

A STUDY ON ACID VIOLENCE AND CORROSIVE ACID DAMAGE PATTERN TO TEXTILES

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RAZAK

CERTIFICATE

This is to certify that the dissertation entitled “**A study on Acid Violence and Corrosive Damage to Textiles**” is bonafide record of research work done by Miss Nurul Fatil Atikah Binti Razak, Matric Number: 165130, during the period of October 2025 until February 2026 under my supervision. This dissertation is submitted in partial fulfillment of the requirements for the Degree of Bachelor of Science in Forensic Science. All the achievements and data from this research are hereby declared as the property of University Science Malaysia (USM).

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DECLARATION

I hereby declare that this thesis is the result of my own investigation, except where otherwise stated, and duly acknowledge. I also declared that it not been previously or concurrently submitted as a whole for any other degrees at Universiti Sains Malaysia or other institutions. I grant Universiti Sains Malaysia the right to use the dissertation for teaching and promotional purposes.

Signature:

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Nurul Fatil Atikah Binti Razak

Date: 1 FEB 2026

ACKNOWLEDGEMENT

In the Name of Allah, the Most Gracious and Merciful

I would like to express my gratitude to Allah for giving me the strength and guidance for me in completing this research and dissertation successfully.

I would like to take the opportunity to express my full gratitude to my supervisor, ChM Dr. Wan Nur Syuhaila Mat Desa, lecturer of the School of Health Sciences, Universiti Sains Malaysia, who always gave full support, continuous guidance in developing the research framework, and invaluable advice when there were problems in my research, for me to go through this research. Her knowledge about the acid attack analysis and chemistry gives me new knowledge and helps to guide me in writing the thesis. Her patience and encouragement that guide at all times including beyond working hours which have been essential in completing this study.

I also want to thank the love to my family members, especially my parents, Razak bin Ahmad and Norhasimah binti Abdul Rahim, for their endless prayers, emotional support, and understanding throughout my undergraduate journey. Without their encouragement, this achievement would not have been possible.

I am also grateful to my friends and course mates for their moral support, discussions, and motivation during the challenging moments of this research.

Finally, I would like to thank everyone who has contributed directly or indirectly to the completion of this study.

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ABSTRAK

Kes serangan asid merupakan salah satu bentuk jenayah yang memberi kesan fizikal dan psikologi yang serius kepada mangsa serta meninggalkan bukti forensik yang penting di tempat kejadian. Kajian ini dijalankan bagi menilai kesan agen menghakis terhadap pelbagai jenis tekstil serta mengenal pasti kehadiran anion agen menghakis melalui ujian titik warna, di samping menganalisis trend kes serangan asid di Malaysia melalui analisis arkib berita dalam talian. Reka bentuk kajian ini melibatkan analisis kandungan berita bagi mengenal pasti corak perlakuan kes simbah acid di Malaysia, eksperimen makmal untuk menilai kesan agen menghakis terhadap tekstil seperti kapas, viskos, dan poliester, serta ujian titik warna atau reagen kimia untuk pengesanan dan mengenalpasti agen menghakis. Analisis berita pula menunjukkan peningkatan dan pola tertentu dalam kes serangan asid di Malaysia. Pemerhatian menunjukkan bahawa agen menghakis menghasilkan perubahan fizikal yang ketara pada tekstil termasuk perubahan warna, pengembangan gentian, dan disintegrasi struktur kain bergantung kepada jenis tekstil dan tempoh pendedahan. Ujian titik warna pula menunjukkan keupayaan untuk mengesan kehadiran anion tertentu dengan jelas dan pantas. Secara keseluruhannya, kajian ini membuktikan bahawa analisis kesan agen menghakis pada tekstil dan pengesanan anion melalui ujian titik warna mempunyai nilai signifikan dalam membantu penyiasatan forensik yang melibatkan jenayah kecederaan atau juga kematian pada mangsa.

