

IDENTIFICATION AND RECOVERY OF FINGERPRINTS FROM GLASS
FRAGMENTS IN MOLOTOV COCKTAIL CASES

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Specially dedicated to my beloved family
Ku, Mak, Nadia, Burhan, Fatin and Syafiq. Thank you for your love and support.

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ABSTRACT

Increasing reports on Molotov cocktail cases in the local media has warrant a need for a detailed investigation of the perpetrator of the crime. A study is therefore embarked to compare fingerprint quality recovered from glass fragments of Molotov cocktails. The accelerants used were petrol, kerosene, diesel and motor oil. Different types of accelerant were used to observe the effect of accelerant on the quality of fingerprint recovered from glass fragment of Molotov cocktails. In the study, Molotov cocktails were exploded and glass fragments bearing fingerprint marks were collected and transported back to laboratory for analysis. Prior to fingerprint analysis, soot were removed from glass fragment using three techniques of brushing, NaOH (2 %) wash solution and tape lifting. After soot removal, enhancement fingerprint were done by using methods such as dusting method, superglue fuming method and Small Particle Reagent (SPR) method. Then, fingerprints from glass fragment of Molotov cocktails were identified by manual matching. Powder dusting method was used for sample petrol only because most of glass fragment were obtained in dry condition. Other than that, superglue fuming method was used in majority of sample whether Molotov cocktails were allowed to burn out naturally or the fire was extinguished using water. Small particle reagent method was mostly used for the wet glass fragment. Fingerprints recovered were photographed and were sent for manual matching. Based on the enhancement fingerprint method used, most of the latent fingerprint was developed with various qualities. Based on the percent recovery, SPR method shows the best recovery (43.75 %) at the scale 3 fingerprint, followed by superglue fuming and dusting powder. In manual matching method, percentage success rate in the case where fire of Molotov cocktails was allowed to burn out naturally was 55.56 % while in the case of fire extinguished using water, percentage success rate was 33.33 %. This study also showed that manual matching method of fingerprints recovered from Molotov cocktails with fingerprint obtained from suspect or standard can be done.

ABSTRAK

Peningkatan laporan mengenai kes-kes *Molotov cocktail* di media tempatan telah menjamin keperluan untuk siasatan terperinci pelaku jenayah. Oleh itu, satu kajian dilakukan untuk membandingkan kualiti cap jari yang didapati daripada serpihan kaca *Molotov cocktail*. Bahan bakar yang digunakan adalah petrol, minyak tanah, diesel dan minyak motor. Jenis bahan bakar yang berbeza digunakan untuk memerhatikan kesan bahan bakar pada kualiti cap jari yang pulih daripada serpihan kaca *Molotov cocktail*. Dalam kajian itu, *Molotov cocktail* diletupkan dan serpihan kaca yang mengandungi tanda-tanda cap jari dikumpulkan dan diangkut kembali ke makmal untuk analisis. Sebelum analisis cap jari, jelaga dikeluarkan dari serpihan kaca menggunakan tiga kaedah iaitu memberus, larutan natrium hidroksida (NaOH) 2 % dan dengan menggunakan pita selofon. Selepas penyingkiran jelaga, penimbulan cap jari dilakukan dengan menggunakan kaedah yang berbeza seperti kaedah serbuk cap jari, kaedah *superglue fuming* dan kaedah *Small Particle Reagent* (SPR). Kemudian, cap jari dari serpihan kaca *Molotov cocktail* dikenal pasti dengan pemadanan secara manual. Kaedah serbuk cap jari telah digunakan bagi sampel petrol sahaja kerana kebanyakan serpihan kaca telah diperolehi dalam keadaan kering. Selain daripada itu, kaedah *superglue fuming* telah digunakan dalam majoriti sampel sama ada *Molotov cocktail* dibenarkan untuk membakar secara semula jadi atau kebakaran dipadamkan dengan menggunakan air. Kaedah *small particle reagent* kebanyakannya digunakan untuk serpihan kaca basah. Gambar cap jari yang diperolehi dihantar kepada pemadanan manual. Berdasarkan kaedah peningkatan cap jari yang digunakan, kebanyakan cap jari pendam telah dibangunkan dengan pelbagai kualiti. Berdasarkan peratus pemulihan, kaedah SPR menunjukkan pemulihan terbaik (43.75 %) pada cap jari skala 3, diikuti oleh *superglue fuming* dan serbuk cap jari. Dalam kaedah pemadanan manual, peratusan kadar kejayaan dalam kes di mana api *Molotov cocktail* dibenarkan untuk membakar keluar secara semula jadi adalah 55.56 % manakala dalam kes api *Molotov cocktail* dipadamkan menggunakan air, peratusan kadar kejayaan adalah 33.33 %. Berdasarkan hasil kajian ini, padanan cap jari yang diperolehi daripada *Molotov cocktail* dengan cap jari yang diperolehi daripada suspek atau standard yang boleh dilakukan.

