



Chloride in Mineral Water

Introduction

Many mineral waters contain an easily titratable amount of chloride ions. The most accurate method for chloride determination is inflection point titration, but for quick measurement, if the sample matrix is reproducible, end point titration can be used with a combined silver electrode.

Principle

The titrant reagent for chloride determination is silver nitrate (AgNO_3); using end point titration, the titrant concentration must be at least 0.05 eq/l and generally between 0.1 and 0.05 eq/l. The water sample must be acidic at around pH 4.5. That can be obtained by means of acetic acid but for mineral waters with high pH, nitric acid 1M can be also used.

The reaction corresponds to:



Results are normally expressed as mg/l of chloride (AW = 35.45 g/mol) or sometimes as mg/l of sodium chloride (NaCl with MW = 58.45 g/mol).

Electrode and reagents

MC6091Ag Metal Electrode, combined silver/reference (part no. E34M004) with CL114 cable (part no. A94L114)

AgNO_3 0.05 eq/l solution

Dissolve 8.494 g of analytical grade AgNO_3 in distilled water and dilute to 1000 ml using a volumetric flask. As AgNO_3 can be found as very pure grade, it can be considered as reference material.

HNO_3 1M solution

Dilute 78 ml of concentrated HNO_3 in 500 ml of distilled water. Let it cool to room temperature and dilute to 1000 ml using a volumetric flask.

End Point titration settings

Burette volume:	25 ml
Stirring speed:	400 rpm
Working mode:	mV (with i=0)
Number of end points:	1
End point:	-100 mV
Stirring delay:	30 seconds
Minimum speed:	0.1 ml/min
Maximum speed:	4.0 ml/min
Proportional band:	100 mV
End point delay:	10 seconds

Sample unit:	ml
Standard amount:	50 or 100 ml (depending on chloride in the sample)
Titration:	Increasing mV
Result:	mg/l

Procedure

For carbonated mineral waters, or waters containing a high level of carbonate ions, it is necessary to add 5 or 10 ml of HNO_3 , boil the sample and let it cool to room temperature before the titration.

For other samples, add 10 ml of HNO_3 0.1 eq/l and titrate directly.

Pipette 50 or 100 ml of sample.

If necessary, add distilled water.

Connect the electrode.

Dip electrode and delivery tip in the solution.

Start method by pressing the RUN key.

Results

As 1 molecule of titrant reacts with 1 molecule of Cl^-
Generally expressed as mg/l of chloride ion (AW = 35.453 g/mol)

$$R = V(\text{titr}) * C(\text{titr}) * 35.453 * 1000 / V(\text{smp})$$

-V(titr) = total volume of titrant to reach the end point in ml

-C(titr) = titrant concentration in eq/l (currently 0.05)

-V(smp) = sample volume in ml 35.453 = Atomic weight of chloride ion

For a result expressed as mg/l of NaCl, replace 35.453 with 58.453 (MW of NaCl).

For a result in mg/l of Cl or NaCl

Enter

The sample amount in the SAMPLE screen

The titrant concentration in the TITRANT screen

1 Titrant and 1 Sample in the COEFFICIENTS display

58.44 as molecular weight (for NaCl) or 35.453 (for Cl)

The Titration Manager gives a result according to the above formula.

For 5 determinations of a mineral water

Mean: 88 mg/l
Standard deviation: 0.7 mg/l
Rel. standard deviation: 0.8%

Working range

With 100 ml for the sample volume and 0.5 ml as experimental lower limit for titrant delivery, we can consider a chloride concentration corresponding to approx. 8.5 mg/l as experimental limit.

For the best possible accuracy, the working range starts at 130 mg/l for a 25 ml burette cylinder (corresponding to 35% of the capacity).

Notes

Because this application note works with an end point titration, it is not recommended to titrate with a reagent lower than 0.05 eq/l. If you use a reagent with a concentration below 0.05, change the end point delay to 20 or 25 seconds because the AgCl precipitation is a low speed reaction for low chloride concentration.

Starting measured potential can indicate presence of halides other than chloride in the sample. Normally chloride ions give a measured potential around -220/-300 mV; if the measured potential is below these values, you can expect Br⁻ or I⁻; if presence of S²⁻ is expected, it is necessary to prepare the sample as a carbonated mineral water to eliminate H₂S.