Experiment 2
Fingerprint Detection using Ninhydrin

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I. INTRODUCTION

Finding fingerprints is important in solving crimes, and ninhydrin is a useful chemical for this job. When ninhydrin reacts with the oils on our skin, it turns fingerprints purple, due to the formation of Ruhemann's purple. This purple colour helps us see how much amino acid is in the sample.

This experiment has two parts. First, we mix ninhydrin with an amino acid called L-alanine, creating a blue/purple product by shaking and heating. In the second part, we make fingerprints on different papers, put ninhydrin on them, and heat them to show purple prints. We also compare these prints with ones made using an ink pad.

The goal is to show that ninhydrin is good at revealing hidden fingerprints. This experiment follows common practices in forensic science and helps improve how we find fingerprints.

Follow general safety procedures while performing any experiment. Wear special glasses, gloves, and a chemical-resistant apron to protect yourself from ninhydrin since it is an irritant and biologically active reagent. This is also important because it will stain the skin. Try to minimize the time spent working with ninhydrin to reduce the risk of irritation or unwanted contact. Use the forceps provided, and never use your bare hands for any task. Since ninhydrin is usually dissolved in an alcoholic (and flammable) solvent, we must keep them away from flames or other dangerous areas. Wash all apparatus carefully after completing the experiment.

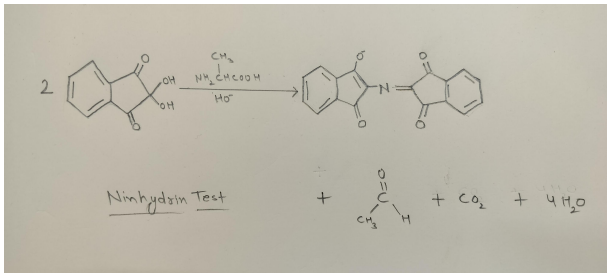


Fig. 1: Reaction between ninhydrin and alanine

II. EXPERIMENT DETAILS

A. Apparatus

1) Test tubes
2) Hot plate
3) Petri dish
4) Forceps
5) Inkpad
6) Gloves
7) Protective goggles

B. Materials

1) 25 mmol/L solution of L-alanine
2) 25 mmol/L Ninhydrin solution in methanol
3) Two pieces of blotting paper
4) two pieces of filter paper
5) two pieces of regular paper

C. Procedure

1) Experiment 1: Formation of Ruhemann's purple

i Mix the methanol solution of ninhydrin (25 mmol/L), and L-alanine (25 mmol/L) in a 2:1 ratio in a test tube.
ii Cover the test tube mouth with aluminum foil.
iii Gently shake the test tube to start the reaction – a light blue colour means Ruhemann's purple is forming.
iv Heat the mixture in a hot water bath to intensify the blue colour.

2) Experiment 2: Fingerprint detection

i Record fingerprints on papers with different textures, like blotting paper, regular paper and filter paper
ii Now, carefully take some drops of ninhydrin solution in a petri dish with the help of a dropper.
iii Soak the paper in ninhydrin solution for 1-2 minutes. And cover the petri dish.
iv Take the paper carefully with forceps and dry the excess solution using a fanning motion.
v Hold the paper above the hot plate for 2-3 minutes. Make sure not to hold it too close to avoid burning the paper.
vi While heating, we can observe some light blue fingerprints start to appear on the paper.
vii Take a reference fingerprint with the help of an ink pad on a separate paper and compare it with your results.

III. Results

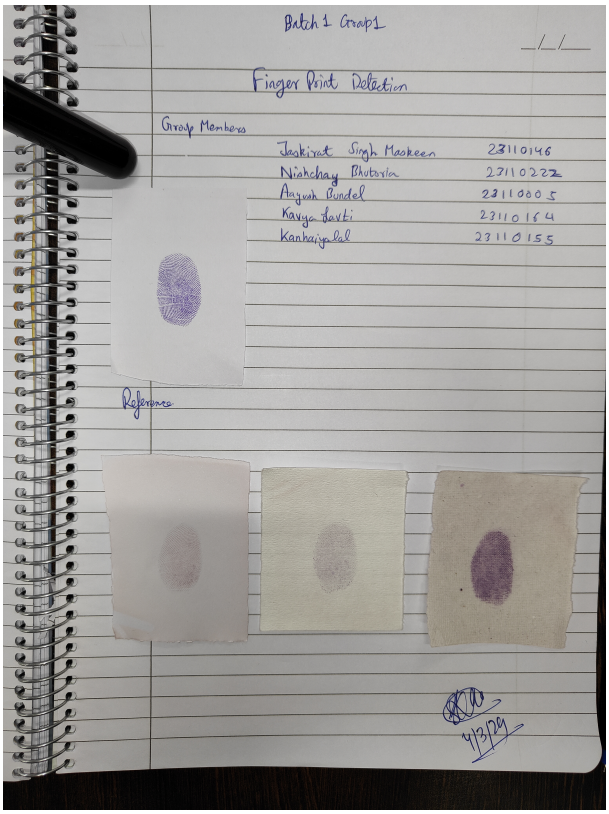


Fig. 2: Results

A. Experiemnt 1:

Heating a mixture of ninhydrin diluted with methanol generated a blue/purple colour, indicating the formation of Ruhemann's purple. This colour's intensity depends on the reactants' temperature and concentration.

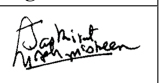
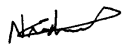
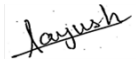
B. Experiemnt 2:

The sharpness of the detected fingerprint depends on the quality of the paper. With fine paper, we get a very detailed fingerprint. As the paper's roughness increases, the fingerprint details decrease. The colour of the fingerprints obtained depends on the concentration of ninhydrin solution, which reacts with amino acids in skin oils and sweat, and the heating of paper. More heating leads to more purple colour.

IV. Conclusion

We had two sub-experiments for this week. In the first experiment, we used a mixture of ninhydrin and methanol and combined it with L-alanine, which resulted in a blue colour within two minutes. After heating the test tube in a hot water bath, the colour deepened and turned purple. This indicates that the rate of this reaction increases with an increase in temperature.
For the second experiment, we put our fingerprints on three different kinds of paper and soaked them in ninhydrin solution before heating them over on a hot plate. The fingerprints gradually appeared on the respective papers, which indicates the presence of amino acids in our skin oils and sweat that react with ninhydrin solution to give a blue-purple product. We can also conclude that the fingerprint's sharpness depends on the paper's texture. Fine paper results in a very detailed fingerprint as compared to filter paper or blotting paper which have a rough texture.

V. Author Contribution

Name	Contribution	Signature
Jaskirat Singh Maskeen (23110146)	Document structure, Results, and Conclusion, Heating the papers over hot plate	
Nishchay Bhutoria (23110222)	Introduction, Mixing methanol and ninhydrin, and applying fingerprint.	
Aayush Bundel (23110005)	Experimental details, Applying fingerprints, Heating over hot plate	
Kavya Lavti (23110164)	Experimental details, Heating the test tube in hot water bath	
Kanhiyalal (23110155)	Equation, Applying fingerprints