

Experiment 3

PREPARATION OF A STANDARD SODIUM HYDROXIDE SOLUTION, DETERMINATION OF PURITY OF IMPURE KHP AND STANDARDIZATION OF HYDROCHLORIC ACID

2 lab periods

Reading: Chapter 1 (pg 23-24), Chapter 8, and Chapter 11 (pg 206-212; 219-223; 223-226) of Quantitative Chemical Analysis, 8th Edition, Daniel C. Harris (7th Edition: Chapter 7 (pg 121-123), Chapter 8, and Chapter 11 (pg 206-208 and 212-216)).

CHEM 233 Quantitative Analysis Laboratory Experiments, 7th Edition, pg 6-11.

Objective

This lab will introduce you to the concept of the analytical titration. You will learn how to standardize strong acids and bases and how to determine the purity of an impure weak acid. The lab will allow you to practice the basic laboratory skills you need in order to perform accurate and precise titrations.

Suggested Schedule

Lab 1: Dry KHP and unknowns at 105-110 °C for at least two hours. Prepare NaOH and HCl solutions. Standardize. If there is time, do your calculations before leaving the lab.

Lab 2: Titrate your impure KHP sample. Do your calculations before leaving the lab.

In this experiment, you will prepare standard solutions of sodium hydroxide (NaOH) and hydrochloric acid (HCl). A standard solution has a concentration that is exactly known. The standard NaOH solution will be used to determine the purity of an impure solid acid and the standard HCl solution will be used for analyses later on in the semester. Solid NaOH is very hygroscopic and contains many impurities. It is also difficult to measure out concentrated HCl with any accuracy. We don't know the exact composition of the solid NaOH or the exact concentration of the HCl solution. Thus, it is necessary to use another approach to determine the concentrations of the standard solutions. We will use the primary standard acid, potassium hydrogen phthalate (KHP, a solid), to make an acid solution of known concentration. KHP can be weighed out very accurately on the analytical balance, and is available with a purity of 99.99%. KHP contains one titratable acidic functional group. We can titrate this KHP solution with our NaOH solution to standardize (determine the concentration of) the NaOH solution. Then, with our standardized NaOH solution, we can both determine the purity of an impure sample of KHP and titrate the HCl solution to accurately determine the HCl concentration.



Reaction 1: Titration of KHP with NaOH

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Michael Rajnik

A red circular graphic with a gradient, appearing as a semi-circle or a partial circle, located to the right of the name bar.

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