

Sheet No.

GT200-WA011 Wastes

Total Hardness Analysis of Tap Water 1/3

Method : Chelatometric titration (photometric detection)
 Apparatus : Automatic Titrator GT-200
 Photometric detector GT-LDII Interference filter wavelength 620 nm
 Titration mode : CROSS-B, Detection: mV
 Related standard : Standard Methods for the Examination of Water Hardness Total hardness

*This sheet is provided as information. It is not to guarantee the analysis values. Please use under the ideal conditions considering external factors including the analysis environment and properties of the sample.

Outline

Hardness is derived by converting the amount of calcium ions and magnesium ions in tap water to the amount of calcium carbonate expressed in mg/L. Total hardness analysis of tap water is carried out by chelate titration (photometric detection).

Reagents

[Titrant]

■0.01 mol/L EDTA solution (for testing and research)

[Reagents]

■10w/v% potassium cyanide solution: Dissolve 1 g of potassium cyanide in pure water and volume up to 10 ml.

■Hydrochloric acid (1+9): Add 10 ml of hydrochloric acid to 90 ml of pure water.

■10w/v% hydroxylamine hydrochloride solution: Dissolve 10 g of hydroxylamine hydrochloride in pure water and volume up to 100 ml.

■0.01 mol/L magnesium chloride solution: Place magnesium oxide into pre-baked crucible, heat in a muffle furnace at a temperature of 700°C or greater for about 3 hours, and leave to stand to cool down in a desiccator. Once cooled down, place 0.403 g of magnesium oxide in a 100-ml beaker, add 10 ml of pure water and cover with a watch glass. Slowly add hydrochloric acid (1+9) to dissolve magnesium oxide until granules are disintegrated. Place the beaker in a water bath set to a temperature of about 80°C to evaporate hydrochloric acid, wash out the residual white substance left at the bottom of the beaker into a 1-L volumetric flask using pure water, and volume up to 1 L.

■Ammonia buffer solution (pH 10): Place 67.5 g of ammonium chloride in a 1-L beaker, add 300 ml of pure water to dissolve, add 570 ml of ammonia solution, and volume up to 1 L using pure water.

[Indicator]

■Eriochrome black T (EBT): Dissolve 0.5 g of eriochrome black T and 4.5 g of hydroxylamine hydrochloride into 100 ml of ethanol. Store in a brown bottle. Shelf life is 1 month. (Store in a dark cool place)

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Analytical Procedure

- (1) Place 100 ml of tap water into a 200-ml beaker using a measuring cylinder.
- (2) Add 5 drops of 10w/v% potassium cyanide solution. (Masking of copper, iron, and zinc)
HANDLE WITH CARE!
- (3) Add 5 drops of 10w/v% hydroxylamine hydrochloride solution.
 (Add when a large amount of iron exists in the tap water.)
- (4) Accurately measure 1 ml of 0.01 mol/L magnesium chloride solution and add into the beaker.
 (No need to add if magnesium ions exist in the tap water.)
- (5) Add 2 ml of ammonia buffer solution (pH 10).
- (6) Add 0.5 ml of EBT indicator solution, and titrate using 0.01 mol/L EDTA solution. (Red → Blue)

[Equation]

$$\text{Total hardness (CaCO}_3 \text{ mg/L)} = (\text{A1} - 1) \times (1000 / \text{S}) \times 1$$

(when magnesium chloride solution is added)

$$\text{Total hardness (CaCO}_3 \text{ mg/L)} = \text{A1} \times (1000 / \text{S}) \times 1$$

(when magnesium chloride solution is not added)

A1 : Titer of 0.01 mol/L EDTA solution to the end point (ml)

S : Sample amount (ml)

Other Requirements

- Bring the tap water to room temperature prior to measurement. Low water temperature may delay the color change of indicator.
- Pay attention to handling methods and storage of reagents when using 10w/v% potassium cyanide solution.
- Handle measurement reagents with care after reading through and understanding their labels and safety data sheets.
- Wear personal protective equipment such as protective goggles and gloves when handling the reagents.

Measurement Results

	Sample amount (ml)	Titer (ml)	Measurement value (%)
1	100	7.4365	64.4
2		7.4021	64.0
3		7.4183	64.2

Number of data	(n)	3
Average		64.2
Standard deviation	(SD)	0.1701
Relative standard deviation	(RSD%)	0.2681

Total hardness of tap water was measured using GT-200. Average over 3 measurements was 64.2 mg/L. Relative standard deviation (RSD%) was 0.27%, exhibiting measurement with relatively high reproducibility.

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ID No.: 5 GT No.1

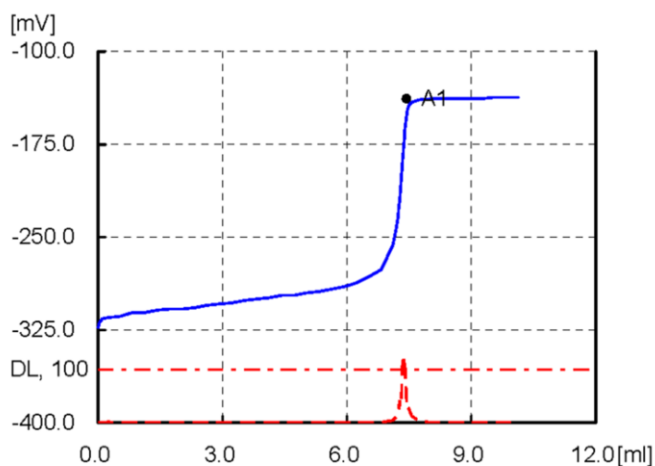
User: GT-200

Measurement date: 2013/03/05 17:58

Measurement type : Sample Titr

Sample name : Service water

Sample size (S) : 100 [ml]



C1: 64.37 [mg/L]

A1: 7.4365 [ml] -138 [mV]

Pi : -323 [mV]

Start : 0 [ml] -323 [mV]

End : 10.134 [ml] -137 [mV]

Time: 3' 21"

Run File No.: 0 Quick Mode

Titration File No.: 23 Service water test (total hardness)

Mode : CROSS-B End1 End1 Width: -500 [mV] ± 500 [mV]

Detect : mV1

BRT No. : 1

Reagent : 19

WTint : 0 [sec]

Vup : 300 [μl]

Vlow : 10 [μl]

dE : 5 [mV]

dT : 3 [sec]

DL : 100 [mV/ml]

DetCnt : 15

Vmax : 50 [ml] C1: (A1-1)*(1000/S)*1

Vover : 1 [ml] [mg/L]

Reag : 0.01M-EDTA E : 1 M : 0.01 [Mol/l]

f : 1

Buret Injection Speed: 500 [ul/sec]