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Research Article

The Utilization of an Improvised Fuming Device in the Development of Latent Fingerprint

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ABSTRACT

Developing latent print is an important process in investigating a person's identity for the solution of a case. There are different types of developing latent prints that are being used by the Fingerprint Examiner. Cyanoacrylate or superglue reacts with the moisture present on the latent print. It is one of the most effective methods of developing latent print. There are various types of fuming chambers that are used in this method that can be bought in the markets, but they cost a lot of money; many of the fuming chambers present in the market do not have specific sizes. Fingerprint analysis is a crucial part of forensic science, serving as an important tool in identifying a person link with the crimes. The traditional method of developing latent fingerprints using cyanoacrylate has limitations that require innovative solutions.

The current study differs from this study, which only focuses on developing fingerprints on portable objects. To address the challenges related to the size of the fuming box, the participants recommended using different sizes - small, medium, and large - depending on the size of the evidence being processed. To address the challenge of fuming box size, it is advisable to equip forensic laboratories with a range of fuming box sizes, including small, medium, and large options. This will allow the Fingerprint Examiner to match the size of the evidence with an appropriate fuming box, ensuring efficient and effective development of latent prints.

Keywords: *Dactyloscopy, Fingerprint analysis, Personal identification*

Introduction

Developing latent print is an important process in investigating a person's identity for the solution of a case. There are different types of

developing latent prints that are being used by the Fingerprint Examiner. Cyanoacrylate or superglue reacts with the moisture present on the latent print. It is one of the most effective

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methods of developing latent print. There are various types of fuming chambers that are used in this method that can be bought in the markets, but they cost a lot of money; many of the fuming chambers present in the market do not have specific sizes. Fingerprint analysis is a crucial part of forensic science, serving as an important tool in identifying a person link with the crimes. The traditional method of developing latent fingerprints using cyanoacrylate has limitations that require innovative solutions.

The study of Bumbrah (2017) focuses on several pre-treatment and post-treatment procedures that will be used to develop latent fingerprints. The study did not focus on the use of a fuming box in developing latent fingerprint in, which this study sought to establish. Jones, Calum & Fraser, Joanna & Deacon, Paul & Lindsay, Maurice & Carlisle-Davies, Felicity & Fargugia, Kevin. (2019) assessed a portable cyanoacrylate fuming system for developing latent fingerprints. They focus on studying the LumiFume™ system in comparison to traditional cabinet fuming with Lumicyano™, in which it produces the same result. The study of Poudel, Brillhart, and Tom (2021) focuses on the efficacy of patented commercialized products for developing latent fingerprint which is different from this study which used an improvised material for developing latent fingerprints. The study conducted by Barros, Oliveira Neto, Barbosa, Tonietto, Jacintho, Del Sarto, and Paulino focuses on the efficiency of the development of fingerprints with the use of the cyanoacrylate method found in the interior and exterior parts of vehicles. The current study differs from this study, which only focuses on developing fingerprints on portable objects.

Materials and Methods

This study sought to determine the effectiveness of an improvised fuming box that would not cost a significant amount of money to produce a fully developed latent print.

Three major questions will be answered by this study, which include

1. How is the improvised fuming device used in

latent fingerprinting?

2. What are the challenges encountered by the PNPFG in the use of the improvised fuming device in the latent print?
3. What are the recommendations that can be made to enhance the use of an improvised fuming device in latent fingerprinting?

The result of the study will be beneficial to the PNP Forensic Group Fingerprint Identification Division to remove the expenses of buying an expensive fuming box.

Qualitative research has been conducted to explore the effectiveness of improvised fuming devices in developing latent fingerprints using cyanoacrylate methods. The study used a case study approach. Before administering or conducting an interview, the researcher must first be able to secure letter approval from the head of the unit to conduct the said research. The researcher prepared interview questions for the participants. The researcher created the step-by-step procedures and the materials that will be used in developing a fingerprint using an improvised fuming device. Latent fingerprints were developed by cyanoacrylate methods using an improvised fuming device.

