

## Determination of total hardness in Water

### Description

The determination of the total hardness in water is done by titration with the sodium salt of ethylenediaminetetraethanoic acid (EDTA), the detection is carried out with a Cu electrode and Cu-EDTA. The sum of EDTA complexable ions is determined. The result is calculated as mmol / l.

### Instruments

Titration	TL 5000 or higher
Electrode	Cu 1100 PLH
Cable	L 1 A
Reference electrode	B 2920+
cable	L 1 N
Stirrer	Magnetic stirrer TM 235 or similar
Lab accessory	Glass beaker 150 ml
	Magnetic stirrer bar 30 mm

### Reagents

1	Na <sub>2</sub> EDTA 0.1 mol/l
2	Ammonia solution 25%
3	Ammonium chloride
4	Copper-EDTA solution 0.1 mol/l (Cu(NH <sub>4</sub> ) <sub>2</sub> -EDTA)
5	Distilled Water
6	Electrolyte solution L300
All reagents should be of analytical grade or better.	

## **Titration procedure**

### **Reagents**

The titer determination of the EDTA solution is carried out as described in the application note "Titer determination of EDTA".

Buffer solution pH 10

Dissolve 54.0 g of ammonium chloride in a little water, add 350 ml of ammonia solution 25% and make up to 1.0 liter with water.

### **Cleaning of the electrode**

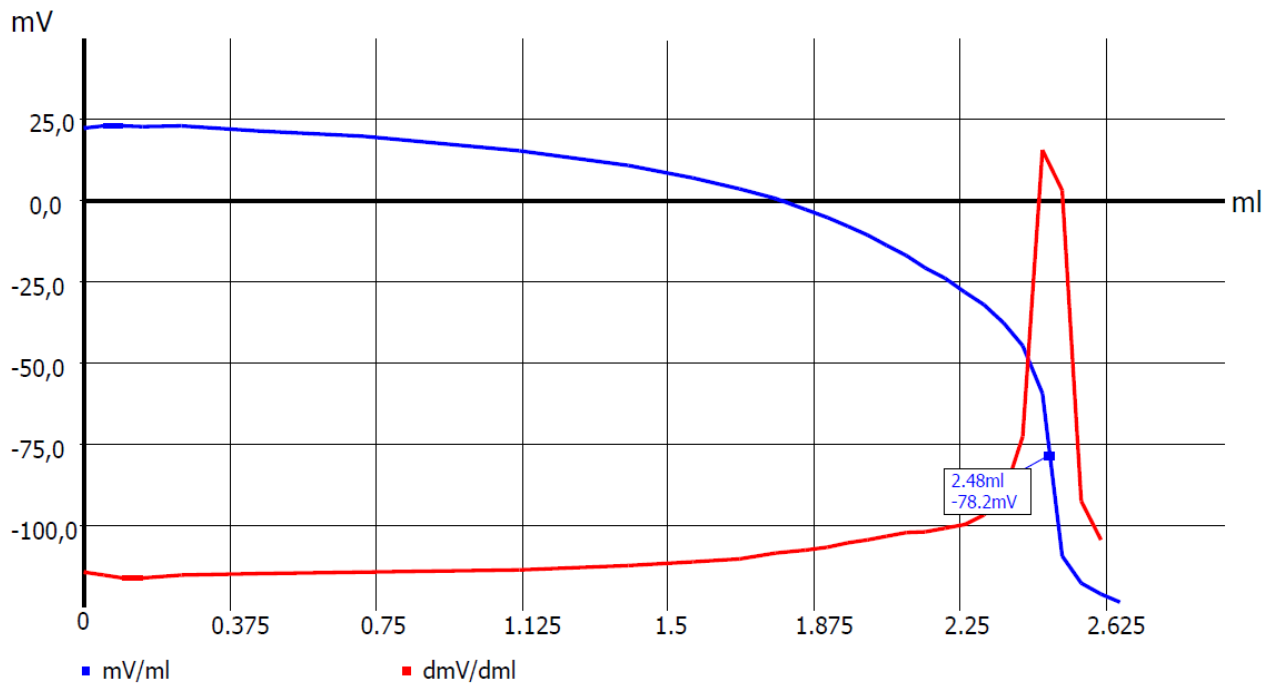
The electrodes are cleaned with distilled water. The Cu 1100 is stored clean and dry, for the storage of the reference electrode use electrolyte solution L300.

### **Sample preparation**

100.00 ml of sample are placed in a 150 ml beaker, 5 ml buffer solution pH 10 and 1 ml of Cu-EDTA 0.1 mol / l are added. Then it is titrated with Na<sub>2</sub>EDTA 0.1 mol / l. The consumption should be about 5 - 15 ml. For very hard water samples, the amount of sample may be reduced, for very soft water samples, a lower concentration EDTA solution may be needed.

## Titration parameter

### Sample titration



Default method	Total hardness		
Method type	Automatic titration		
Modus	Dynamic		
Measured value	mV		
Measuring speed / drift	User defined	Minimum holding time	5 s
		Maximum holding time	12 s
		Measuring time	4 s
		Drift	3 mV/min
Initial waiting time	0 s		
Dynamic	flat	Max step size	0.5 ml
		Slope max ml	10
		Min. step size	0.05 ml
		Slope min. ml	120
Damping	none	Titration direction	decrease
Pretitration	off	Delay time	0 s
End value	off		
EQ	On (1)	Slope value	120
Max. titration volume	20 ml		
Dosing speed	100%	Filling speed	30 s

Calculation:

$$\text{Result [mmol/l]} = \frac{(EQ1 - B) * T * M * F1}{W * F2}$$

B	0	Blank value
EQ1		Consumption of titrant at first Equivalence point
T	WA	Actual concentration of the titrant
M	1	
V	man	sample volume [ml]
F1	1000	Conversion factor
F2	1	Conversion factor

If the result is needed in other units than mmol / l, it can be calculated with the following factors F2:

Unit		F2
mmol/l	mmol/l	1
German hardness	°dH	0,1783
French hardness	°fH	0,1
ppm CaCO <sub>3</sub>	ppm	0,01

Any questions? Please contact the application team:

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