Titration for Acetic Acid in Vinegar

Hands-On Labs, Inc.
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Lab Report Assistant

This document is not meant to be a substitute for a formal laboratory report. The Lab Report Assistant is simply a summary of the experiment’s questions, diagrams if needed, and data tables that should be addressed in a formal lab report. The intent is to facilitate students’ writing of lab reports by providing this information in an editable file which can be sent to an instructor.

Exercise 1: Determining the Concentration of Acetic Acid

**Data Table 1.** NaOH Titration Volume.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Initial NaOH Volume (mL)** | **Final NaOH Volume (mL)** | **Total volume of NaOH used (mL)** |
| **Trial 1** |  9 mL |  .2 mL | 8.8 mL |
| **Trial 2** | 10 mL |  1.1mL | 8.9 mL |
| **Trial 3** | 10 mL | 1.2 mL | 8.8 mL |
|  |  **Average Volume of NaOH Used (mL)** : 8.8 mL |

**Data Table 2.** Concentration of CH3COOH in Vinegar.

|  |  |  |
| --- | --- | --- |
| **Average volume of NaOH used (mL)** | **Concentration CH3COOH in vinegar (mol/L)** | **% CH3COOH in vinegar**  |
| 8.83 ml | .88 mol/L | 5.31% |

Questions

1. The manufacturer of the vinegar used in the experiment stated that the vinegar contained 5.0% acetic acid. What is the percent error between your result and the manufacturer’s statement?

5.302-5

.302 (.302/5.0)

.0604 (.0604\*100)

=6.04%

1. What challenges would you encounter with the titration if you had used apple cider vinegar or balsamic vinegar as the analyte instead of white vinegar?

**Other vinegars contain other chemicals that may have interfered or negated results while white vinegar contains only acetic acid. Additionally, balsamic and apple cider vinegar are dark in color which would make it difficult to identify a color change. These reasons make while vinegar the best option for use.**

1. How would your results have differed if the tip of the titrator were not filled with NaOH before the initial volume reading was recorded? Explain your answer.

**If the tip of the titrate was not filled with NaOH before the initial volume reading was recorded then the initial volume reading would likely subsequently be inaccurate. This would then skew all the subsequent readings afterwards. While it did not take a very noticeable amount to fill the stopcock, the measurements were down to the tenth of an mL and it took at least 3-4 10ths to clear the air at the start of the experiment. This was more than enough to skew the result of the experiment.**

1. How would your results have differed if you had over-titrated (added drops of NaOH to the analyte beyond the stoichiometric equivalence point)?

**The results would have differed, as the percentage of acetic acid that was calculated would have been greater than the actual percentage within the sample. The data recorded would have indicated a larger amount of NaOH required to neutralize the acid within the vinegar.**

1. If a 7.0 mL sample of vinegar was titrated to the stoichiometric equivalence point with 7.5 mL of 1.5M NaOH, what is the mass percent of CH3COOH in the vinegar sample?

**M=. 0075L(1.5mol/1L)(1mol/1mol)(1/. 0075)=1.5**

 **%=(1.5/1)(1/1000)(1/1)(60.05/1)(100)**

**= 9.008%**

1. Why is it important to do multiple trials of a titration, instead of only one trial?

**It is imperative to the accuracy of trials to perform multiple trials as this will minimize error and reduce the risk of human error as you will have a better idea of what to do the more times you try the experiment. Multiple trials will also offer an average of results as opposed to simply 1 and this will result in a greater level of final accuracy.**