**Determination of the Ascorbic Acid Content of a Vitamin Pill**

1. **Preparing the Vitamin C Solutions**
2. Weigh three Vitamin C tablets, and calculate the average mass of a pill. Record your data in the respective data table.
3. Crush the three Vitamin C tablets in a mortar with a pestle.

**Note:** The smaller the particle size, the easier the powder will dissolve.

1. Weigh out about 0.5 g (±0.05g) powder into a weighing dish. Record all digits from the balance.
2. Transfer the powder into a 250-mL Erlenmeyer flask. Rinse the weighing dish with water from a squeeze bottle into the Erlenmeyer flask to ensure quantitative transfer.
3. Add about 40-50 mL water, and place the Erlenmeyer flask on a hot plate.
4. Heat it gently, and swirl the content periodically.
5. Once the content is not changing visibly, remove the flask from the hot plate.

**Note:** Some filler materials won’t dissolve. Do not boil the solution!

1. **Setting up the Buret**
2. Fill a 150-mL beaker about half with your standardized NaOH solution
3. Rinse the buret 3 times with small portions (few mL’s) of the NaOH solution.
4. Mount the buret with a clamp on a stand, making sure it is perpendicular to the benchtop. **Note:** The buret should be mounted by its lower third.
5. Make sure stopcock is closed (perpendicular to the buret), then fill the buret with the NaOH stock solution, using a small funnel. The stock solution in the buret is the titrant.

**Note:** While filling buret, lift funnel to allow air to come out.

1. Have a waste beaker under the buret, open the stopcock (parallel to the buret), and fill the buret tip, making sure there are no air bubbles left in the tip.

**Note:** Handle the stop cock on the buret gently. Too much force can eject the tip flooding the bench with NaOH solution. Also, stop the titration and call your instructor, if the stopcock leaks after opening it.

1. Fill buret to about, but below the 0 mL mark.
2. Remove any hanging drop before starting by touching the tip to the inner wall of the beaker.
3. Read buret at bottom of meniscus at eye level and record the volume to the second decimal place (to nearest 0.01 mL).
4. Position the tip of the buret inside the neck of the flask, but not touching the wall of the flask.
5. Position a white paper towel so it is behind and underneath the flask for better contrast to observe the color change.
6. **Performing a test trial**
7. Place the flask under the buret.
8. Add 1 mL of the titrant at a time while continuously swirling the solution in the Erlenmeyer flask.
9. When the solution turns pink-purple, read the volume from the buret.
10. Calculate the amount of NaOH solution used and subtract 2 mL from it. This is the rough volume.
11. **Performing the titration**
12. Refill the buret, read and record the initial reading.
13. Number three weighing dishes.
14. Make solutions from the three samples in Erlenmeyer flasks just like before (A.1-6). Number the flasks as well.

**Note:** Do not forget to add the phenolphthalein.

1. Place the first flask under the buret and add the calculated rough volume of NaOH in one shot, while swirling the solution in the Erlenmeyer flask.
2. After the addition of the rough volume, continue to add the titrant *one drop at a time* while swirling the solution until the solution turns pale “baby-pink”. This point is the end point.

**Note:** As the titration approaches the end point, the temporary purple color where the titrant hits the solution persists longer before the solution is thoroughly mixed. Near the end point, add half a drop by allowing half a drop hanging from the tip of the buret, and transferring the drop into the solution by touching the tip with the inner wall of the flask.

1. Read and record the final reading.
2. Perform the titration of the remaining two samples in the same way (D.1-6).
3. Calculate the exact concentration of the stock solution.
4. Label the plastic bottle, including the exact concentration. Collect the left over stock solution from the beaker and the buret, transfer it into the plastic bottle. Save the stock solution in your cabinet for the next lab.

**Note:** Generally, solutions/chemicals are NOT to be returned into the original container. Saving the unused titrant from the buret and the beaker is a precaution to make sure there will be enough titrant for the second part of the lab.

1. When done, rinse the buret and the volumetric flask well with distilled water 3 times and return.
2. Discard the waste as instructed.
3. **Data Tables**

Average Mass of Vitamin C Pills

|  |  |
| --- | --- |
| Total mass of three pills (g): |  |
| Average mass of a Vitamin C pill (g): |  |

**Test Run**

|  |  |
| --- | --- |
| Mass of sample (g): |  |
| Rough volume of NaOH standard (mL): |  |

**Trials**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Trial 1 | Trial 2 | Trial 3 |
| Concentration of NaOH (M): |  |
| Mass of sample (g): |  |  |  |
| Initial buret reading (mL): |  |  |  |
| Final buret reading (mL): |  |  |  |
| Volume of NaOH (mL): |  |  |  |
| # of moles of NaOH (mol): |  |  |  |
| # of moles of ascorbic acid in sample (mol): |  |  |  |
| Mass of ascorbic acid in sample (g) |  |  |  |
| Ascorbic acid content of sample (%): |  |  |  |
| Average ascorbic acid content of sample (%): |  |
| Average ascorbic acid content of a 1000-mg pill (mg): |  |

1. **Post-lab Questions**
2. Why do you think ascorbic acid reacts with NaOH 1:1 ratio, even though it has more hydrogen atoms?
3. Why do you think you calculated the average mass of the three pill instead of just weighing a single pill?
4. Why do you think the amount of water used to make the Vitamin C solutions could be approximated instead of measuring it out accurately?
5. What color change did you observe when the Vitamin C solution was titrated with NaOH solution?
6. Why did you calculate the ascorbic acid content for each trial first, and the average them, instead of calculating the average volume of the titrant used in the three trials?
7. Why do you think the average ascorbic acid content is significantly less than 100%?