COMPARISON OF STABILITY LATENT FINGERPRINT ON PLASTIC

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ABSTRACT

The aims of this research are to study the latent fingerprint remaining the period on plastic by on using black powder dusting and superglue method to reveals determined the latent fingerprints and compared them qualities of them on three types of plastic surfaces including Polyethylene Terephthalate (PET), High Density Polyethylene (HDPE) and Polystyrene Polypropylene (PP) The plastics were selected from the supermarket and they were investigated to find latent fingerprints in five different periods; 1 hour, 3 hours, 6 hours, 1 day, 5 days and 7 days. The numbers of latent fingerprints appearing were recorded. The result shows that the superglue method was detected the latent fingerprints on all kinds of a plastic surface but not in all periods. After comparing the duration of the latent fingerprint by using independent T-test statistic, it was found that, at a significance level of 0.05, both latent fingerprints appeared identical.

Keywords: latent, fingerprints, plastic, stability

1. INTRODUCTION

Forensic science and fingerprints

Fingerprints, palms and footprint examination is a branch of personal identification based on the research of scientists for a long time, it is found that the stripes that appear on the fingers, palms, feet of humans can be used for examination and proof person due to the 2 truth are describe at following [1].

1. Individual fingerprints, palms and footprint of the individual are uniqueness which each person has different special characteristics.

2. The fingers, palms, footprint of each individual's feet do not change (permanence) from birth until death or even dead, if the body is maintained well, fingerprints, palms, footprints will remain unchanged.

The occurrence of latent fingerprints

Latent fingerprints are caused by substances that excrete from the sweat glands, sebaceous glands and fats from the skin tissue. The skin of the fingers is wet with substances that excrete from the sweat glands, which are scattered on the convex lines. Fat that is continuously excreted from the skin and attached with substances that are excreted from the sebaceous glands due to contact with other skin. If the wet hand touches the object, the excreted substance will transfer to the surface of the object that the finger has to hold until the fingerprint is scratched because the invisible fingerprints are caused by the transfer of the substance out to the object, so the object is dry and smooth.

Substances that from sweat glands are colorless, have a neutral pH or slightly acidic (pH 4-7), consisting of 98 - 99% moisture and 1 - 2% organic and inorganic compounds. Inorganic salts include calcium salts, Magnesium etc. Organic substances such as amino acids (proteins), urea, lactic acid and etc [2].

Substances that from the colorless sebaceous glands include fatty acids, vitamins, etc. The quality and quantity of substances that are excreted from the sebaceous glands varies from person. The amount of substances excreted depends on the temperature and the mental state. The amount of substances excreted will increase when the temperature is high or high tension of mind why looking at the fingerprints with the naked eye and do not see because of the marks of the substance that is excreted without color [3].

Type of fingerprint

Fingerprints are divided into 3 types, namely [4]

1. Arch type was divided into 2 types as plain arch and tented arch.

2. Loop type was divided into 2 types as right loop and left loop.

3. Whorl were divided into 5 types such as Plain Whorl, Center Pocket Loop, Lateral Pocket Loop, Twinned Loop or Double Loop and Accidental Whorl with characteristics and fingerprints as shown in Figure 1.

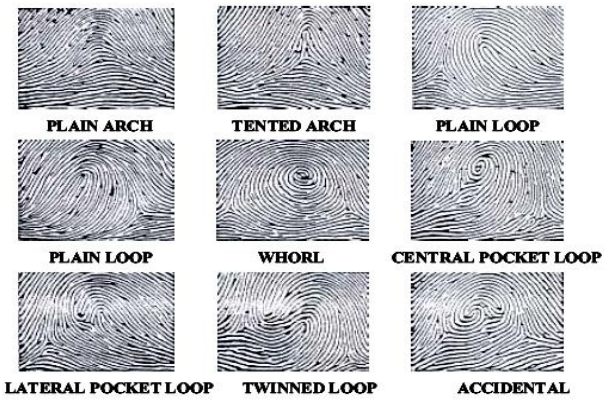

Figure 1 Type of the fingerprint were displayed unique characteristics of the whorl.

Special characteristic of minutiae

Lines that are on the fingerprints, palms and footprint consisting of stripes that have specific characteristics, called spots, special characteristics or defects as follows: Ridges forking or Bifurcating, Ridges beginning or Ending suddenly, Closures or Lakes, Dot and Short Ridge [5].

