DENVER INSTRUMENT

# Alkalinity of Bleach (NaClO Solution)

## Introduction

A bleach solution contains mainly NaClO plus basic products such as NaOH and $Na_2CO_3$. The concentration of basic products is generally expressed as NaOH concentration, which is around 8 g/l NaOH, i.e. 0.2N concentration. The alkalinity determination uses an acid/base titration.

## Principle

The $OH^-$ content is simply determined by an acid/base titration using a 0.1 eq/l strong acid as titrant.

Depending on the bleach solution, the titration curve generally shows 2 inflections. The most common method involves a titration of all the basic functions by a predetermined end point titration at pH 4.00. Before this titration, it is necessary to reduce the ClO-ions present in the solution.

## Electrodes and reagents

pHC2011-8 Combined pH Electrode (part no. E16M317)
$H_2O_2$ 30% (volume)

Hydrochloric acid 0.1 eq/l (or 0.1 mol/l)

Slowly add 8.3 ml of concentrated hydrochloric acid to 500 ml of distilled water and dilute to exactly 1000 ml. Calibrate the titrant versus $Na_2B_4O_7$, 10 $H_2O$ (sodium borate) as standard.

(See separate application note)

Distilled water

IUPAC Series pH standards
pH 4.005 (part no. S11M002) and pH 10.012 (part no. S11M007)

## End Point titration settings

| | |
|---|---|
| Burette volume: | 25 ml |
| Stirring speed: | 400 rpm |
| Working mode: | pH |
| Number of end points: | 1 |
| End point: | 4.00 pH |
| Stirring delay: | 45 seconds |
| Minimum speed: | 0.2 ml/min |
| Maximum speed: | 8.0 ml/min |
| Proportional band: | 3.00 pH |
| End point delay: | 5 seconds |
| Sample unit: | ml |
| Sample amount: | 5 |
| Titration: | Decreasing pH |
| Result: | g/l |

## Procedure

Calibrate the electrode using the two IUPAC standards

Pipette 5 ml of sample

Always dilute the sample with the same volume of distilled water (max. 50 ml)

Slowly add 5 ml of $H_2O_2$ for 5 ml of sample

Dip electrode and delivery tip in the solution

Start method by pressing the RUN key

## Results

Expressed as NaOH content (MW = 40 g/mol) in g/l

As 1 molecule of titrant reacts with 1 molecule of NaOH

R(NaOH) = V(titr) * C(titr) * 40 / V(smp)

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

-V(smp) = sample amount

-C(titr) = exact concentration of the titrant in eq/l

**For a result in g/l**
Enter

The sample amount in the SAMPLE screen

The titrant concentration in the TITRANT screen

1 Titrant and 1 Sample in the COEFFICIENTS display

40 for NaOH 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: | % NaOH |
| Equation formula: | R1 / 10 |

R1 is the titration result calculated in g/l.

**5 determinations on a commercial concentrated bleach**

| | |
|---|---|
| Mean (as NaOH): | 7.25 g/l |
| Standard deviation: | 0.07 g/l |
| Rel. standard deviation: | 1% |

## Working Range

Results are expressed in g/l of NaOH (MW = 40 g/mol)

1 ml of HCl 0.1 eq/l represents 4 mg of NaOH or, with a 5 ml sample volume a NaOH content corresponding to 0.8 g/l

The working range can be calculated as the following formula:

Result (in g/l) = V(titr in ml) * 0.8 * 1000 / V(smp)

Using the conditions given in this application note (5 ml sample and a 25 ml burette for titrant), it is possible to obtain results between 7 g/l (for 35% capacity of the burette) and 20 g/l (total capacity of the burette) with the best possible accuracy and reproducibility.

## Notes

Addition of $H_2O_2$ is necessary to reduce the ClO-ion to Cl- before running the alkalinity titration.