The participants of the study are ten (10) Fingerprint Examiner ages 25 to 30 years old, and at least three years designated as Fingerprint Examiners assigned at PNP Forensic Group Fingerprint Identification Division. The participants were able to perform the development technique themselves on June 1, 2023. Later, the participants were asked via interview about their observations on the use of the improvised fuming device.

The data was collected and analyzed using content analysis to identify themes and trends on the challenges encountered by the PNPFG in the use of the improvised fuming device in the latent print, and recommendations that can be made to enhance the use of the improvised fuming device and the effectiveness of improvised fuming devices.

All ten (10) participants followed the step-by-step procedure as follows:

Procedure:

STEP 1. Wear rubber/surgical gloves to avoid contamination in handling objects with latent print.

STEP 2. Open the cover of the improvised fuming device.



STEP 3. Place the aluminum foil with 20 drops of cyanoacrylate inside the improvised fuming device



STEP 4. Place the non-porous object on top of the object stand with the suspected latent print facing the bottom of the fuming device.



STEP 5. Put back and close the cover of the improvised fuming device.



STEP 6. Get the microwavable plastic tub container with hot water, then put on top the improvised fuming device



STEP 7. Let the cyanoacrylate fume meet the latent print for about 15 minutes, open the cover of the device, and get the object with the latent print.

STEP 8. Examine the object, look for the developed latent fingerprint. It is developed if a whitish form of fingerprint appears on the object.

STEP 9. If the latent fingerprint is not thoroughly developed yet, repeat steps 2 to 6 until it is completely developed. Do not overexpose the latent print because it will completely make the object turn totally white.

STEP 10. If the latent print is already developed, take a photograph of the developed latent fingerprint.

Case Analysis

A. Evaluation of the Case

1. How is the improvised fuming device used in latent fingerprinting?

A. Were the materials and procedure able to fully develop the latent fingerprint on the object?

The use of an improvised fuming box with the application of heat from water can be a valuable tool in revealing latent prints on various types of evidence. However, according to the respondent, the

success of this technique relies on the correct choice of materials, adherence to precise procedures, and recognition that the visibility of developed latent prints may vary depending on the nature of the evidence. By employing this method conscientiously and considering the specific characteristics of the evidence, forensic experts can enhance their ability to identify and analyze latent prints, contributing significantly to the process of solving criminal cases.

- B. Based on your experience in developing a fingerprint using this method, what are the possible factors that can affect the result of the experiment?

To achieve optimal results, a fingerprint examiner must carefully control the amount of cyanoacrylate used and consider the prevailing weather conditions. According to the respondent, too much cyanoacrylate or Mighty Bond can affect the result of the experiment. By striking the right balance, they can ensure that the developed latent prints are clear, distinct, and suitable for analysis and comparison. Additionally, implementing best practices and adhering to standardized procedures will enhance the reliability and accuracy of the forensic examination, ultimately contributing to the successful resolution of criminal investigations.

- C. Considering the size and dimension of the improvised fuming device, what objects or evidence that can be found on the crime scene bearing latent fingerprints are possible to undergo the cyanoacrylate method using improvised fuming device?

The versatility of the improvised fuming device allows for the development of latent prints on a wide range of small objects found at crime scenes. Respondent's statement that Items such as broken glass and small objects with smooth surfaces can be efficiently accommodated in the fuming box. The compact size of the device makes it ideal for processing evidence like small knives, scissors, ballpoint pens, IDs, cups, bottles, utensils, and more. By harnessing the power of cyanoacrylate fuming within this portable apparatus, fingerprint examiners can reveal hidden fingerprints on these items, potentially providing crucial leads in criminal investigations.

- D. What are your observations on the step 1-10 procedure of developing latent print using improvised fuming device?