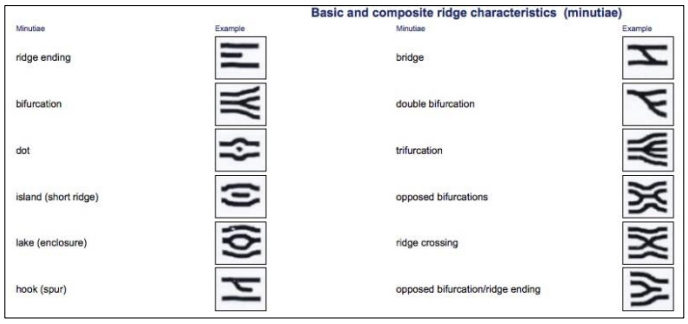

Figure 2 The pattern lines of a special characteristic of minutiae fingerprint

Detecting fingerprints, palms and feet

The method of collecting fingerprints at the crime scene in anyway depends on the conditions of the scene. The investigator should have the expertise to select appropriate methods and objects for inspection by choosing according to the principles and applied with creativity such as collecting fingerprints on wet areas as soon as possible in order to stop the effect of the water that will occur on the area, the fingers may dry out using a hair dryer. Objects with rough skin may be collected using rolling powder dusting method. Objects that have a smooth surface, using dusting method, etc. by means of collecting fingerprints, such as dry or powdered methods, wet methods, light methods, and methods of casting marks. Most of them use the same method but some cases use 2 methods or more as appropriate [5].

Type of Plastic

This type of plastic sample is popular in making food containers as follows.

1. Polyethylene terephthalate – PET: This plastic is clear, strong, durable, sticky, not easily broken, can prevent gas permeability. Resistant to light and high temperatures up to 70- 100 ^{o}c, resistant to high impact and very resistant to scratches has a high melting point used make food packaging and used with the oven and microwave [6].

2. Polyethylene - PE: This type of plastic has 2 types: HDPE (High Density Polyethylene) used to produce packaging for water pipes and automotive equipment and LDPE (low density Polyethylene) for film production and packaging materials.

3. Polyvinyl chloride – PVC: A thermoplastic plastic. Currently produced to contain residue of vinyl chloride which causes liver cancer to be less than 1 mg / kg therefore safe for filling food, resistant to oil, smell well, resistant to high temperatures not more than 90^{o}c.

4. Polypropylene – PP: The same application as polyethylene but with higher durability, especially resistant to temperature. General properties like high density polyethylene both physical and chemical but better quality durable and stronger.

5. Polystyrene (PS): Commonly used to make cups, trays, glass used once and discarded. The foam tray is a plastic type. If used for packing hot items, the foam tray will melt out and contaminate food [6].

2. OBJECTIVE

To study latent fingerprint remaining period on plastic by on using black powder dusting and superglue method to reveals determined the latent fingerprints and compared the qualities of them on three types of plastic surfaces.

3. METHODOLOGY

Equipment

1. The plastic used in fingerprint identification is divided into 3 types, each type 1 example, namely Polyethylene Terephthalate (PET), High Density Polyethylene (HDPE) and Polystyrene Polypropylene (PP) type.
2. Superglue, a cup for superglue and superglue incubators.
3. Black powder and brush for use in dusting.
4. Scissors for use in cutting plastic and clear tape.
5. Gloves to prevent other fingerprints that will occur while touching.
6. Forceps for plastic clamping.
7. Magnifying glass for use in counting points and special characteristic of minutiae.
8. Paper for tracing fingerprints, using white cardboard in order to have the color of paper cut to the color of the dust powder.

Method

1. Collect latent fingerprints from participants in the experiment

Collecting latent fingerprint samples from the participants and do not wash hands before collecting samples for at least 1 hour and fingerprints on the plastic to be stamped into the frame. The researcher pressed the finger of the participant to experiment directly on the plastic, where the participant must not exert any pressing force, then pull the hand up vertically to prevent the fingers from twisting or moving, which may cause latent fingerprints to be mistaken by stamping the thumb on each type of plastic. By using the amount of time that the thumb touches the plastic each time as closely as possible. After that, remove the plastic stamped fingerprints already stored in the basket each plastic does not overlap or collide.

2. Detection of latent fingerprints

Performed 5 times according to the duration : 1 hour, 3 hours, 24 hours (1 day), 120 hours (5 days) and 168 hours (7 days). Repeat 3 times. Remove the plastic that has been looking for latent fingerprints

The black powder dusting method. By dipping the brush onto a little dust powder. Gently sweep the brush dust that is attached to the brush tip will stick to the fingerprint. When seeing the fingerprints and using a brush that does not have dust, gently sweep away the excess dust and storing latent fingerprints by using clear tape attached to the fingerprint and peeling the transparent tape attached to the finger print on the prepared white paper.

