Inorganic Pharmaceutical Chemistry –Lab3- Report

Experiment: 3

Title: Assay of benzoic acid

Prepared by:-

Aya Ali Abood (Group 4)

Date of delivery:-

8/11/2022

1-Purpose

The purpose of the lab was to determine the weight of benzoic acid in a certain volume of solution, using the measured normality (concentration) of benzoic acid. This normality determined using base acid titration technique.

1- Introduction

Acid and Base titrations are used to determine the concentration of a solution with unknown concentration. When an acid reacts with a base, they neutralize the individual acid and base properties and produce salt and water. The H+ cation of the acid combines with the OH- anion of the base to form water. The salt is formed by the cation of the base and the anion of the acid. By writing out a fully balanced equation for the reaction, it is possible to determine the molar ratios in which the acid and base will react.

Titration is the defined as a technique to determine the concentration of a sample solution. This can be attained by the slow addition of solution with known molarity (known as a titrant) to a known volume of another solution with unknown molarity (known as the analyte) until the mixture reaches neutralization, which is frequently shown by a change in color. An indicator is a substance which undergoes a distinct color change at or near the equivalence point at which the amount of titrant added is just enough to fully neutralize the analyte solution.

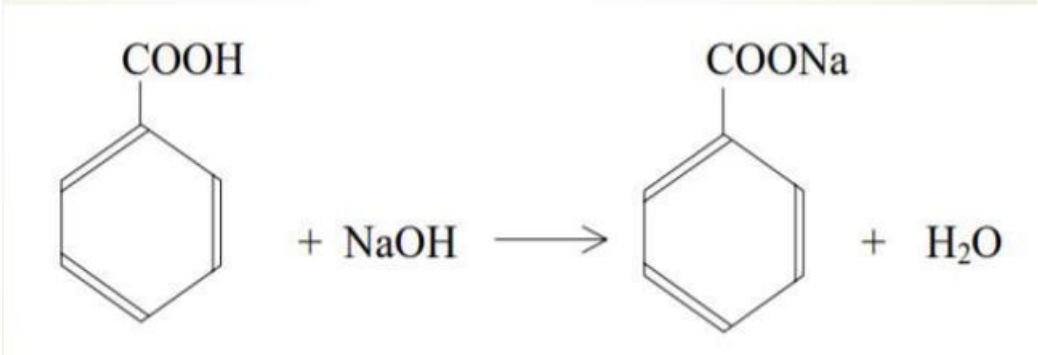
The aim of titration is to find the equivalence point at which, there will be a point where the mole number of acid (H+ ions) equates the mole number of base (OH- ions). Once the reaction has reached its equivalence point, the titration shall be stopped immediately and shall be noted as the end point of titration. Ideally, the end point should coincide with the equivalence point of titration.

The difference between using a weak acid and using a strong acid is the equivalence point. The equivalence point has a higher pH when a stronger base is used to titrate a weak acid. Once the acid has been neutralized, the equivalence point is above the pH of 7. When a weak acid is neutralized, the solution that remains is basic because of the acid's conjugate base remains in solution. When a strong base and a strong acid are used, the equivalence point occurs at pH=7 since the remaining conjugate base and conjugate acid are about equally strong.

In the experiment, as the base is added to the acid the point of neutralization is reached gradually.

In this experiment the weak benzoic acid is titrated against a standard basic solution like sodium hydroxide, this weak acid has properties of :-

- ✓ Benzoic acid (M. wt.= 122.123 g/mol) is an organic compound which is described by the chemical formula C6H5COOH.
- ✓ It consists of a carboxyl group attached to a benzene ring. Therefore, benzoic acid is said to be an aromatic carboxylic acid.
- ✓ This compound exists as a crystalline, colorless solid under normal conditions.
- ✓ The term 'benzoate' refers to the esters and salts of C6H5COOH.
- ✓ Benzoic acid is a primary standard substance that is due to its high purity.