ABSTRACT

Acid attack cases are one of the forms of crime that have serious physical and psychological effects on the victim and leave important forensic evidence at the scene. This study was conducted to assess the effects of corrosive agents on various types of textiles and identify the presence of corrosive agent anions through the color spot test, in addition to analyzing the trend of acid attack cases in Malaysia through the analysis of online news archives. The design of this study involved news content analysis to identify patterns of acid spill cases in Malaysia, laboratory experiments to assess the effects of corrosive agents on textiles such as cotton, viscose, and polyester, and color spot tests or chemical tests for the detection of corrosive agent anions. News analysis also showed an increase and certain patterns in acid attack cases in Malaysia. Observations showed that corrosive agents produce significant physical changes in textiles, including color changes, fiber expansion, and disintegration of fabric structure, depending on the type of textile and the duration of exposure. The color spot test also showed the ability to detect the presence of certain anions clearly and quickly. Overall, this study proves that the analysis of corrosive agent effects on textiles and the detection of anions through the color spot test have significant value in assisting forensic investigations, which involves hurt or even death to victims

CHAPTER 1: INTRODUCTION

1.1 Background of The Study

Nowadays, the increasing number of acid attacks in Malaysia has been reported and has caused concern among the public. Therefore, there are a lot of motives behind the investigation of the acid attack incident to be revealed. By understanding the perpetrator's motive from their perspective, the investigator can establish the connection between the evidence and the actual incident that occurred. An acid attack, also known as vitriolage, can be defined as an intentional act of throwing corrosive agents at another person to cause injury or disfigurement (Kaur & Kumar, 2020). Therefore, textile is the common evidence in the investigation of the acid attack because cloth can be the first material that comes into contact in an acid attack incident, besides the effect on the skin.

There are three consequences of the acid violence on the victim, which are physical, psychological, and social consequences. Physical consequences of acid attack on violence commonly result in severe chemical burns, permanent disfigurement, and medical complications. Typically, inorganic acids tend to cause rapid tissue damage to the skin, as they can produce coagulative necrosis, which occurs when cells die due to protein denaturation, resulting in a lack of blood supply (Roopali & Vaishali, 2023). Indirectly, it can cause facial disfigurement or a scar on the skin, which can lead to psychological and socio-economic problems on the victim's side, since it is tough to heal the scar caused by an acid attack because

of the depth of the tissue damage (Ismail, Guriro, Lakho, & Mehraj, 2025; Zalmi & Amiri, 2021).

Most of the acid violence that happens in India and Pakistan is motivated to disfigure physical, facial, and bodily features due to marriage refusal against women and can be categorized as gender-based violence. Since the harm can be permanent to the victim, it can be challenging for the victim to heal from a psychological issue due to the stigma perspective with the victim. Low self-esteem, depression, anxiety, and Post-Traumatic Stress Disorder (PTSD) have been reported as the common psychological issues that victims face by victim (Ismail, et al., 2025). Therefore, the government or non-governmental sectors need to provide psychological evaluation for acid violence survivors to maintain their mental health and well-being following the incident. In Malaysia, some organizations are responsible for providing such services to the survivors, for example, the Malaysia Mental Health Association (MMHA) and Women's Aid Organization (WAO), where the survivor can visit their website for further information.

Most of the study focuses on the physical injuries and psychological effects experienced by the victim, while there is very limited information about evidence analysis on acid attack incidents, particularly concerning the effect of corrosive agents on textiles, which may be useful information in acid attack investigations. Additionally, the information about corrosive agents used in the acid attack case is mostly not reported specifically in the news for the public and researchers, for further public awareness and developing a strategy in research on acid

attack cases. Besides that, the lack of information on cases can also affect the legal processing, which can affect the justice for the victims.

Acid attack cases can also give social consequences to the victim since humans need social relationships and social support from each other. Mittal (2020) study about the influence of social support on acid attack victims during rehabilitation categorizes non-social support and positive social support. In general, social interaction is important in determining an individual's mental health because it is related to emotional support for coping mechanisms during rehabilitation. Based on Mittal's (2020) study, it is stated that many victims experience non-social support, including social isolation and social exclusion, due to society's stigma towards the victims, which the victims may face the unfair treatment from society (Mittal, et al., 2020).

Social isolation and exclusion are different based on each factor that manifests itself. Social isolation can be defined as the victim's withdrawal or avoid themselves from social activities that they once enjoyed. It is because the victim labeled themselves as a disgrace towards their family, and a lot of stigma that attached to the victim after the attack, so the victims isolate themselves from any social contact (Azim & Zaman, 2023). Social exclusion can be defined as the same as social isolation, but it is more about the society's behavior towards the victim, which is beyond the victim's control. It happens when the victims do not receive support from their families after the acid attack incident because of physical damage to their face and body

due to the corrosive agent. Some of the victims may have experienced losing their jobs and college, even against their will (Mittal et al., 2020).

