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Fingerprint Detection
Using Ninhydrin solution to expose latent fingerprints

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I. INTRODUCTION

INTRODUCTION

No two person have same fingerprint and thus fingerprint detection is used by the investigators to identify people using distinct ridge patterns of the fingerprint. This is usually done by using a chemical reagent called Ninhydrin. It produces a purple or purple brown tint when it reacts with amino acids present in sweat. Amino acids with a greater percentage of nitrogen form a stable complex that makes the fingerprint visible on various surfaces. In this experiments we have performed two task:

1) Studying the reaction between the Ninhydrin and L-alanine
2) Obtain fingerprint us in Ninhydrin on different types of paper and compare them using the fingerprint produced by the ink pad This experiment aims to generate precise fingerprints using Ninhydrin solution.

II. EXPERIMENTAL DETAILS

A. Apparatus

1) Beaker (50ml)
2) Volumetric Flask (100ml)
3) Measuring Cylinder (10ml)
4) Burette (10ml)
5) Standard Pipette (10ml)
6) Test Tube (Volume Unknown)
7) Wash bottle with water
8) Weighing machine
9) Hand-held Vacuum Pump

B. Materials

1) Distilled Water
2) Gloves and Glasses for safety

C. Procedure

1) Subsection Volumetric Pipette and Graduated Pipette Calibration:

a. Rinse the pipette thoroughly before beginning the experiment.
b. Weigh the empty beaker on a precision balance and record the measurement.
c. Insert the pipette into the water container.
d. Use a rubber suction bulb to draw water above the mark for volumetric pipettes or inside the pipette for graduated pipettes.
e. Remove the bulb and place a finger over the end of the pipette.
f. Withdraw the pipette and wipe off any excess water with tissue paper.
g. Adjust the water level until the lower meniscus aligns with the marked line.
h. Transfer the water from the pipette to the beaker and record the weight of the beaker with the water.
i. Repeat the process for graduated pipettes, ensuring to transfer the water up to the specified mark.
j. Weigh the beaker again and note down the readings. 11. Repeat the procedure thrice, ensuring complete drying between each repetition.

2) Subsection Volumetric Flask and Measuring Cylinder Calibration:

a. Rinse the volumetric flask and measuring cylinder before starting the experiment.
b. Weigh the empty volumetric flask and measuring cylinder using a precision balance and record the measurements.
c. Fill the volumetric flask and measuring cylinder with distilled water up to the marked line.
d. Record the new weight of the water-filled apparatus.
e. Repeat the process twice more, ensuring complete drying between each repetition.
f. Record all measurements accurately.

3) Subsection Volume Calculation:

a. To calculate the original volume, subtract the weight of the empty apparatus from the weight of the water-filled apparatus.
b. Divide this difference by the density of water to obtain the volume.

III. RESULTS

A. Methods for calculation:

The values that we know beforehand:

- Measure the weight of the dry instrument $= W_1$
- Measure the weight of the instrument filled with water $= W_2$
- Indicated volume of water on the instrument $= V_{indicated}$
- Density of water $= 0.997$ g/ml

We calculate the actual Volume of water using the given formula:

$$V_{actual} = \frac{W_2 - W_1}{0.997}$$

After taking the average of 3 lab readings, we obtain an average value of V_{actual} The percentage deviation from $V_{indicated}$ is given by:

$$\text{Percent Deviation} = \frac{|V_{indicated} - V_{actual}|}{V_{indicated}} \times 100$$

Standard deviation for unknown value of Test Tube is given by:

$$\sigma = \sqrt{\frac{\Sigma(\bar{V} - V_i)^2}{n}}$$

where i = 1, 2, 3 and n = 3

For Volumetric Flask Weight of Dry Volumetric Flask = 68.1698 g	Reading 1	Reading 2	Reading 3	Average Volume of Water (in mL)	% Deviation from expected value
With Water	167.7155	167.6074	167.6544		
Only Water	99.5457	99.4376	99.4846	99.788	0.211
Volume of Water (in mL)	99.8452	99.7368	99.7839		

For Pipette Weight of Dry Beaker = 27.5607 g	Reading 1	Reading 2	Reading 3	Average Volume of Water (in mL)	% Deviation from expected value
With Water (g)	37.5644	37.5446	37.5619		
Only Water (g)	10.0037	9.9839	10.0012	10.026	0.03
Volume of Water (in mL)	10.0338	10.0139	10.0312		

For Graduated Pipette Weight of Dry Beaker = 27.5607 g	Reading 1	Reading 2	Reading 3	Average Volume of Water (in mL)	% Deviation from expected value
With Water (g)	37.5542	37.4781	37.5107		
Only Water (g)	9.9935	9.9174	9.9500	9.984	0.016
Volume of Water (in mL)	10.0236	9.9472	9.9800		

For Measuring Cylinder Weight of Dry Beaker = 33.3146 g	Reading 1	Reading 2	Reading 3	Average Volume of Water (in mL)	% Deviation from expected value
With Water (g)	43.369	43.355	43.3962		
Only Water (g)	10.0544	10.0404	10.0816	10.089	0.09
Volume of Water (in mL)	10.0846	10.0706	10.1119		

For Test Tube Weight of Dry Test Tube = 12.3470 g	Reading 1	Reading 2	Reading 3	Average Volume of Water (in mL)	Standard Deviation (σ)
With Water (g)	23.6361	23.6222	23.6965		
Only Water (g)	11.2891	11.2752	11.3495	11.339	0.032
Volume of Water (in mL)	11.3231	11.3091	11.3836		

TABLE I
OBSERVATIONS AND RESULTS

IV. Conclusion

1) This experiment gave the idea of the importance of measuring the right volume. Firstly, we calibrated the given glassware. Next, we calculated the volume of water by using the relation between density, mass, and volume, with the help of a given density at room temperature. After the calculation of the mean volume obtained was 99.788 mL, 10.026 mL, 9.983 mL, 10.089 mL and 11.338 mL for volumetric flask, pipette, graduated pipette, measuring cylinder and test tube respectively. The deviation observed is 0.211%, 0.030%, 0.016%, 0.090% and 0.032 mL respectively

2) The experiment used the following measuring instruments: A volumetric flask (100ml), a Measuring cylinder, a Graduated pipette, a Test tube. The results showed that these instruments have a small error.

V. Reading images

VI. Author Contributions

Name	Roll number	Contribution	Signature
Faayza Vora	23110109	Introduction, Safety measures, Drying the paper over hotplate	
Goraksh Bendale	23110118	Results, Compilation of the report, Applying fingerprints, Handling instruments in lab	
Dishant Tanmay	23110100	Materials and apparatus for both the experiments	
Hriday Pandya	23110136	Procedure, Applying fingerprint, Heating the testtupe in hot water bath, HAndling of instruments in the lab	
Haravath Saroja	23110127	Conclusion, Drying of the paper over hotplate.	

TABLE II
Author's Contribution