Also it is uses in pharmacy could be included as follows:-

- ✓ As an inactive ingredient in the pharmaceutical industry, it is used as antimicrobial preservative, antifungal, and tablet and capsule lubricant.
- ✓ Benzoic acid has been used in combination with salicylic acid, as in Whitfield's ointment, for use as an antifungal for athlete's foot and ringworm.
- ✓ Benzoic acid is also a precursor to many chemical reactions yielding organic compounds.
- ✓ It is used in the treatment of skin irritation caused by insect bites, burns etc

Safety for the experiment could possibly be perceived as extensive. One must make sure to not get any of the chemicals or inhale them in such a manner that could be detrimental to the health of the person conduction the experiment

Materials and Tools

- volumetric flask
- Retort stand
- White tile
- conical flask
- pipette
- Burette

Chemical Reagents :-

- NaOH solution
- Ethanol
- benzoic acid
- Phenolphthalein – indicator

2-Procedure

1. Dissolve about 500 mg of Benzoic Acid, accurately weighed, in 25 mL of diluted alcohol (ethanol).
2. take 10 ml of the solution and add 2 drops of phenolphthalein as an indicator.
3. titrate with 0.1 N sodium hydroxide. Titrate until you get a pink color.

3-Results

4- Calculations

1- Calculation of the normality of benzoic acid at end point:-

$$N1\,V1 = N2\,V2$$

V1(FROM TITRATION)= 20 ml

$$0.1 \times 20 = N2 \times 10$$

N2= 0.2 N (Concentration of benzoic acid)

2- Calculation of the weight of benzoic acid :-

$$N = \frac{Wt}{e.q\ wt} \times \frac{1000}{v(ml)}$$

$$0.2 = \frac{Wt}{122} \times \frac{1000}{10}$$

Wt= 0.244 gm (weight of benzoic acid)

3- Calculation of percentage of benzoic acid:-

$$\frac{w}{v}\% = \frac{w}{v} \times 100$$

$$\frac{w}{v}\% = \frac{0.244}{10} \times 100$$

$\frac{w}{v}\% = 2.44\%$ (Percentage of benzoic acid)

5-Discussion

Basic acid-base titration is generally used to obtain the normality of a solution given the normality of other solution that involves neutralization between acid and base. This experiment was done to determine the concentration of the acid solutions. Identifying concentration of an acid solution was given attention in the experiment.

In the experiment of titration, there will be an equivalence point at which the amount of titrant added is just enough to completely neutralize the analyte. Once the equivalence point has been reached the titration process will be stopped immediately and will be noted as the end point. Equivalence points differ from end point as equivalence point is the point in titration at which two reactants are brought together while end point is the point at which an indicator undergo a change and the titration is spotted. The main difference between the two is that equivalence points are theoretical point and end points are the physical points.

The whole experiment dealt with the acid and base solutions. Throughout the experiment, the concentration of 0.1N of NaOH was used. The solution was moved inside the burette. Then 0.5 grams of C_6H_5COOH was dissolved with 25ml of diluted ethanol inside the beaker glass, then 10ml of sample was taken for the starting of titration process, then 2 drops of Phenolphtalin was dropped gently using pipette.

It was mixed using the stirrer and placed below the burette. Then NaOH was poured into the beaker glass. The solution started to change color. Finally, after the experiment, it was known that the volume of the NaOH that was used to titrate the weak base is 20 ml.

This volume was used to calculate the quantity (weight) of benzoic acid , which was 0.244 gram and then the weight percentage of benzoic acid in 10 ml volume of solution was calculated to be 2.44 %.

In every experiment, no physical quantity can be measured with perfect certainty; there will always be errors in any measurement. There are two types of experimental errors: systematic and random error. Systematic errors are errors that affect the accuracy of a measurement while random errors are errors that affect the precision of a measurement. A common form of systematic error is called a parallax error. Parallax error is the deceptive change of the position of an object. It should be avoided because it usually causes errors in volume measurements. This can be avoided by reading volume measurements at eye level to the apparatus.

6-References

1- Carlson, G.A. (2000-2002). Experimental Errors and Uncertainty.
2- Gleichmann, Nicole (2020). Molarity vs Molality: Formula and Definitions.
3- Gros, L., Bruttel, Peter and Von Kloeden, M (2005). Practical Titration.
4- University of Birmingham (2016). How do you perfect the acid-base titration?