In the forensic investigation, textiles can be one of the pieces of evidence that are crucial in acid attack cases. Textile damage examination is a common test of textile evidence found at the crime scene, which involves observation or qualitative analysis. In general, this examination analyzed the tear of the textile and the original tools that cause the tear (Sloan et al., 2022). Analyzing the textile can provide information about the chemical damage to clothing, to link the evidence to the suspect, and corrosive substances that were used on the textile. Textiles can be categorized by their fiber source, which is natural or man-made.

In the Choudhary (2020) study, it shows the preliminary chemical test was used to identify the cation and anion from the sample, such as clothes, bags, slippers, and others, before it undergoes the confirmatory test. Therefore, from the analysis, forensic scientists can determine the corrosive agent that was used during the acid attack (Choudhary, et al., 2020). However, the study about the relationship between chemical damage and the mechanism of the corrosive agent had been contact on cloth, such as splashing, pouring, or other ways still lacking in published literature.

1.2 Problem Statement

This study was conducted based on the problem statement that was highlighted and observed from the previous study. Despite the increasing number of acid attack cases around the world, there are still limited studies about the corrosive damage to textiles and evidence analysis in acid attacks. In Malaysia, acid attack cases have become a trend every year that has been reported in online news platforms like News Straits Times, The Star, SinarDaily, and more. However, most of the acid attack cases that happen in Malaysia are unsolved because of the lack of evidence and information. This can cause growing public and forensic concern over the acid violence case. Therefore, it is important to understand the prevalence and trend of acid attacks that happen in Malaysia to establish the significance and strategy to solve the acid attack cases.

According to Williams (2018), there have been no published works related to the influence of corrosive agents on textiles currently (Williams, 2018). Therefore, there are a few references for forensic scientists to deal with acid attack evidence, which can cause the evidence to be questioned in court. It is important to know the validated method to get the crucial information to solve the case. From the acid attack cases, it is important to identify the substance that was used on the victim to link the evidence with the suspect, and to know the source of the substance that was bought or taken from the perpetrator. Therefore, the colour test reagent can be used to identify the ionic compound from the evidence to know the type of corrosive agent that was used.

Besides that, since there are so many types of cloth textile like cotton, polyester, and viscose, the effect of the corrosive agent may vary across the different textiles. Some of the corrosive agents

may produce tears or damage on the cloth, so it can be one information to the investigator since there are so many tears and damage in the forensic case that may be caused by a different tool. In the Katare (2023) study, it only uses one corrosive agent, which is sulphuric acid 98% concentration on different textiles such as cotton, denim jeans, and terin. Therefore, this paper explores more effects of different corrosive agents and textiles to assist the investigator in understanding fabric damage analysis and the pattern itself.

1.3 Objective of the study

This section describes the research objectives in this study. There is one general objective and three specific objectives that are concerned with the acid attack cases in Malaysia.

General Objective

The general objective of this study is to gain a comprehensive understanding of acid attack incidents in Malaysia by examining their occurrence, physical impact, and chemical characteristics of the acids recovered from textiles through reagent based analytical tests.

Specific Objective

The specific objectives are derived from the general objective. The specifics were:

1. To study the prevalence of acid attacks and the common factors that influence them in Malaysia.

- This investigation is based on acid attack cases that happen in Malaysia, based on online news platforms such as News Times Straits, The Star, SinarDaily, and MalayMail. The information from the case was analyzed to know the motive, the causes of the acid attack that happened, and the legal implications involved.
2. To compare the physical effect or damage pattern on cotton, polyester, and viscose after exposure to laboratory-grade corrosive agents.
 - This analysis examines the tear or damage caused by hydrochloric acid, sulphuric acid, nitric acid, and formic acid on the textile in the splashed technique.
 3. To identify the ionic compounds present in corrosive agents using colored spot test reagents.
 - This analysis examines how to detect the anion of the corrosive agent from the textile after being subjected to the corrosive agent.

