Al-Mustaqbal University

College of pharmacy

Analytical Chemistry Lab

Preparation and Standardization of an acid by Titration

The first stage-First semester

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Certainly, you should know that laboratories, especially chemistry laboratories, are nothing but a place for experimentation, learning, trying, making mistakes, and learning from error, but you must be careful when dealing with chemicals because you will take responsibility for yourself and their safety inside the laboratory.

There are many painful accidents that occur within the laboratories, which usually arise as a result of some negligence, but I am with you to tell you some things that you must take into account and follow in order to avoid any injury.

The most important rules that will keep you in a safe area inside the laboratory:

1-The first rule is to wear a white coat when entering the laboratory because it will protect you from chemicals when they fall on your clothes.

2-When you put contact lenses on the eyes, you must remove them when entering the laboratory because these lenses absorb fumes, which will cause damage to the eye

3-If you are a person with long hair, it must be tied or kept away from the fire to avoid ignition.

4-Stay away from wide and loose clothes that may catch fire while you are unaware, and cause many problems inside the laboratory.

5- Be careful when dealing with chemicals and do not return surplus materials to their original packaging.

6-Use test tubes, beakers, and other utensils to obtain only small amounts of chemicals.

7-Be careful not to taste or smell any chemical because there are some toxic substances that one milliliter of them is enough to kill you.

8-It is preferable not to bring any food or drink into the laboratory.

9-Use special tools for removing chemicals and never pull them out with your mouth.

10-Keep flammable materials away from the flame, such as alcohol, etc.

11-When heating any substance inside the test tube, be careful not to point the nozzle of the tube in the direction of your body, and also do not look at the nozzle of the tube because a sudden eruption may occur inside the tube.

Volumetric analysis: the quantitative analysis of an unknown chemical solution by determining the amount of reagent of known concentration necessary to effect a reaction in a known volume of the solution

Titration :A process for determining the concentration of a solution by measuring the volume of one solution needed to completely react with another solution

Standard solution: a solution having a very well-known concentration of a solute, can measurement number of moles of substance is present in a measured volume of solution, generally expressed as the molar concentration (or molarity) of the substance. A measured volume of the standard solution then reacts with the substance being analyzed (has two types)

a)A primary standard :is a reagent which is very pure, representative of the number of moles the substance contains and easily weighed. A reagent is a chemical that is used to cause a chemical reaction with another substance. Often, reagents are used to test for the presence or quantity of specific chemicals in a solution.

A good primary standard meets the following criteria:

1-high level of purity

2- low reactivity (high stability)

3- high equivalent weight (to reduce error from mass measurements)

4- not likely to absorb moisture from the air (hygroscopic) to reduce changes in mass in humid versus dry environments

5- non-toxic

6- inexpensive and readily available

b)A secondary standard is a chemical that has been standardized against a primary standard for use in a specific analysis. Secondary standards are commonly used to calibrate analytical methods. NaOH, once its concentration has been validated through the use of a primary standard, is often used as a secondary standard.

Equivalence Point: It is a theoretical point where the amount of two reactants are just equivalent.

End Point: It is a practical point at which the reaction is observed to be complete, this point is usually observe with the help of indicator.

Indicator :An auxiliary substance (either weak acids or weak bases) which helps in the usual detection of the completion of the titration process at the end point. acid-base titrations, are generally used indicators. They change their color within a certain pH range.

Molarity: is the number of moles of solute dissolved in one liter of solution. The units, therefore are **moles per liter**, specifically it's **moles of solute** per **liter of solution**.

$$molarity = \frac{moles\ of\ solute}{liter\ of\ solution}$$

Normality : is the number of equivalents of solute dissolved in one liter of solution. The units, therefore are **equivalents per liter**, specifically it's **equivalents of solute** per **liter of solution**.

$$Normality = \frac{No.\ of\ equivalents\ of\ solute}{liter\ of\ solution}$$

Determination normality for hydrochloric acid solution by a standard solution of sodium hydroxide

HCl reacts with sodium hydroxide according to the following equation:

$HCl + NaOH = NaCl + H_2O$

The eq.wt. of both the HCl and NaOH is equal to their molecular weights and so both the acid and alkaline are strong, any indicator may be used.

Glassware and Materials:

Burette, Stand, Conical flask,Funnel,Beaker,Pipette, Graduated Cylinder, Dropper and Washing bottle,Watch glas.

HCl solution unknown normality,(0.1 N)NaOH (standard) solution of known normality,Phenol naphthalene indicator

Procedure

1- Transfer by a pipette 5 ml of unknown HCl solution to a conical flask.

2- Add to the conical flask two or three drops of phenol naphthalene indicator.

3- Fill the burette with NaOH solution to zero mark.

4- Titrate HCl against NaOH until the color of solution changes from colorless to pink.

5- Repeat the experiment three times and record your results

Calculation:

The volume of HCl used in three times is 5 ml.

2. Average volume of NaOH used = (calculated from burette).

$$\boldsymbol{V\ average} = \boldsymbol{V_1} + \boldsymbol{V_2} + \boldsymbol{V_3}/\ \boldsymbol{3}$$

3. Then the unknown concentration calculated by using the law:

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