Determination the Concentration of NaOH and Na_2CO_3 in the same solution

Introduction

It is known that NaOH absorb CO_2 from air and is converted into carbonates:

$$2NaOH + CO_2 \longrightarrow Na_2CO_3 + H_2O$$

Therefore, a solution of NaOH contains some Na_2CO_3. In some cases it is necessary to know the amounts of NaOH and Na_2CO_3 present in a solution. There are two methods may be used for this analysis, in the first method (which is more accurate than the second method) (hydroxide + carbonate) is determine by the titration using one indicator. The second method depending on the titration with HCl using two indicators ph.ph and methyl orange. The titration in the presence of ph.ph gives results different from those obtained by titration in the presence of methyl orange.

In the presence of ph.ph the end point is the end point at which all hydroxide neutralized and all the carbonate is converted into bicarbonate.

$$NaOH + HCl \longrightarrow NaCl + H_2O$$

$$Na_2CO_3 + HCl \longrightarrow NaCl + NaHCO_3$$

When Na_2CO_3 is titrated in the presence of methyl orange the indicator become pink only after all the salt has been converted into H_2CO_3.

$$NaHCO_3 + HCl \longrightarrow NaCl + H_2CO_3$$

Procedure

1- Transfer (25) mL of the mixture solution into conical flask.
2- Add five drops of ph.ph indicator into the conical flask(the color is pink).
3- Start titration against the HCl solution very carefully until the color disappear then record the burette reading which is V_1.
4- Now add 1-2 drops of methyl orange in the titrated solution (the solution is yellow) continue the titration until

the solution become pink and take the burette reding agin V_2.

Calculations

V_1 = volume (mL) of HCl for all hydroxide + half of carbonate
V_2 = volume (mL) of HCl needed for the other half of carbonate

So that
(V_1- V_2) = volume of HCl needed for all hydroxide = V_3
$2V_2$ = volume of HCl needed for all the carbonate = V_4

$$N_{base} \times V_{base} = N_{acid} \times V_{acid}$$

$$N_{NaOH} \times V_{NaOH} = N_{HCl} \times V_3$$

$$N_{NaOH} = \frac{N_{HCl} \times V_3}{V_{NaOH}}$$

$$N_{Na2CO3} \times V_{Na2CO3} = N_{HCl} \times V_4$$

$$N_{Na2CO3} = \frac{N_{HCl} \times V_4}{V_{Na2CO3}}$$