The procedure and results of using both the fuming box and improvised fuming device are similar, with the only difference being the absence of electricity in the latter as respondent's statement. In both methods, cyanoacrylate fuming is employed to develop latent prints on various objects or evidence. However, based on the statement of the respondent when using the improvised fuming device, the amount of super glue utilized should be adjusted according to the size of the object being processed. This ensures optimal development and clarity of the latent prints. One notable distinction between the two approaches is that the improvised fuming device requires more time for preparation, as it involves heating water manually for the fuming process. Additionally, the developing time may also be longer in the improvised method due to the manual control of temperature and fuming conditions. Despite these differences, both techniques remain valuable tools in forensic investigations, offering the ability to reveal hidden fingerprints on different items found at crime scenes and contributing to the overall process of evidence analysis and identification.

- E. What are your observations on the materials used in developing latent fingerprints using improvised fuming device?

According to the respondent, the improvised fuming device offers a cost-effective, easily accessible, and portable solution for developing latent prints. By utilizing everyday materials, fingerprint examiners can perform on-the-spot fingerprint analysis efficiently and economically, enhancing the speed and effectiveness of crime scene investigations. Its practicality, combined with the ability to yield valuable results without the need for electricity, makes the improvised fuming device a valuable addition to the forensic toolkit, serving as a versatile and reliable method for identifying hidden evidence and aiding in the resolution of criminal cases.

2. What are the challenges encountered by the PNPFPG in the use of the improvised fuming device in the latent print?

A. What are the challenges you encountered in using the materials and equipment while performing the development process?

One of the challenges encountered by the respondent in using the materials and equipment while performing the development process was the size and kind of evidence that may be considered before using the improvised fuming box. There are lot of physical evidence of various sizes that can be subjected to the cyanoacrylate method. In this case, the size of the fuming box should also be considered.

Another problem encountered by the participants is that they struggle to determine the exact amount of cyanoacrylate necessary to develop the latent print while using improvised fuming device. The amount of cyanoacrylate is also a factor in developing latent print. The size of evidence and the size of the fuming box are important factors in the amount of cyanoacrylate that will be used.

The participants of the study did not encounter any problem in terms of the time of exposure of the object with the latent print to the fume of cyanoacrylate. The ideal time of exposure is around 20 minutes. Factors such as the temperature of water may also be considered in time exposure. The hotter the water temperature is, the faster the fume of cyanoacrylate is released, as stated by the respondent.

B. In comparison, what are the advantages and disadvantage on using the usual fuming box you are using, and this improvised fuming device?

Based on the participants, in comparison with the usual fuming box and improvised fuming device, it was noted that the advantage of the usual fuming box is that it gives them less preparation since it is custom-built to do the process. On the other hand, the improvised fuming

box takes more time in preparation and steps, including the preparation to boil the water. According to them, as to the cost, improvised fuming device is much cheaper than the usual fuming box. The cost of the materials of improvised fuming box will range from less than 500 pesos only. Another advantage of an improvising fuming box is that it doesn't require the use of electricity, while the usual fuming box will not work without electricity. Power interruption may affect the result of latent print when using a usual fuming box, while the improvised fuming box will be able to perform its task without electricity. It will be convenient for the FG offices without electricity or having power interruption to use improvised fuming box as it does not require electricity.

C. What problems with safety measures have you encountered while conducting the development process?

The participants of the study do not encounter a problem when it comes to safety measures. The development process is safe and not hazardous. With proper care in using materials and proper wearing of personal protective equipment, any risk of exposure to the chemicals and laboratory accidents can be prevented.

D. Do you think that this technique requires special training to perfect the utilization of this improvised fuming device? Why?

Proper and special training must be achieved first before conducting this laboratory activity. Utilizing this improvised fuming device requires that the examiner must finish basic fingerprint identification course. Since the improvised fuming device and the usual fuming device also has the same procedure and chemical used to develop latent print special training is a must.

E. Will it be hard for the PNP Forensic Group to accept and utilize this development technique? What are the reasons

that will prevent this development technique to be utilized in the PNP Forensic Group?

According to the respondent, it will not be hard for the PNP Forensic Group to accept and utilize this development technique. It will be easier for them to examine the evidence with the use of improvised fuming device without the procurement of the actual/usual fuming box. This technique can help those FP examiners to conduct an examination within their office without the availability of the usual fuming box. Further, the participants do not see any reason that will prevent this development technique to be utilized in the PNP Forensic Group.

