



CIO⁻ Determination in Bleach Indirect Titration

Introduction

A bleach solution contains mainly NaClO plus basic products such as NaOH and Na₂CO₃.

CIO⁻ can be determined by redox titration. Besides the direct titration by sodium arsenite; CIO⁻ determination can be run with a two-step titration; quantitative oxidation of I⁻ CIO⁻ giving I₂ and titration of I₂ by sodium thiosulphate. The titration result is generally expressed as % of CIO⁻.

Principle

Oxidation of I⁻ by CIO⁻ follows the reaction



Titration of I₂ by sodium thiosulphate follows the reaction



The result of these 2 equations is 1 ion CIO⁻ corresponds to 2 ions S₂O₃²⁻

The titration of I₂ by S₂O₃²⁻ is run by pre-set end point titration with imposed current potentiometry.

Electrode and reagents

MC231Pt2 Metal Electrode, double platinum wire, with adapter part no. A94P801 (BNC/2xbanana) or M241Pt2-8 Metal Electrode

Distilled water

KI solid state

HCl pure grade

Na₂S₂O₃ 0.1 eq/l or 0.1 mol/l (For concentration determination see separate application note)

Weigh exactly 24.8181 g of Na₂S₂O₃, 5H₂O

Dissolve in 500 ml of freshly boiled distilled water

Add 2 or 3 drops of CHCl₃

Dilute to 1000 ml in a volumetric flask

Wait for one day and filter if necessary

Store in a brown glass bottle

Electrode and reagents

Burette volume:	25 ml
Stirring speed:	400 rpm
Working mode:	mV with i = 10 µA (DC)

Number of end points:	1
End point:	200 mV
Stirring delay:	40 seconds
Minimum speed:	0.1 ml/min
Maximum speed:	5.0 ml/min
Proportional band:	200 mV
End point delay:	5 seconds
Sample unit:	ml
Sample amount:	0.5
Titration:	Increasing potential
Result:	g/l

Procedure

Install the titration system with the Na₂S₂O₃ solution

Connect the electrode

Pipette (or preferably weigh) the sample amount

Dilute the sample with 50 ml of distilled water

Add 1 g of KI and 5 ml of HCl

Dip electrode and delivery tip in the solution

CIO⁻ Determination in Bleach - Indirect Titration

Start method by pressing the RUN key

Results

Commonly expressed as g/l of CIO⁻ (MW = 51.43 g/mol)

Use as titrant unit: mol/l (M)

As 2 moles of titrant corresponds to 1 mole of CIO⁻ in sample:

$$R = V(\text{titr}) * C(\text{titr}) * 51.43 / 2 * V(\text{smp})$$

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

C(titr) = concentration of titrant in mol/l

51.43 = molecular weight of CIOV(smp) = sample volume in ml

For a result in g/l

Enter

The sample amount in the SAMPLE screen

The titrant concentration in the TITRANT screen (in mol/l)

2 Titrants and 1 Sample in the COEFFICIENTS display

51.43 as molecular weight

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

For a result as a %

As the Titration Manager cannot give a result in % if the sample unit is a volumetric unit, you can use the equation feature

Equation number: 1
Equation result: % ClO
Equation formula: R1 / 10

R1 is the titration result calculated in g/l

5 determinations on a commercial concentrated bleach

Mean (as ClO⁻): 78.8 g/l
Standard deviation: 1.2 g/l
Rel. standard deviation: 1.6 %

Working range

As a commercially available concentrated bleach corresponds to a ClO⁻ concentration in of around 80 g/l (corresponding to a total volume of titrant of around 16 ml for 0.5 ml of sample), it is possible to use the dilution procedure to facilitate pipetting or weighing 0.5 ml of sample.

For example, pipette 5 ml of sample, dilute to 100 ml with water and take an aliquot of 10 ml.

In the SAMPLE display enter

DILUTION: YES
Sample: 5 ml
Final dilution volume: 100 ml
Aliquot: 10 ml