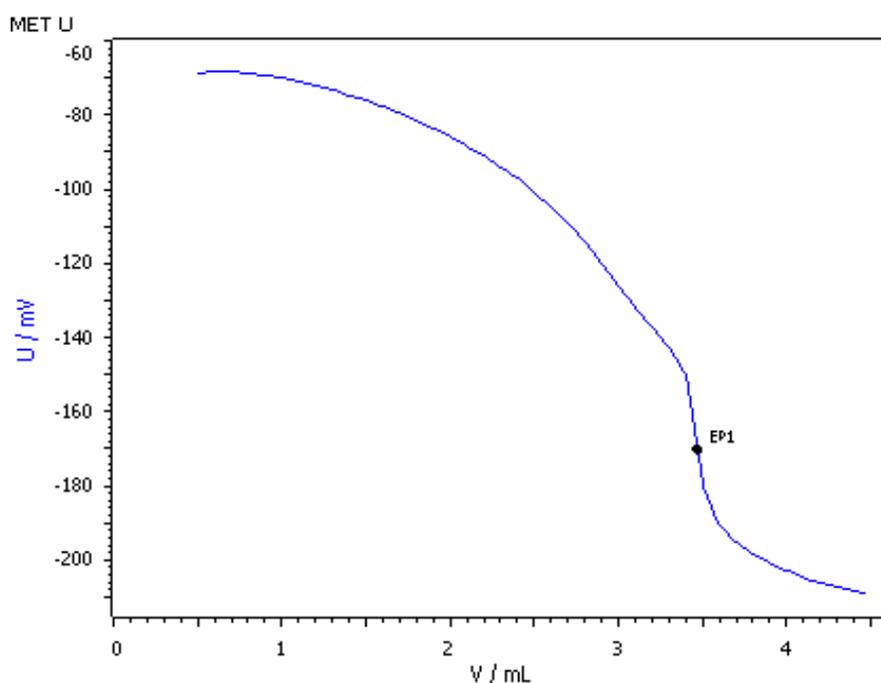


Automated determination of calcium, magnesium, and total hardness in water using the Cu ISE



The calcium, magnesium, and total hardness in water can be analyzed using the Cu ISE. For the total hardness determination, EDTA is used as titrant, while for the calcium hardness determination EGTA is used. The magnesium hardness can then be calculated from the two titrations.

Method description

Sample

Herisau tap water

Sample preparation

No sample preparation is required.

Configuration

907 Titrand	2.907.0010
815 Robotic USB Sample Processor XL	2.815.0020
786 Swing head	2.786.0040
Swing arm	6.1462.070
Titration head	6.1458.010
Sample rack 28 x 200 mL	6.2041.830
800 Dosino, 5 x	2.800.0010
802 Stirrer	2.802.0020
5 mL Dosing unit, 2x	6.3032.150
10 mL Dosing unit, 3 x	6.3032.210
Disposable PP sample beakers, 200 mL, 1000 pieces	6.1459.310
Cu ISE	6.0502.140
LL ISE Reference	6.0750.100

Solutions

Titrant 1	c(EDTA) = 0.1 mol/L
Titrant 2	c(EGTA) = 0.1 mol/L 19.4 g Na ₂ EGTA is weighed into a 500 mL volumetric flask and suspended in approx. 150 mL deion. H ₂ O. c(NaOH) = 10 mol/L is added in portions until all EGTA is dissolved. The mixture is then made up to 1 L with deion. H ₂ O.
Buffer solution pH = 10	54 g NH ₄ Cl is weighed into a 1 L volumetric flask and dissolved in deion. H ₂ O. 350 mL w(NH ₃) = 25% is added and the mixture is made up to 1 L with deion. H ₂ O.
CuEDTA	c(Cu(NH ₄) ₂ EDTA) = 0.1 mol/L
c(CuSO ₄) = 0.1 mol/L	2.50 g CuSO ₄ · H ₂ O is weighed into a 100 mL volumetric flask. The flask is

	filled up to the mark with deion. H ₂ O and mixed.
Cu-EGTA	25 mL of c(CuSO ₄) = 0.1 mol/L and 25 mL c(EGTA) = 0.1 mol/L are mixed.

Analysis

100 mL tap water is pipetted into a sample beaker, then 0.5 mL Cu-EDTA and 5 mL buffer solution are added. After a pause of 30 s, the solution is titrated with c(EDTA) = 0.1 mol/L until after the equivalence point.

Again 100 mL tap water is pipetted into a new sample beaker; then, 0.5 mL CuEGTA and 5 mL buffer solution are added. After a pause of 30 s, the solution is titrated with c(EGTA) = 0.1 mol/L until after the equivalence point.

Parameters

Mode	MET U
Pause	30 s
Stirring rate	8
Signal drift	50 mV/min
Min. waiting time	5 s
Max. waiting time	26 s
Volume increment	0.1 mL
Stop EP	9
EP criterion	30 mV
EP recognition	all

Results

Mean results (n = 5)

Total hardness / (mmol/L)	3.517
s(rel) / %	0.57
Ca hardness / (mmol/L)	2.547
s(rel) / %	0.47
Mg hardness / (mmol/L)	0.971
s(rel) / %	0.94

Comments

It is possible to obtain two equivalence points for the total hardness titration; in this case, the second equivalence point has to be evaluated.