Laboratory of Analytical chemistry

Experiment No. (2):

Standardization of Sodium hydroxide by titration against secondary standard Hydrochloric acid solution

Objective of experiment: To determine the exact concentration of unknown solution of NaOH.

Sodium hydroxide (NaOH) commercially available for laboratory use cannot be used as a primary standard because of the following reasons:

1- It cannot be obtained in a state of high purity.
2- It is highly hygroscopic, meaning that it rapidly absorbs moisture from the atmosphere and dissolves in it.
3- It readily absorb carbon dioxide (CO_2) from the atmosphere.(NaOH is highly alkaline , Carbon dioxide is an acidic gas). Therefore Sodium hydroxide reacts with carbon dioxide and changes to sodium carbonate.

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

So in this experiment an approximate concentration of a sodium hydroxide solution is prepared. It is then standardized by titrating it against of HCl solution (which was standardized before).

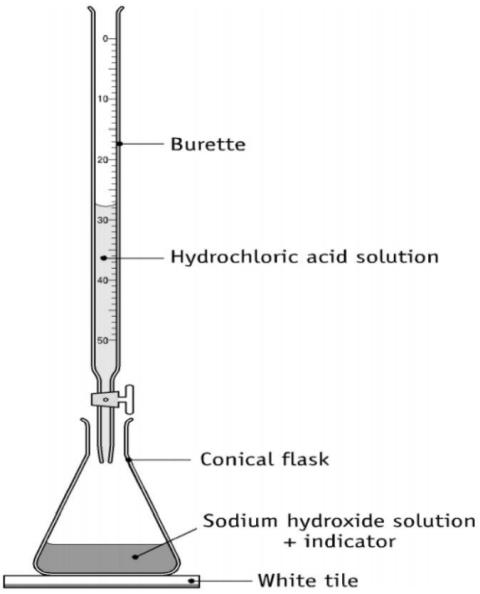
HCl reacts with NaOH according to the following equation:

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

The eq.wt. of both the HCl and NaOH is equal to their molecular weights and so both the acid and base are strong.

- 0.1N HCl solution is used as a secondary standard.

- The indicator used in this experiment is methyl orange, It is a weak base with PH range (3.2- 4.5). This indicator appear yellow color in basic medium and red in acid medium.



Chemicals

1. Standardized HCl solution (0.1N)
2. Unknown NaOH solution
3. Distilled water
4. Methyl orange indicator

Procedure

1- Wash and fill the burette with 0.1 N HCl solution. Be sure that there are no air bubbles in the tip of the burette.
2- Take 10 ml of NaOH solution and transfer it into a clean washed conical flask using a measuring cylinder.
3- Add 2 drops of methyl orange indicator into the conical flask.
4- Record the initial volume of HCl in the burette before you begin the titration.
5- Start titration by the adding the HCl solution from the burette gradually into the titration medium (the solution in the conical flask) with continuous stirring for the titration medium till the color changes from yellow to faint red. Notice carefully the final reading on the burette.
6- Repeat the experiment (at least 3 times), till you get concordant readings, and then take the average volume.
7- Calculate the normality of NaOH.

Calculation

At the equivalence point

no. of milliequivalence of HCl = no. of milliequivalence of NaOH

$$(N_1 \times V_1)_{HCl} = (N_2 \times V_2)_{NaOH}$$

$$(0.1 \times V_{average}) = N_2 \times 10$$

$$0.1 \times Y = N_2 \times 10$$

$$N_2 = \frac{0.1 \times Y}{10} = (\quad) \text{ eq/L NaOH}$$

Home work:

Explain in detail the neutralization curve between the reaction of a strong acid and a strong base?

Best wishes

Assistant Lecturer : Jumana N. Al-Hajeri