1.4 Hypothesis

The hypotheses for this particular study have been formed based on the specific objectives stated in 1.3.

$H1_0$ = There is no difference between reports of burn injury by acid in two English online news.

$H1_1$ = There is a difference between reports of burn injury by acid in two English online news.

$H2_0$ = There are no identifiable patterns in media reports regarding acid attack incidents in Malaysia.

$H2_1$ = There are identifiable patterns in media reports regarding acid attack incidents in Malaysia

1.5 Significance of the Study

This study's purpose is to help understand more about the trend and prevalence of acid attacks that happen in Malaysia. From a forensic perspective, it helps the investigator and forensic scientists understand the effect of the corrosive agent on textiles and identify the anion of the substance from the evidence at the crime scene. The information gathered from the analysis helps to present the findings at the crime scene. Additionally, it can improve the method of collecting evidence at the crime scene and the examination to strengthen the legal process for victims.

CHAPTER 2: LITERATURE REVIEW

2.1 Background of Study

Forensic science can be defined as the application of scientific principles in analyzing and interpreting the evidence at the crime scene to fulfill the purpose of the justice administration system. The word “forensic” is taken from the Latin word “forensis”, which means of the “forum”. Forensic analysis of physical evidence is crucial in investigating criminal or civil cases, as the results of the evidence’s interpretation can help support a conviction in court and link the suspect to the crime scene (Kapoor, et al., 2023).

Forensic chemistry is one of the fields in forensic science, which generally focuses on chemical analysis techniques to examine and analyze the evidence found at the crime scene (Kapoor, et al., 2023). Forensic chemistry application has been used in the acid attack case for qualitative or quantitative analysis of the evidence, which includes identifying the type of substance used. It is because the chemical analysis technique is able to examine the nature and properties of the evidence collected from the crime scene.

An acid attack can lead to injuries to the victim’s face and body, which can contribute to third-degree burns, which are known as full-thickness burns that affect the epidermis, dermis skin layer, and can extend to the subcutaneous tissue (Jain, et al., 2025). Therefore, it is important to investigate and identify the corrosive agent used for further analysis or procedure in the court. In the acid attack cases, evidence that can be collected from the crime scene is liquid residue from

the container and clothing that has been exposed to the corrosive agent. This evidence undergoes chemical analysis to identify the corrosive agent, such as liquid residue from the cloth can be extracted and analyzed to get the information about the case. Besides that, the physical changes, like the pattern of the tear, are caused by the corrosive agent and can also be useful information since there are a lot of types of tears in forensic cases. It is important to have reliability and an accurate forensic technique to analyze acid attack evidence.

2.2 Demographic and Motivational Trends

2.2.1 Gender-Based Violence

Acid attack cases have frequently been related to gender-based violence in South Asia, according to Mittal (2021), based on the Acid Survivors Foundation Annual Report, stating that 70% of the victims are women who reported in India in 2015. She also studies sub-themes like gender-based violence from different sources of trauma, such as intimate partner violence, domestic violence, and acid attack. It states that her research participants revealed that the perpetrator of an acid attack is commonly the victim's close member, such as a husband or boyfriend, based on a different motive (Mittal et al., 2021).

It also happens in Bangladesh, where the victims of an acid attack in 2015 included 24 males and 50 females, according to their statistics. Most of the women that involved in the acid attack case were from poor families with limited access to education, which led to ignorance and injustice on their side (Kamruzzaman & Hakim, 2016).

Based on a study by Singh (2018), gender-based violence in the acid attack due to the male-dominated societies, females are always considered in a subordinate social position because of cultural and social norms (Singh et al., 2018). Violence against women can be a key to maintaining male dominance and authority in society. It may be related to the cultural norms and beliefs from different traditional and religious values. The acid attack that happened in India is highly profiled as gender-based violence because in the Indian mythology, it teaches women have to obey their man or husband. Therefore, as the old norms are being normalized from the start, it is difficult to change the norms in society because it was considered harmful to the traditional practices (Anon., 2006).