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LIST OF ABBREVIATION

SPR - Small Particle Reagent

PDRM - Polis Diraja Malaysia

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CHAPTER 1

INTRODUCTION

1.1 Background of Study

Arson is a crime that may generally be defined as intentional destruction of property *via* fire for unlawful purposes (Gannon and Pina, 2010). Arson represents a serious problem both in cost of human lives and money (Tan *et al.*, 2000). It leads to major financial damage, serious injury or death around the world (Labree *et al.*, 2010).

Molotov cocktails or petrol bombs are incendiary devices often used in war, terrorism, riot and civil unrest situations due to the availability of materials and ease of manufacture. Fingerprints are always available from the shattered glass of Molotov cocktails. Recovery of fingerprints on the glass fragment of Molotov cocktails debris would be a greater evidential value, directly linking the suspect with the bottle that has been thrown (Stow and McGurry, 2006).

Fire investigators always ignore the glass fragment of Molotov cocktails to be collected as evidence. They always believe fingerprints on glass fragment will be destroyed by fire. Although many of the fingerprints will be destroyed by fire, some will survive even on the incendiary device (Stow and McGurry, 2006).

1.2 Statement of Problem

In riot or civil unrest situations cases, arsonists often use Molotov cocktail as their incendiary devices. The types of accelerant used as fuel differ based on the availability of accelerant. When an arsonist carries a Molotov cocktail to the scene, their fingerprint will be deposited on the item. Fire investigators always believe the fingerprints on glass fragments will be destroyed by fire and did not collect the evidence. This study is designed to study possibility of recovering fingerprints in Molotov cocktail cases and the effects of accelerant towards the recovery of the fingerprints. Quality of fingerprint was analysed based on the different fingerprint recovery techniques. With the available standards to be matched, these fingerprints could be used as a critical evidence in arson cases.

1.3 Objectives of Study

The objectives of this study are:

- 1) To recover the fingerprint marks on the glass fragment of Molotov cocktails by using the dusting method, superglue fuming method and Small Particle Reagent (SPR) method.
- 2) To identify the fingerprint that has been obtained from the fragment of Molotov cocktails.
- 3) To compare the quality of the recovered fingerprint based on the different recovery techniques.

1.4 Scope of Study

This study is carried out to determine the possibility of recovering fingerprint marks on the glass fragment which have been covered by soot. Petrol, kerosene, diesel and motor oil will be used in this study as an accelerant. Three methods will

be applied in the soot removal from glass fragment. The methods are brushing, NaOH wash solution and tape lifting. After the removal of soot, the enhancement of fingerprint marks will be done by using dusting powder, superglue fuming and Small Particle Reagent (SPR) methods. Then, fingerprints will be identified and the qualities from the different technique compared.

1.5 Significance of Study

This study would help and facilitate the investigator who will be handling Molotov cocktails cases either from the Fire and Rescue Department, the Royal Police or the Chemistry Department. This study may assist the analyst in choosing the most suitable method for fingerprint enhancement based on the type of accelerant used in Molotov cocktail. In addition, it may also help with study and comparison of the quality of fingerprint recovered from glass fragment of Molotov cocktail based on different enhancement fingerprint technique.

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