

Experiment 2: Fingerprint detection using Ninhydrin

Introduction

Ninhydrin is used to reveal fingerprints left at crime scenes. Ninhydrin reacts with amino acids found in the natural oils on our skin to produce a purple product, known as Ruhemann's purple. The intensity of the color may also be used as a quantitative test for the quantity of amino acids present in a sample. **Safety Precautions**

Either work in a well-ventilated area or use a very dilute solution as Ninhydrin is an irritant, biologically active reagent. It is usually dissolved in an alcoholic solvent. Alcohol solvents are flammable liquids; keep away from flames or other sources of ignition. Ninhydrin will stain skin. Wear chemical splash goggles, chemical-resistant gloves, and a chemical-resistant apron. Please review current Material Safety Data Sheets for additional safety, handling, and disposal information.

Materials

Test tubes, Blotting paper, filter paper and regular paper, 2 pieces each, Hot plate, Petri dish, Forceps, Inkpad, water-soluble

- Prepare 100ml of **Ninhydrin solution** in IPA, (100mM): First dissolve ninhydrin in 20ml of methanol and then make up the rest of the volume with IPA.
- Prepare 100ml 25 mM solution of **L-alanine** in water.

Experiment 1:

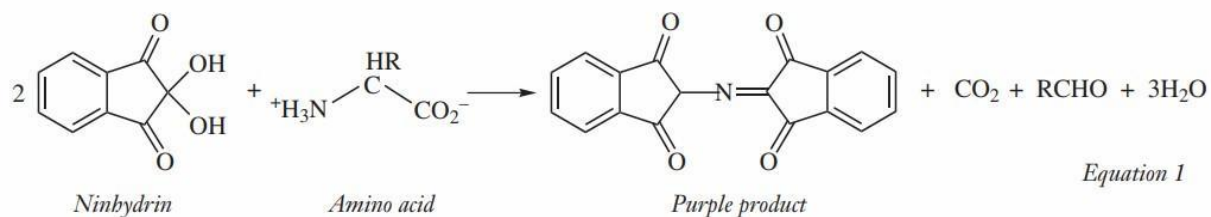
1. Take a test tube and mix the methanol solution of ninhydrin (25 mmol/L) and L-alanine (25 mmol/L) in a 2:1 ration.
2. After mixing, cover the test tube with alu-foil.
3. To start the reaction, shake the test tube carefully. A light blue color will appear, indicating the formation of Ruhemann's blue product.
4. For completion of the reaction, heat the reaction mixture in a hot water bath. Upon heating, the intensity of the blue color will increase.

Experiment 2:

1. Make a set of fingerprints on a sheet of blotting, filter and regular paper.
 2. Holding the paper in a gloved hand, spray the paper or dip with ninhydrin solution (100 mM stock solution). Allow the paper to soak for a few minutes. Let it hold on to the filter paper to drain excess solution. In case of spraying let it dry before picking it up with forceps. This will prevent the fingerprints from "running."
 3. When the paper is dry enough that the solution will not run, pick up the paper and allow it to air dry completely using a fanning motion.
 4. When dry, hold the blotting or filter paper above a heat source such as a hot plate (80°C). Hold the paper about 10 cm above the heat source to prevent scorching.
- Note: It takes about 2–3 minutes of heating over the low setting of the hot plate for the fingerprints to appear. Do not burn the paper.
5. A set of purple prints or spots will soon appear.
 6. Produce a corresponding set of fingerprints on a second piece of blotting or filter paper using a water-soluble ink pad.
 7. Compare the two sets of fingerprints.

Discussion

Ninhydrin is a pale yellow solid. It reacts with amino groups in amino acids and proteins to produce a purple or blue product (Equation 1). The reaction is slow at room temperature; heat is used to speed up the reaction.



Latent fingerprints are composed of several chemicals that are naturally present in skin oils or released through the pores of the skin via perspiration. Some of the chemicals in fingerprints include sodium chloride, amino acids, glucose, lactic acid, and ammonia.

Result:



Inkpad Based Fingerprint



Ninhydrin Based Fingerprint

Expectation: Each group of students will produce multiple fingerprints using different types of papers. Resulting fingerprint from ninhydrin should be clearly visible and matches with the inkpad-based fingerprint.