

Assay of sodium
hydroxide
solution

NaOH solution

- From B.p, NaOH solution contains not less than 97.5% w/w of total alkali (as NaOH) and not more than 2.5 % w/w Na₂CO₃.
- **Assay:**
 - 10 ml of unknown(bulb pipette).
 - 25 ml of distilled water.
 - Add 2.5 ml of barium chloride solution.
 - Titrate with 1N HCl solution using 1-2 drops of phenolphthalein indicator
 - The first end point from pink → colorless(turbid)
 - To the turbid sol. add 5 drops of Bromophenol Blue ind. and complete titration with 1N HCl .
 - The second end point bluish violet → yellowish green

1N HCl solution



The buret contains the titrant.

10 ml of unknown
25ml of D.W
2.5 ml of BaCl₂ solution
1-2 drops of ph.ph. ind. (1st titration)
5-6 drops of B.p.B ind. (2nd titration)



This flask contains the solution to be titrated and the indicator.



Chemical principle:

- NaOH is strong base, absorbs CO₂



- both NaOH and Na₂CO₃ react with HCl



When we assay a sample, we do the assay for total alkalinity contributed to NaOH and Na₂CO₃.

- Barium chloride (BaCl₂) is added to precipitate all carbonate



- **1st titration:**



Why HCl do not react with BaCO₃?

Why the end point is turbid?

- **2nd titration:**



definition of chemical factor: the weight of substance that is chemically equivalent to 1ml of std. solution.

- **Calculation of the *chemical factor*:**

a) From reaction of HCl with NaOH:

1Mwt of NaOH \equiv 1 Mwt HCl

1 Mwt of NaOH \equiv 1 eqwt HCl

1 ~~x~~40 gm of NaOH \equiv 1 liter of 1N HCl

40/1000 gm NaOH \equiv 1ml of 1N HCl

0.04 gm of NaOH \equiv 1ml of 1N HCl of total alkalinity calculated as NaOH(**chemical factor**)

b) From reaction of 2HCl with Na₂CO₃

2Mwt of HCl \equiv 1Mwt of BaCO₃ \equiv 1Mwt Na₂CO₃

1Mwt Na₂CO₃ \equiv 2Mwt of HCl

1Mwt Na₂CO₃ \equiv 2 eqwt of HCl

$\frac{1}{2}$ Mwt Na₂CO₃ \equiv 1 eqwt of HCl

106/2 gm Na₂CO₃ \equiv 1liter of 1N HCL

53 gm Na₂CO₃ \equiv 1liter of 1N HCL

53/1000 gm Na₂CO₃ \equiv 1ml of 1N HCL

0.053 gm Na₂CO₃ \equiv 1ml of 1N HCL (chemical factor)

- **Calculations :**

V_1 is the of HCl consumed in the 1st titration

V_2 is the of HCl consumed in the 2nd titration

$V_1+V_2= V_3$ total HCl consumed.

correct the V_3 according to this equation:

$$V \times N = V' \times N'$$

Corrected $V_3 \times 0.04 =$ gm wt. of total alkali

Then the % w/v of total alkali

Corrected $V_2 \times 0.053 =$ gm wt. of Na_2CO_3

Then the % w/v of Na_2CO_3 in the unknown

- **Example :**

A sample of sodium hydroxide solution was prepared. Estimation of 10 mL from this sample for total alkali consumed 4.5 mL of 1.11 N hydrochloric acid solution.

a) What is the normality of this sodium hydroxide sample? *Answ. 0.4995 N*

b) If you know that the container from which this solution had been prepared was 3% w/w contaminated with sodium carbonate, how much of 1.11 N hydrochloric acid solution would be consumed in the determination of sodium carbonate using 10 mL of the sample?

(Note: the chemical factors are 0.04 g of total alkali equivalent to 1 mL of 1 N HCl and 0.053 g of Na_2CO_3 equivalent to 1 mL of 1 N HCl; atomic weights for Na=23, O=16, H= 1, C= 12) *Answ. 0.1 mL*