Investigation of the Optimal Conditions and Performance of a Self-assembled Cyanoacrylate Fuming Chamber

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Abstract

This study aimed to determine the optimal conditions and evaluate the performance of a self-assembled cyanoacrylate fuming chamber for developing latent fingerprints on evidence items. Key factors considered included the amount of cyanoacrylate, fuming duration, number of items per cycle, and the surface characteristics of the evidence. Kenji cyanoacrylate adhesive (96% concentration) and black 7 × 10 cm zip-lock bags were used as test samples. After fuming, fingerprints were enhanced using Rhodamine 6G and Basic Yellow 40, with UV excitation at 365 and 395 nm. The optimal conditions were found to be 0.2xxx grams of adhesive, 15 minutes of fuming, and no more than 10 items per cycle, which produced fingerprints clear enough for imaging and examination. Non-porous surfaces yielded the best results, especially when stained with Basic Yellow 40. Some semi-porous surfaces also provided usable prints, although surfaces with matte coatings caused background staining and reduced clarity. Porous surfaces produced poor results with this method and are better examined using ninhydrin or other techniques. In conclusion, the self-assembled cyanoacrylate fuming chamber is effective for developing latent fingerprints on non-porous and certain semi-porous surfaces. Selecting an appropriate enhancement technique based on the surface type is essential for reliable forensic examination.

Introduction

Crime today has become more complex, making accurate personal identification more important than ever. One widely used method is developing latent fingerprints on evidence objects. A common technique for this is cyanoacrylate fuming, which works well on non-porous surfaces such as plastic, glass, and metal. However, commercial fuming chambers are expensive and often imported, causing difficulties for many units in purchasing the equipment. This research aims to develop a low-cost, self-assembled cyanoacrylate fuming chamber for effective use in real forensic work. The study focuses on key factors such as the amount of glue, fuming time, number of items per session, and suitable surface types. The goal is to create an efficient and practical chamber that supports forensic fingerprint development.

Objectives

1. To study the appropriate amount of cyanoacrylate glue for use in a self-assembled cyanoacrylate fuming chamber.
2. To study the suitable fuming time for a self-assembled cyanoacrylate fuming chamber.
3. To study the appropriate number of evidences that can be processed per fuming cycle in a self-assembled cyanoacrylate fuming chamber.
4. To study and compare the effectiveness of the fluorescent fingerprint dyes Basic Yellow 40 and Rhodamine 6G after fuming with a self-assembled cyanoacrylate fuming chamber.
5. To study the types of evidence or surface materials that are compatible with a self-assembled cyanoacrylate fuming chamber.

Experimental

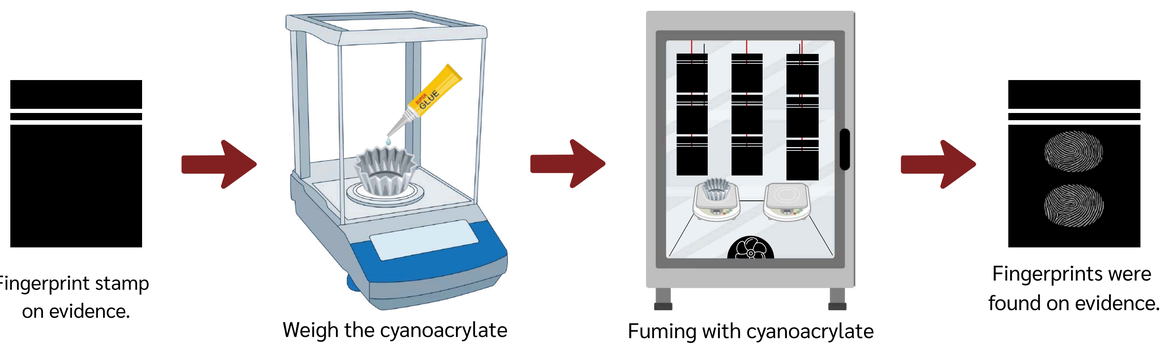


Fig.1 The process of detecting latent fingerprints using self-assembled cyanoacrylate fuming chamber.

Discussion and Conclusion

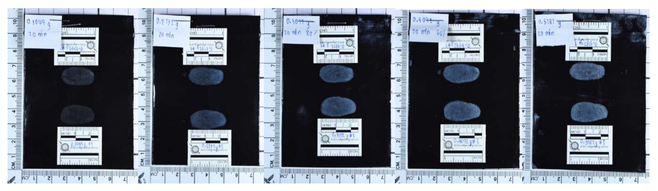
- Optimized Conditions
  - Cyanoacrylate amount: 0.2xxx g
  - Fuming time: 15 minutes
  - Number of items per cycle: 10 pieces (~700 cm^2)
- Performance on Different Types of Substrates
  - Non-Porous : Snack packages, Plastic coffee cups → Clear fingerprints after fuming and spray Basic Yellow 40
  - Semi-Porous : A4 paper bag → Clear fingerprints
    Toothpaste box → Poor clarity due to background fluorescence
  - Porous: Envelopes, Cardboard box → Fingerprints are not clear

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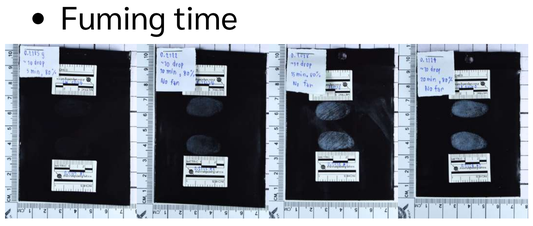
Results

- Amount of cyanoacrylate



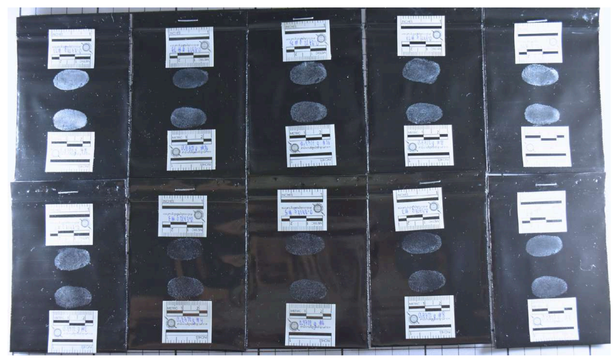
The appropriate amount of glue is 0.2xxx g

- Fuming time



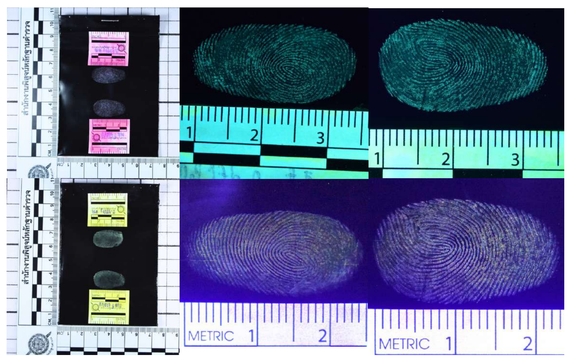
The appropriate time is 15 min.

- Number of evidence items



The appropriate number of pieces of evidence is 10 items.

- Effectiveness of BY40 and R6G



Comparing the performance of fluorescent fingerprint dyes BY40 and R6G after fuming with cyanoacrylate.

- Types of evidence or surface



Fingerprints appear on non-porous, semi-porous, and porous surfaces of evidence.

Fig.2 Experimental results for finding optimal conditions using a self-assembled cyanoacrylate fuming chamber.

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