/L as Cl⁻
- Ampule breaker
- TenSette Pipet, 0.1–1.0 mL

Procedure for use with the **0.0141 N** titrant:

1. Open the standard solution ampule.
2. Use the TenSette Pipet to add 0.1 mL of the standard to the titrated sample. Swirl to mix.
3. Titrate the spiked sample to the end point. Write down the amount of titrant that was used to reach the end point.
4. Use the TenSette Pipet to add 0.2 mL of standard to the titrated sample. Swirl to mix.
5. Titrate the spiked sample to the end point. Write down the amount of titrant that was used to reach the end point.
6. Use the TenSette Pipet to add 0.3 mL of standard to the titrated sample. Swirl to mix.
7. Titrate the spiked sample to the end point. Write down the amount of titrant that was used to reach the end point.
8. Each 0.1 mL of standard that was added should use 2.5 mL of titrant to reach the endpoint. If more or less titrant was used, there can be an interference (see [Interferences](#)) or the concentration of the titrant has changed (see [Standard solution method](#)).

Procedure for use with the **0.141 N** titrant:

1. Open the standard solution ampule.
2. Use the TenSette Pipet to add 1.0 mL of the standard to the titrated sample. Swirl to mix.
3. Titrate the spiked sample to the end point. Write down the amount of titrant that was used to reach the end point.
4. Use the TenSette Pipet to add 2.0 mL of standard to the titrated sample. Swirl to mix.
5. Titrate the spiked sample to the end point. Write down the amount of titrant that was used to reach the end point.
6. Use the TenSette Pipet to add 3.0 mL of standard to the titrated sample. Swirl to mix.
7. Titrate the spiked sample to the end point. Write down the amount of titrant that was used to reach the end point.
8. Each 1.0 mL of standard that was added should use 2.5 mL of titrant to reach the endpoint. If more or less titrant was used, there can be an interference (see [Interferences](#)) or the concentration of the titrant has changed (see [Standard solution method](#)).

Standard solution method

A silver nitrate standard solution will slowly decompose with exposure to light. Complete the following test to make sure the concentration is accurate.

Required for accuracy check:

- Sodium Chloride Standard Solution, 1000-mg/L as Cl^-
- 100-mL Class A volumetric flask (for use with 0.0141 N titrant only)

Procedure for use with the **0.0141 N** titrant:

1. Add 10.0 mL of the sodium chloride standard solution, 1000-mg/L as Cl^- , to a 100-mL Class A volumetric flask. Dilute to 100 mL with deionized water and mix fully. This solution has a concentration of 100 mg/L chloride.
1. Add 100.0 mL of the diluted sodium chloride standard solution, 100-mg/L as Cl^- , to an Erlenmeyer flask.
2. Add the Chloride 2 indicator and swirl to mix.
3. Titrate the standard to the end point with the 0.0141 N silver nitrate titrant and calculate the result. If the result is more than 105 mg/L chloride, discard the silver nitrate titrant and replace it with a fresh supply.

Procedure for use with the **0.141 N** titrant:

1. Add 100.0 mL of the sodium chloride standard solution, 1000-mg/L as Cl^- , to an Erlenmeyer flask.
2. Add the Chloride 2 indicator and swirl to mix.
3. Titrate the standard to the end point with the 0.141 N silver nitrate titrant and calculate the result. If the result is more than 1050 mg/L chloride, discard the silver nitrate titrant and replace it with a fresh supply.

Summary of method

Silver nitrate is used as the titrant and potassium chromate as the indicator. Silver nitrate first reacts selectively with the chloride in the sample to produce insoluble white silver chloride. After all the chloride has been precipitated, the silver nitrate reacts with the chromate to form an orange or red-brown silver chromate precipitate.

Consumables and replacement items

Required reagents

Description	Quantity/Test	Unit	Catalog number
Chloride 2 Indicator Powder Pillows	1 pillow	50/pkg	105766
Titrant—select one or more based on range:			
Silver Nitrate Standard Solution, 0.0141 N	varies	1 L	31653
Silver Nitrate Standard Solution, 0.141 N	varies	500 mL	1255149

Required apparatus

Description	Quantity/Test	Unit	Catalog number
Buret, Class A, 25-mL	1	each	2636540
Buret Clamp, double	1	each	32800
Flask, Erlenmeyer, graduated, 250-mL	1	each	50546
Graduated cylinder—select one or more based on range:			
Cylinder, graduated, 10-mL	1	each	50838
Cylinder, graduated, 25-mL	1	each	50840
Cylinder, graduated, 50-mL	1	each	50841
Cylinder, graduated, 100-mL	1	each	50842
Support Stand	1	each	56300

Recommended standards

Description	Unit	Catalog number
Chloride Standard Solution, Voluette® Ampule, 12,500-mg/L as Cl ⁻ , 10-mL	16/pkg	1425010
Sodium Chloride Standard Solution, 1000-mg/L as Cl ⁻	500 mL	18349
Voluette Ampule breaker, 10 mL	each	2196800

Optional reagents and apparatus

Description	Unit	Catalog number
Filter Paper, 12.5 cm diameter	100/pkg	69257
Hydrogen Peroxide, 30%	473 mL	14411
Sulfide Inhibitor Reagent Powder Pillow	100/pkg	241899
TenSette Pipet, 0.1 to 1.0 mL	each	1970001
Water, deionized	500 mL	27249
Pipet, TenSette®, Pipet, 1.0–10.0 mL	each	1970010
Pipet Tips, for TenSette Pipet 1970010 ¹	50/pkg	2199796
Pipet Tips, for TenSette Pipet 1970010 ¹	250/pkg	2199725
Pipet, TenSette, Pipet, 0.1–1.0 mL	each	1970001
Pipet Tips, for TenSette Pipet 1970001 ¹	50/pkg	2185696
Pipet Tips, for TenSette Pipet 1970001 ¹	1000/pkg	2185628
pH Paper, 0–14 pH range	100/pkg	2601300
Sampling Bottle with cap, low density polyethylene, 250 mL	12/pkg	2087076
Flask, Class A volumetric, 100 mL	each	1457442
Dropper, glass	5/pkg	1419705
Clippers for powder pillows	each	66800

¹ Other sizes are available



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