3. What recommendations can be made to enhance the use of an improvised fuming device in latent fingerprint?

A. What are the things that you can recommend regarding the materials used in developing latent fingerprints?

As to the materials used in developing latent fingerprints, it was recommended that it is better to use a bigger storage box or fuming box so that there will be enough space for different evidence inside the box. It is also recommended that the fuming box should have various sizes, which can also be used for bigger evidence.

B. What brand of cyanoacrylate would you recommend being used? How many cyanoacrylates would you recommend to clearly develop the latent fingerprint? How many minutes of exposure of cyanoacrylate to the object with a latent print would you recommend to enhance the development of the latent fingerprint?

There are numerous brands of cyanoacrylate available in the market, in which there are expensive ones and there are also cheap ones. As to the brand of cyanoacrylate that will be used to develop latent print, it was recommended that the common household brand, which is the "Mighty Bond," should be

used in developing latent print. This brand is already known for its effectiveness, based on the observation and experience of the participants of this study.

When considering the amount of cyanoacrylate that should be used in this technique, the respondent recommended that 1 whole small tube of Mighty Bond, or around 15 grams, is advisable. The amount of the mighty bond needed also depends on the size of the box and the evidence being subjected to this process.

As to the time of exposure of cyanoacrylate to the object with latent print, it was recommended that 20-30 minutes was enough to enhance the development of the latent fingerprint. Considering factors on exposure time depends on the temperature of the hot water, based on the observation of participants.

C. Would you recommend changing the size of the improvised fuming box? What size or dimension would you recommend?

The recommended size of the improvised fuming device or box is 10 liters. Respondent recommended that it would also be better if there are variety of sizes of the box, from small, medium, and large boxes, if it is portable or hand-carried, and convenient to use.

D. Would you suggest any safety precautions in the conduct of this method?

Still, prevention is better than a cure. Safety precautions should be a priority in conducting experiments or laboratory activities. Respondent recommended that the wearing of gloves, eye protector and face masks should be implemented throughout the process to avoid exposure to the chemicals. The process of cyanoacrylate is also recommended to be done in an open area where proper ventilation is available because prolonged exposure to the smell of the fume of cyanoacrylate is irritating to the nose and might result in allergic reactions for some individuals.

- E. Would you recommend conducting further research to solve other problems with this improvised fuming device?

According to the participants, further research on these techniques should be conducted to investigate positive and negative factors that can possibly be encountered in using the improvised fuming device. The temperature of the boiling water is a considerable factor in the development process of latent print. It is advisable to have an exact temperature of water that will be used in this technique. Direct boiling of water over the fire is also advisable to improve the development of latent print.

Result and Discussion

The participants of the study were able to completely develop the latent fingerprint using the materials and procedure. This indicates that the improvised fuming box is an effective means to develop latent print.

To solve the challenges regarding the size of the fuming box that were encountered while performing the development process, it is advisable to use different sizes of fuming box from small, medium, and large boxes. The size of evidence will be a determining factor in what size fuming box will be used.

To solve the problem encountered by the participants as to the exact amount of cyanoacrylate necessary to develop the latent print while using improvised fuming device, it is advisable to use the all content of 1 small tube of mighty bond or 3 grams for small boxes, 2 small tube of mighty bond or 6 grams for medium boxes and 3 small tube or 9 grams for large fuming box.

Time is also a consideration in developing latent fingerprints. The advisable time of exposure of the object with the latent print to the fume of cyanoacrylate is 20 minutes.

The participants of the study do not encounter a problem when it comes to safety measures. The development process is safe and not hazardous. With proper care in using materials and proper wearing of personal protective equipment, any risk of exposure to the chemicals and laboratory accidents can be prevented.

Conclusion

In conclusion, the study demonstrates that the improvised fuming box proved to be an effective means of developing latent prints. To address the challenges related to the size of the fuming box, the participants recommended using different sizes - small, medium, and large - depending on the size of the evidence being processed.