2.2.2 Motive Behind the Acid Attack

The motive behind the acid attacks that happen in Bangladesh and India is mostly due to relationship, marriage, and dowry issues, while in the United Kingdom, gang-based activities are the motive behind acid attacks occurring, and most of the victims involved in the UK are mostly male (Byard, 2020). An acid attack that is motivated by the dowry issue is one of the common motives behind the acid attacks that occur in India and Bangladesh because a woman's family fails and is unable to fulfill dowry demands by the male family. In their culture, a dowry needs to be prepared and provided by a wife to their husband at marriage. Since Bangladesh is one of the patriarchal societies where men hold the power against women in the society, dowry-related violence is a common occurrence due to their cultural norms (Kamruzzaman, 2015).

In the United Kingdom, most of the motive behind the acid attack cases was attributed to gang activity. It is because gang members must have high value in social status and material wealth, so by using the corrosive agent or acid on someone, it is the method they exert power and control over other people (Lewis et al., 2020).

From the existing literature, it has been found that there is a lack of academic studies on acid attack cases, specifically on the motives behind the crime, in Malaysia. The existing studies published by authors from Malaysia have focused on the socio-legal and legal aspects, but none have focused on the motives or behavioral factors behind the crime. For example, Talib et al. (2015) have focused on the misuse of acid from a socio-legal perspective, but there has been no focus on the motives behind the crime, and Jamil et al. (2012) have focused on the legal aspects, specifically on the existing laws and protection mechanisms, but again, no focus on motives. Except for some findings from the newspaper, where a psychologist has stated that the motives behind the crime may be resentment or revenge, there have been no academic studies on the motives behind the crime (Talib et al., 2015; Khalidin et al., 2012; New Straits Times, 2024).

2.3 The effect of the Corrosive agent on Textile

In acid attack cases, clothing is one of the pieces of evidence used for analysis to gather information by observing the damage and discoloration caused by the fabric's dye. However, the characteristics of the damage may differ for different types of textiles due to the nature of the textile and the corrosive agents used, as there are numerous textiles used in clothing, including natural, synthetic, and blended textiles (Dubey 2015). Therefore, it is important for forensic

scientists to understand the chemical and physical properties of the textile and corrosive agent to be able to connect the evidence and story behind the crime.

2.3.1 The properties of corrosive agents

There are three corrosive agents that are commonly used in acid attack cases, which are sulphuric acid, hydrochloric acid, and nitric acid (Welsh, 2009). All these corrosive agents are strong acids due to it generally 100% ionized in solution, and the pH value may around 0 to 1 (Clark, n.d.). The lower the pH value, the higher the concentration of hydrogen ions, which aligns with the relationship between pH and hydrogen ion concentration $[H^+]$ is logarithmic, which is not linear as the formula shows below:

$$\text{pH} = -\log_{10}[H^+]$$

However, the use of formic acid in the acid attack or vitriolage has also been reported in Manoj et al (2018) study in India. Formic acid is a weak acid, but it also has strong corrosive acid properties like other corrosive agents, like sulphuric acid, hydrochloric acid, and nitric acid, which cause extensive tissue burns with coagulative necrosis (Manoj & Sujisha, 2018). However, since formic acid is a weak acid that only partially ionizes in the solution and produces hydroxonium ion $[H_3O^+]$, so the effect of the low concentration of formic acid on skin may not be as severe as the higher concentration (Clark, n.d.).

2.3.2 Textile material types

Three textiles commonly used for clothing are cotton, polyester, and viscose, each with distinct properties and utilized according to its specific function. For example, in the summer season, there are excellent choices to wear cotton cloth because cotton is more breathable than polyester. *Figure 2.1* shows three layers of the cotton, which are the primary wall, secondary wall, and lumen, acting as a hollow tube for absorbency performance. When the fiber matures, it causes the protoplast within the lumen to dry up and produce a central void and pore space. Cotton is made up of the seed of the *Gossypium* plant and contain 90% of cellulose, while 10% of the fiber is non-cellulosic polysaccharides. (Wang, et al., 2020).

