

Primary and secondary standard solutions in chemistry essay sample

[Science](#), [Chemistry](#)



Primary standards, such as potassium hydrogen phthalate (KHP) ($C_8H_5KO_4$), display unique characteristics such as high purity, maintain stability during storage within a long period of time whether in solid or liquid form, large molar mass as calculated to be 204 (RMM), low reactivity with the surrounding air, high stoichiometry and low hygroscopicity (property of absorbing water from its surroundings), which makes them ideal in making precise assessments of the unknown concentration of a known chemical.

Secondary standards such as sodium hydroxide (NaOH) do not have the properties listed above, therefore it is low in purity, it is highly liable in absorbing the water molecules (H_2O) from the atmosphere, it has high reactivity, its concentration changes over time, has lower molar mass known to be 40 (RMM). They are used in standardisations by comparing against primary standards.

Primary standards are high in purity; whereas secondary standards have a low purity. Primary standards such as potassium hydrogen phthalate ($C_8H_5KO_4$) remain stable when stored and the concentration does not alter over time whether it is in solid form or liquid form; however, secondary standards, for e. g. sodium hydroxide (NaOH), does not remain stable and the concentration changes rapidly over time. The primary standard, potassium hydrogen phthalate for example, has a higher molar mass (204 RMM) than the secondary standard, sodium hydroxide (40 RMM) for e. g. Primary standards' reactivity with the surrounding is low in oppose to secondary standards where it is high and react with the water molecules in the atmosphere.

The function of the both standards is to provide as a reference to be used when standardising a solution. Initially, a primary standard is used to standardise a secondary standard.

Titration is the quantitative technique used to identify the concentration of an unknown solution by using a solution of which its concentration is known. The known solution, named titrant, is added into the analyte (unknown solution) from a burette until the reaction between the two is identified as complete by the colour change of the indicator.

Colorimetry is also used to identify the concentration of an unknown sample, however it is typically used for the identification of concentration of coloured solutions. The colorimeter enables to pass different wavelengths of light through the sample, hence measures the amount of light absorbed by the sample.

Titration Errors

* Using diluted titrant and analyte: Once the burette is rinsed with distilled water, if it is not rinsed with the titrant, which was the sodium hydroxide (NaOH); it will become slightly diluted. This error will lead onto introducing a little more of sodium hydroxide with the vinegar, which means that the calculated mass for vinegar will be a little higher than usual and that will increase the percentage of the concentration of the vinegar. The same goes with the pipette when filling it with analyte, which was the acetic acid (vinegar-CH₃COOH); if the pipette is not rinsed with the analyte after being rinsed with distilled water, the analyte will become slightly diluted and it will

mean that a little more sodium hydroxide will be introduced and it will increase the percentage of the vinegar concentration more than it was supposed to be.

* Preparation of the standard solution: A standard solution has to be mixed well in order to become a homogenous solution. This is necessary in order to estimate the percentage of the concentration of the analyte, in this case it was the potassium hydrogen phthalate. If it is not mixed properly, it may lead on to introducing more or less titrant, sodium hydroxide, into the standard solution of potassium hydrogen phthalate, to reach the end point. Therefore, the calculations for the estimation of sodium hydroxide concentration will be inaccurate, which means that the concentration could be higher or lower than it is in actuality.

Colorimeter Errors

1. The absorption-concentration graph for the calibration curve of identifying manganese in manganin wire could have been drawn inaccurately. Hence, this will directly give an inaccurate result as to what the concentration of manganese will be in manganin wire.

1. If the calibration of the colorimeter is not done before making any measurements, it will give the wrong result of the wavelength of the rose wine samples. Hence, the absorbance cannot be measured accurately and an inaccurate result for the actual concentration of the rose wine will occur.

1. If the serial dilutions for rose wine are performed incorrectly, meaning excess water remained in the test tubes and burette initially, before even beginning the serial dilutions, due to washing them with distilled water, the rose wine samples added into the test tubes will be extra diluted. Therefore, the absorbance of the coloured compounds will be slightly reduced and when drawing out the calibration curve, it will correspond to the inaccurate rose wine concentration.

Improvements for Colorimetry:

Instead of using a hand-drawn calibration curve, it could have been drawn on a computer program “ Excel” to ensure the accuracy of the graph and hence the calibration curve. Therefore, the absorbance measured can correspond to the accurate concentration of the solution being identified.

Using equipment such as a “ spectrophotometer” (difference between) which has 3-4 decimal places instead of a 2 decimal placed would give a much ‘ precise’ result when measuring the absorbance of the samples such as the manganese in manganin wire.

Also, to prevent inaccurate absorbance results, the calibration of the colorimeter must be done each time before measuring the wavelength of rose wine samples. It is done by putting deionised water into the cuvettes previously from measuring the absorbance of the actual wine being which is being identified, by pressing the ‘ R’ button as reference.

Finally, “ automatic pipettes” could be used for the serial dilutions. Using automatic pipettes will increase the accuracy of the amount of manganese sample being measured to form the serial dilutions.

Improvements for Titration:

In order to prevent the sodium hydroxide (titrant) from becoming slightly dilute in the burette, the burettes must be washed with the sodium hydroxide, right after they are rinsed with the deionised water. This way, an accurate amount of titrant will be introduced with the analyte (potassium hydrogen phthalate). Consequently, this reduces the possibility of calculating a higher mass, therefore a higher concentration percentage for vinegar than its actual concentration.

When preparing the standard solution (for e. g. the potassium hydrogen phthalate), it is important to shake the solution in order to have a homogenous solution. This is to ensure that there are no solid particles left in the solution that may interfere with the calculation of the concentration percentage of sodium hydroxide (titrant). The solution must be shaken in order to introduce an accurate amount of titrant with the analyte (potassium hydrogen phthalate) to reach the end point and therefore gain a more accurate concentration percentage of sodium hydroxide (titrant).

Conclusion:

The concentration percentage for vinegar was obtained as 7%, which is close to the actual range of concentration which had to be 5-6%. It could be said

that it is fairly accurate. In order to ensure the accuracy of the titrations, they were performed several times until three consecutive results were obtained. Therefore, the volume measurements of the solution in the burette is quite reliable, due to being repeated. The preparation of Potassium Hydrogen Phthalate as a standard solution was carried out accurately (it was shaken until the potassium hydrogen phthalate dissolved properly) and therefore this allowed to gain an accurate result in the concentration of Sodium Hydroxide, which was 1.11627 molar.

The results obtained for the rose wine concentration percentage was 4% for sample A, 46% for sample B, and 84% for sample C. All the absorbance values found for each of the samples -A, B and C- were within the range of the serial dilutions absorbance. Preparing a serial dilution allowed the results of concentration to be more reliable and therefore more accurate, as when forming a graph of calibration curve for the rose wine samples, the line of best fit was drawn much more accurately.

The manganese concentration in manganin wire was identified as 9%, however it was to be about 12%. This could be due to the calibration curve being drawn inaccurately for the manganese sample. Using a computer program such as 'Excel' in drawing the calibration curve could have improved the result of concentration for the manganese sample, as it would make the line of best fit for the calibration curve graph much more accurate.

Overall, the results gained were not 'entirely' accurate, however by repeating certain parts of the techniques, the reliability of the technique was increased as well as the accuracy.