

# Amino Acid Fingerprints

## Ninhydrin Demonstration



### Introduction

Detectives use ninhydrin 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. The intensity of the color may also be used as quantitative test for the amount of amino acids in a sample.

### Concepts

- Amino acids
- Ninhydrin
- Forensic chemistry

### Materials

- |  |                                     |
|--|-------------------------------------|
| Blotting paper or filter paper, 15-cm diameter, 2 pieces | Ninhydrin solution in alcohol, 0.5% |
| Hot plate or high temperature hair dryer                 | Spray bottle                        |
| Inkpad, water-soluble                                    | Gloves                              |

### Safety Precautions

*Work in a fume hood or well-ventilated area. Ninhydrin is an irritant, biologically active, and is usually dissolved in an alcohol 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 consult current Material Safety Data Sheet for additional safety information.*

### Procedure

1. Ask students to make a set of inkless fingerprints on a sheet of blotting or filter paper. Note: Oily fingerprints work best. Have students run their fingers through their hair before making fingerprints.
2. Holding the paper in a gloved hand, spray the paper with ninhydrin solution. Allow the paper to dry for a few minutes before picking it up. 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. 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. Have students 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.

### Disposal

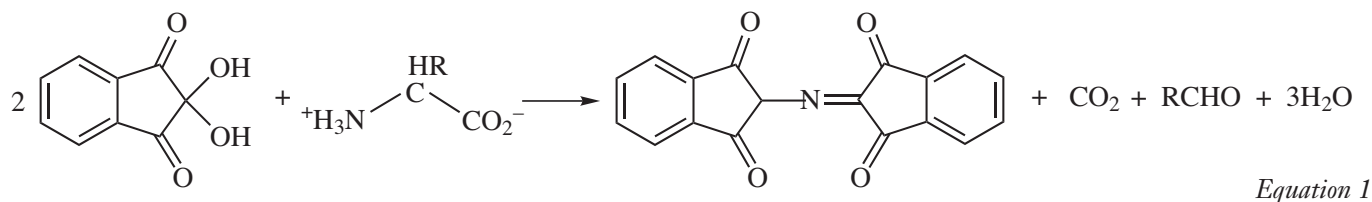
Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures, and review all federal, state and local regulations that may apply, before proceeding. Blotting paper may be disposed of in the trash following Flinn Suggested Disposal Method #26a. The ninhydrin solution may be stored for future use.

## Tips

- Ninhydrin solution may be prepared in ethyl, isopropyl, or butyl alcohol. For convenience, we recommend the purchase of ready-made ninhydrin solution in butyl alcohol (Flinn Catalog No. N0039).
- Some people have very pronounced or sharp fingerprints, whereas others may leave only smudges. To get better fingerprints, have students run their fingers through their hair or rub “oily” parts of their face.
- All amino acids and most proteins give positive results in the ninhydrin test. The ninhydrin test is commonly used to detect amino acid “spots” in the separation of amino acids by paper chromatography. The purple color does not develop until the amino acid–ninhydrin mixture is heated.
- In forensic chemistry, ninhydrin is most often used to detect latent fingerprints left behind on porous surfaces—cloth, paper, and cardboard. Prints on hard, nonabsorbent surfaces, such as mirrors, tile, or glass, are detected using fingerprint powders such as graphite or aluminum dust.
- A series of reference and control tests may be performed to demonstrate the positive reaction of ninhydrin with amino acids and proteins. Prepare a set of 1% reference solutions containing amino acids, such as phenylalanine and tyrosine, and proteins, such as albumin and gelatin. Add 2 mL of ninhydrin solution to 1 mL of each reference sample in a test tube, and heat the solutions at 75–80 °C for 3–5 minutes. If desired, these positive reference tests may be compared against a series of controls that give negative results. Water, salt and sugar should all test negative with ninhydrin.

## Discussion

Ninhydrin is a pale yellow solid. It reacts with amino groups in amino acids and proteins to produce a purple product (Equation 1). The reaction is very 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.

## Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

### ***Unifying Concepts and Processes: Grades K–12***

Evidence, models, and explanation

### ***Content Standards: Grades 5–8***

Content Standard A: Science as Inquiry

Content Standard B: properties and changes of properties in matter

Content Standard C: Life Science, structure and function in living systems

Content Standard F: Science in Personal and Social Perspectives

### ***Content Standards: Grades 9–12***

Content Standard A: Science as Inquiry

Content Standard B: Physical Science, structure and properties of matter

Content Standard C: Life Science, matter, energy, and organization in living systems; behavior of organisms

Content Standard F: Science in Personal and Social Perspectives

Materials for *Amino Acid Fingerprints* are available from Flinn Scientific, Inc.

Catalog No.	Description
N0039	Ninhydrin Solution, 0.5% in Alcohol
AP5338	Bottle, Spray Mist Dispenser
AP8999	Filter Paper, Quantitative, 15.0-cm

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.