The superglue method, by placing the superglue into the prepared dish and placing it in the middle of the superglue incubator put the plastic to find the latent fingerprints hanging over the plate. Close and leave for about 45 minutes. The latent fingerprint will appear. Bring the hidden fingerprints on the plastic which are white in color, making it more visible by using the same black powder dusting method.

3. Check for latent fingerprints

By looking through the magnifying glass and count how many counting points and special characteristic of minutiae and can read special characteristics points as needed or not. The researcher determining the number of counting points and special characteristic of minutiae. If can read 10 points, it can be verified.

4. Data analysis

To compare the appearance of latent fingerprint marks collected in different ways Using inferential statistics is independent t-test with statistical significance at the level of 0.05 and the assumptions set out as follows:

H_0 = Different methods of detecting latent fingerprints on different plastics, with the appearance of latent fingerprint marks no different.

H_1 = Different methods of detecting latent fingerprints on different plastics, appearing different latent fingerprint marks.

4. RESULTS

From the experiment to find latent fingerprints that were collected with a black dust powder method and the superglue method is a latent fingerprint that appears on the plastic, then has a clear line pattern that is sufficient to read the 10 special characteristic of minutiae.

Figure 3 The prototype image of detection on a special characteristic of minutiae

Table 1 The average value of special characteristic of minutiae from the results of the experimental collecting fingerprints on various plastic materials

METHOD	TYPE OF PLASTIC		
	PET	HDPE	PP
The black powder dusting method	9.65	8.04	9.04
The superglue method	7.40	6.44	7.54

From Table 1, the average value of the special characteristic of minutiae from the experimental founf that Plastic type 1 is Polyethylene Terephthalate (PET) has special characteristic of minutiae from the black powder dusting method, equal to 9.65 and the superglue method is 7.40. Plastic type 2 is High Density Polyethylene (HDPE) has special characteristic of minutiae from the black powder dusting method, equal to 80.4 and the superglue method is 6.44. And Plastic type 3 is Polystyrene Polypropylene (PP) has special characteristic of minutiae from the black powder dusting method, equal to 9.04 and the superglue method is 7.54.

Table 2 Comparison of stability latent fingerprint on plastic by independent t-test statistical analysis

METHOD	Mean	Std. Deviation	t	Sig.
The black powder dusting method	8.91	.67122	2.987	.556
The superglue method	7.12	.49325		

*statistical significance at 0.05

From Table 2, The comparison of stability latent fingerprint on plastic from the occurrence of latent fingerprint marks by independent t-test statistical analysis showed that statistically significant at the level of 0.05. There is no difference in the appearance of latent fingerprint marks.

5. CONCLUSION

From the experiment found that many types of non-detectable latent fingerprints that are not visible on the plastic. The latent fingerprints that appear to have insufficient lines to read the special point characteristics can be reached for 10 points and the latent fingerprints appear on the plastic. Not visible as lines may be caused by dust and the comparative analysis of the effectiveness of the method for detecting the existence of latent fingerprint marks on plastic.

The comparison of stability latent fingerprint on plastic from the occurrence of latent fingerprint marks by independent t-test statistical analysis found that statistically significant at the level of 0.05, the detection of latent fingerprints on both methods of plastic has the appearance of latent fingerprint marks that are no different. All types of plastic can retain latent fingerprints, but the length of time for the detection of latent fingerprints is longer. The result of latent fingerprint detection will also decrease. If the fingerprint is kept for a long time, the latent fingerprint will not be able to be collected. Which will find the time that can keep the fingerprints as long as possible by superglue method is 120 hours (5 days) because if long time Latent fingerprints will be destroyed and therefore can't be detected.

6. SUGGESTION

Suggestions from research studies

1) In this research, The researcher studied only 3 types of latent fingerprints that appeared on the plastic, without considering other types of plastic.

2) In collecting latent fingerprints, should be very careful, should concentrate and wear gloves before checking fingerprints. Because it may increase the latency of the fingerprint.

Suggestions for further research

1) Based on this research, the method used to find the fingerprint in the black dust. And the superglue method should be tested by using other additional passive fingerprint methods.

2) There are many types of plastic each type will give different results for the collection of latent fingerprints, so further studies should be conducted on other plastics.

7. ACKNOWLEDGMENT

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