Additionally, to resolve the issue of determining the exact amount of cyanoacrylate needed, the study suggests using specific quantities of 1 small tube of Mighty Bond (3 grams) for small boxes, 2 small tubes (6 grams) for medium boxes, and 3 small tubes (9 grams) for large fuming boxes. Time also plays a crucial role, and the optimal exposure time for objects with latent prints is advised to be 20 minutes.

Fortunately, the participants encountered no safety issues during the development process, as they adhered to proper safety measures and used personal protective equipment, effectively preventing any risk of chemical exposure or laboratory accidents.

Overall, the findings highlight the practicality and safety of the improvised fuming device in developing latent fingerprints, paving the way for a promising approach in forensic investigations.

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THE ACTION PLAN

I. Rationale: Developing latent print is crucial to identifying a person or individual, and it will greatly help in the outcome of investigations. The development of latent print must not be hindered by a lack of budget allocation for procuring expensive materials and instruments. There is a need to provide a solution to this problem. The usual fuming device being utilize the PNP Forensic Group is expensive and not easy to procure. On the other hand, an improvised fuming device is very affordable, and the materials and equipment are easy to acquire, yet very effective in developing latent print.

Activities/ Program	Objectives	Implementation Strategy	Performance Indicators	Responsible unit/ Person	Time Frame	Budget/ Source of Fund	Remarks	Success Indicators
Proposed training program related to the utilization of an improvised fuming device in the development of latent fingerprints	To continuously equip the personnel with appropriate skills and abilities in using an improvised fuming device in the development of latent fingerprints	Prepare a program of instruction	Regular Strategic Training for Qualified Personnel	PNP Forensic Group	February 2026- February 2027	PNP Fund	Secure approval from PNP Forensic Group	Impact on the utilization of an improvised fuming device in the development of latent fingerprints

II. Intents/Outcome/s or Change/s: To implement the utilization of an improvised fuming device as a substitute or main device used in developing latent print using the cyanoacrylate method.

III. Programs/Strategies and Actions

- A. Procurement of material to be used in an improvised fuming device.
- B. Special training will be conducted for fingerprint examiners of PNP, the Forensic Group, the Fingerprint Identification Division in using the improvised fuming device.
- C. Utilization of an improvised fuming device by the PNP Forensic Group.

IV. Timeline: February 2026- February 2027

V. Resources

- a) Persons In-charge: Personnel from the PNP Forensic Group, Fingerprint Identification Division
- b) Other Resource Requirements

Materials:

Consumable Material	Quantity	Amount	Description
Cyanoacrylate (Mighty Bond or Crown Bond)	1 pc	3 grams	Tube container
Aluminum foil	2 folds	2 folds	Saucer plate for cyan
Hot	1 bottle	1000 ml	Hot water (150C)

Equipment	Quantity	Dimension	Description
Improvised Fuming Device	1	8 x 11 x 6.5 inches	Plastic box container
Stick (hanging fan or object)	2 pieces	(8.5 inches)	Bamboo stick
Object with latent print	2 pieces	Not more than 6.5 x 4.5 x 3.5 inches	Non-porous object only
Microwavable plastic tab container	1 piece	8 x 11 x 6.5 inches	Microwavable plastic tab container
Protective Gloves	1 pair	Standard size	Rubber/Surgical Gloves or Fabric Gloves
Digital Single Reflex Camera with macro lens	1 unit		Digital Single Reflex Camera with macro lens

V. Monitoring and Evaluation

Materials and equipment will be regularly subjected for inventory by a laboratory technician or property custodian. During the special training, the attendance of participants will be monitored. The workshop will be conducted after the special training to evaluate the performance of the participants in developing latent prints using improvised fuming device. Post-test evaluation will be conducted for the participants of the special training. Result of the post-test evaluation will be presented to the participants. A report on the outcome of cases involving the utilization of improvised fuming device will be regularly submitted by the fingerprint examiner who uses the improvised fuming device. Utilization of improvised fuming device will be included in the annual report to indicate problems encountered, plans, and actions taken for the continuation of the utilization of improvised fuming device.