Chemistry Lab Report

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Contents

1 Introduction

1.1 Purpose

The objective of this pratical is to **determine the concentration of a sodium hydroxide solution (**NaOH**)** by titrating it against **a potassium hydrogen phthalate solution** (KHP).

1.2 Background

A titration measures the volume of solution transported from a buret. In this investigation sodium hydroxide is titrated into a flask with acid . After enough amount of base is added to

neutralize the acid in the flask, titration is stopped. The end of titration is indicated by the change of color of phenolphthalein, which is colorless in acidic solution and red-pink in others.

Therefore, once the color of the solution turned red-pink, it means the NaOH is in excess and the titration is over. We would use the volume of sodium hydroxide solution added to determine the amount of KHP engaged in this reaction and then calculate the concentration of the base.

The base is standardized according to the following equation:

$$\mathrm{KHP} + \mathrm{NaOH} \rightarrow \mathrm{KNaP} + \mathrm{H_2O}$$

1.3 Apparatuses Used

1. buret
2. pipette
3. conical flask
4. $0.100M$ potassium hydrogen phthalate solution
5. approximately $0.1M$ sodium hydroxide solution(not exact enough)
6. phenolphthalein indicator
7. 3 beakers
8. iron stand and buret clamp
9. graduated cylinder

2 Process of the Experiment

2.1 Procedure

1. Obatian $50ml$ of KHP solution in the beaker.
2. Rinse the pipette and transfer $10.00ml$ of KHP into the conical flask. Then add $15.00ml$ of distilled water and two drops of phenolphthalein into it.
3. Then do the preparation for titration
   (a) Rinse burette with distilled water and NaOH solution.
   (b) Fill in the base and get rid of the ari bubbles.
   (c) Place the conical flask in the right position and adjust the meniscus to origin and record the inital burette reading.
4. Titrate the KHP sample and keep shaking the conical flask untill a permanent pink endpoint is reached. Record the reading on the burette wall.
5. Do the above again and obtain another reading.

2.2 Data Collected

Solution \ Trial	1^{st}	2^{nd}
Volume (ml)	11.23 ± 0.05	11.39 ± 0.05

Table 1: Raw Data Table

2.3 Processing Data

2.3.1 Volume of NaOH

First, we need to work out the average value and the uncertainty of the volume,

$$\overline{V_{NaOH}} = \frac{11.23 + 11.39}{2} = 11.31ml \ \Delta V = 0.05 + 0.05 = 0.10ml$$

So we get

$$V_{NaOH} = 11.31 \pm 0.10ml$$

2.3.2 Concentration of NaOH

From above we've already obtained that $c_1 = 0.100M$, $V_1 = 10.00ml$, $V_2 = 11.31 \pm 0.10ml$. So we get

$$\overline{C_{NaOH}} = \frac{c_1 \times V_1}{\overline{V_2}} \approx 0.088M$$

$$\%\Delta C_{NaOH} = \frac{\text{Uncertainty}}{\text{Mean Volume}} = \frac{0.10}{11.31} \approx 0.88\%$$

$$\Delta C_{NaOH} = \pm\overline{C_{NaOH}} \times \%\Delta C_{NaOH} \approx \pm 0.001M$$

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2.4 Breif Summary

During the whole experiment we titrate a sodium hydroxide solution and record volume of it used. After that we use a series of steps to deduce the thickness of the solution to be $(0.088 \pm 0.001)M$.

3 Conclusion and Evalutaion

3.1 Conclusion

The concentration , as above is $\mathbf{(0.088 \pm 0.001)}M$, this means one liter of the solution contains $\mathbf{(0.088 \pm 0.001)}$ moles of solute.

Also, molar mass of sodium hydroxide is about $40g/mol$, indicating that solute dissolved in the solution has a mass of $\mathbf{(0.035 \pm 0.00)}\boldsymbol{g}$ and the thickness can also be represented by $3.095g/l$.

3.2 Evaluation and Improvements

3.2.1 Evaluation

The concentration of the solution ought be about $0.1M$, but the conclustion we drew above has a percentage dicrepancy of $\pm\frac{0.088-0.100}{0.100}=\pm 12\%$.

However, the concentration we come up with have a relatively small uncertainty of only 0.88%.As it is much smaller than the percentage one, random error alone cannot account for the discrepancy and hence there must have existed **some systematic errors** that make our conclusion **precise but not accurate enough**.

3.2.2 Improvements

Error that causes uncertainties	Enhancement that can be applied
The burette wasn't fully rinsed and not clean enough. Therefore the NaOH solution is diluted and more volume of it is delivered during titration	This is an acceptable one since it will little affect the general uncertainty. Still it can be avoided buy thouroughly clean the instruments before the experiment.
To much KHP solution was added to the conical flask, requiring more NaOH to titrate them and thus lead to errors.	When using pipette, we need to transfer exactly 10.00ml of the solution to make the result accurate.
During the experiment we didn't shake the conical flask frequently enough. The NaOH is actually in excess and more of it is recorded on the reading.	Next time we would stop once in a while to examine whether the soluion has already turned pink to avoid the mistakes.
The experiment only has one set of data and does not have other sets of data to compare with or calculate an mean value, which might make the result not general.	It's really difficult to measure just the amount of KHP into the conical flask, which takes up a lot of time. We'll try to hurry up and collect more data eliminate all the possible erros.