**Determination of the Acid Content of Wine**

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**Abstract**

The determination of the acid content of wine plays an important role in the area of oenology, because it the properties and quality of wine, especially the color and the flavor. Tartaric acid is the principal organic compound present in wines that typically ranges from 0.2 -1.0 %. This experiment aimed to apply the principles of standardization, determine the % tartaric acid content of wine sample and apply the concept of acid-base titration. Furthermore, this experiment seeks to find out the molar concentration of an unknown KHP solution.

The tartaric acid content of commercially available wine was analyzed by titration of Sodium Hydroxide (NaOH) solution, a strong base. This solution is not a primary standard therefore it was standardized against KHP, the primary standard.

The mean concentration of the unknown KHP solution obtained in this experiment was 0.107 Molar and has a 12% error from the true value of 0.1224. On the other hand, the result of the tartaric acid content in this experiment ranges from 0.48- 0.49% which is closed to the ideal range of tartaric acid percentage in wines. According to the data gathered, it can be seen that wine titration with indicator gives sufficient reliable values of wine titration acidity.

**INTRODUCTION**

 Acids play an important role in wines for it influences its taste, balance and color. Tartaric acid, found in grapes and in some fruits, is one of the many acids present in wines. Adding this acid to wines lowers the latter's pH and increases its microbiological stabilization. It also helps in controlling the acid sensation of wines. (Delfini & Formica, 2001, pp. 137-140) Tartaric acid as a composition of grapes ranges from 0.2-1.0% while it ranges from 0.5-4.0g/L as a component of table wines. (Bamforth, 2005, pp. 98-104)

 In this experiment, we will be using titration method to determine the percent of tartaric acid present in a certain wine sample. On the process of acid-base titration, pH is changing until the base has neutralized all the acid or vice versa. This is called the end point and it is located with the help of an indicator. Indicators vary in color change at different pH intervals that is why you have to choose an appropriate indicator. (Khopkar, 1998, pp. 31-37)

 Strong bases or acids are used as a standard solution for they react completely with analytes and show a more accurate end point. However, there are some things we have to consider before proceeding and one of these is to make sure that the titrant is of high purity. Acids and bases are not pure so there is a need for the process of standardization. (Skoog, West, Holler, & Crouch, 2014, pp. 305-323)

 The experiment aims to prepare standard NaOH solution using the principles of standardization and determine the percent of tartaric acid present in a wine sample using the concept of strong acid-base titration. It also aims to determine the unknown KHP solution's molar concentration using the person's knowledge in quantitative analysis.

**METHODOLOGY**

The procedure is divided into three parts: the preparation and standardization of NaOH solution, the analysis of the sample and the analysis of an unknown KHP solution.

 For the preparation of NaOH solution, approximately 2-3 grams of NaOH pellets are weighed into watch glass and was dissolved in 500-mL of the boiled distilled water. The solution was transferred into one liter plastic container. For the standardization process, KHP was accurately weighed into the Erlenmeyer flask for about 0.0500- 0.1000 g. The KHP crystals were dissolved by adding amount of distilled water. Upon dissolving the KHP, 3 drops of phenolphthalein indicator was added then titration with NaOH solution to the first permanent light pink color end point followed.

 For the analysis of the sample, 10.00-mL aliquot of the wine sample was transferred into the Erlenmeyer flask. 20-mL of distilled water and 5 drops of phenolphthalein indicator was added into the aliquot. The sample was then titrated with the prepared NaOH solution to light pink end point.

 For the analysis of an unknown KHP solution, the sample was diluted into a volumetric flask, and only 20 ml aliquot was transferred into the Erlenmeyer flask. Then there is an addition of 20 mL distilled water and 2 drops of phenolphthalein indicator. The sample was titrated with the standard NaOH solution to light pink end point.

**RESULTS AND DISCUSSION**

Table A. Standardization of NaOH sample

|  |  |
| --- | --- |
|  | Trial |
| 1 | 2 | 3 |
| Weight of KHP (g) | 0.0648 ± (0.0001) | 0.0925 ± (0.0001) | 0.0987 ± (0.0001) |
| Volume of NaOH (mL) | Initial | 16.00 ± (0.05) | 19.30 ± (0.05) | 23.30 ± (0.05) |
| Final | 19.30 ± (0.05) | 23.30 ± (0.05) | 27.80 ± (0.05) |
| Actual | 3.30 ± (0.07) | 4.00 ± (0.07) | 4.50 ± (0.07) |
| Molarity (M) | 0.096 ± (0.002) | 0.113 ± (0.002) | 0.107 ± (0.002) |
| Mean Molarity (M) ± uncertainty | 0.106 ± (0.004) |

Table A presents the weight of the primary standard, Potassium acid Phthalate (KHP) that ranges from 0.0500 - 0.1000 grams. The initial, final and actual volumes of the standard NaOH solution in the three trials were also found in this table. The molarity of the standard solution is computed by relating it to the moles and molecular weight of KHP.

There are several factors that to be considered in order to become a primary standard. Table A implies that the prepared NaOH solution didn’t obtain sufficient purity to use as primary standard at the same time it didn’t meet the criteria to be considered as a primary standard such as high purity, unreactive to the atmosphere and high molar mass.

Table B. Sample Wine Analysis

|  |  |
| --- | --- |
| Brand:Novelino | Trial |
| 1 | 2 | 3 |
| Volume of sample (mL) | 10.000 ± (0.060) | 10.00 ± (0.060) | 10.00 ± (0.060) |
| Volume of NaOH (mL) | Initial | 15.00 ± (0.05) | 21.00± (0.05) | 27.20 ± (0.05) |
| Final | 21.00± (0.05) | 27.20± (0.05) | 33.40 ± (0.05) |
| Actual | 6.00 ± (0.07) | 6.20 ± (0.07) | 6.20 ± (0.07) |
| % tartaric acid (ta) | 0.477 ± (0.040) | 0.493 ± (0.040) | 0.493± (0.040) |
| Mean % ta ± uncertainty | 0.488 ± (0.069) |

Table B shows the results obtained from the analysis of a wine sample, Novelino. For a 10-mL volume of the sample, 6mL of the titrant was consumed. The average % of tartaric acid in the wine sample is calculated by relating the moles of NaOH to tartaric acid then, dividing it to the volume of sample and finally, getting the mean of the % tartaric acid of the three trials. From the results gathered, the mean % tartaric acid is 0.488%. The wine sample is within the range of a typical wine content which is 0.2-1.0%.

**CONCLUSION**

NaOH pellets were dissolved with previously boiled distilled water, however, NaOH is not pure, and therefore, standardization is performed. In the standardization process, a known mass of primary standard potassium acid phthalate (KHP) that is dried and dissolved with distilled water is titrated with the NaOH solution until a permanent light pink color end point is observed caused by the phenolphthalein indicator which is pink in a basic solution.

 The determination of the % of tartaric acid present in the wine sample is done through acid-base titration. A 10-mL aliquot of this sample is titrated with NaOH solution until it reached its end point. Three trials were also done and the calculated average percentage of tartaric acid in the wine sample is 0.488%.

 In like manner, 20-mL aliquot of diluted unknown KHP solution is titrated with NaOH solution to light pink end point. The molar concentration of the former was determined given the concentration of the latter. The calculated mean molarity of unknown KHP solution was 0.107M. It is found out that its true value is 0.1224M and there was a 12% error from the experiment performed.

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