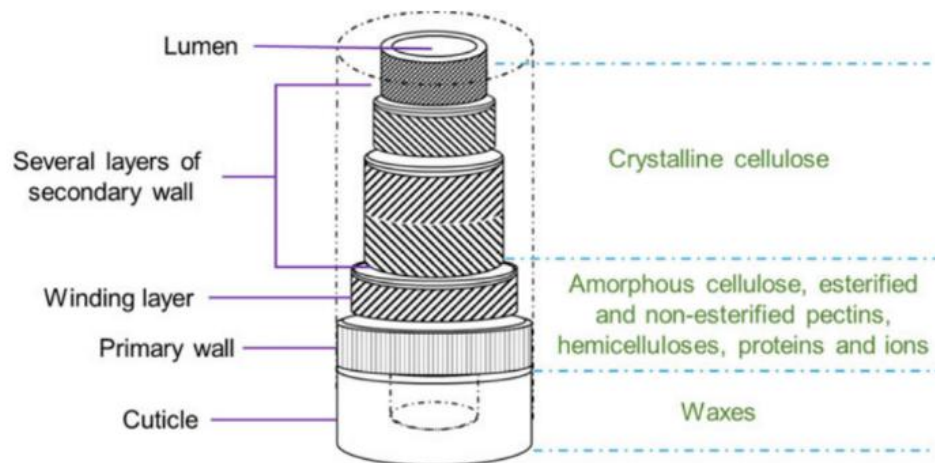


Figure 2. 1: A schematic representation of cotton fiber and its composition

While polyester is suitable for wear in sports or activewear due to its durability, quick drying, and moisture-wicking properties. Polyester is a petroleum-based synthetic fiber that is suitable for sports because it does not absorb sweat, as it has inherently hydrophobic properties, which give it water-repellent behavior. However, for a different use of polyester in clothing, such as dyeing and detergency, the polymer has been modified to make it slightly hydrophilic for this

purpose. Polyethylene terephthalate (PET) is the common form of polyester that is used for textiles and has quick drying properties because of its formula structure, which has a few sites of hydrogen bonding, as shown in *Table 2.1* (Samu et al., 1999).

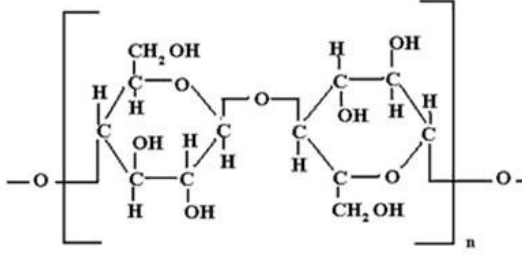
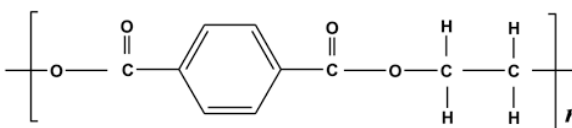
Table 2. 1: Comparative molecular weight and degree of polymerization of cellulose (Hudson et al, 1992)

Fiber	Molecular Weight (g/mol)	Degree of polymerization
Cotton	570,000	3500
Pure cotton linters	150-500,000	1000-3000
Wood pulp	100-160,000	600-1000
Commercial rayon	30-100,000	200-600
Commercial acetate	45-100,000	175-360

Viscose is a semi-synthetic fiber that is made from regenerated cellulose; therefore, viscose may have similar characteristics and properties to cotton since both cotton and viscose have a cellulose structure. For example, viscose rayon is one of the applications of viscose, and its chemical structure has a hydroxyl group, as shown in *Table 2.2*. The difference between cotton and viscose is their degree of polymerization, where cotton has a higher degree of polymerization than viscose, with cotton having 3500 degrees of polymerization, while viscose rayon is from 200 to 600 (Hudson et al., 1992). The degree of polymerization can be defined as the mean number of monomer units in the polymer, and it is often related to the strength of the substance (Adeniran, et al., 2022).

Since cotton has a higher degree of polymerization than viscose, there are many hydroxyl (-OH) groups in the cotton compared to viscose, which facilitate the extensive intramolecular and intermolecular hydrogen bond in the structure. The water absorption in cotton is higher than that of viscose because of the intermolecular hydrogen bonds in the structure, which allow the cotton to have good airflow in the hot and humid weather or conditions.

Table 2. 2: The chemical composition and structural characteristics of cotton, polyester, and viscose (Fabrics, 2024)

Fiber	Chemical Formula	Key functional group	Properties
Cotton		Hydroxyl group (-OH)	Natural, breathable, hypoallergenic, biodegradable.
Polyester		Ester group (-COO-)	Durable, wrinkle-resistant, quick-drying.

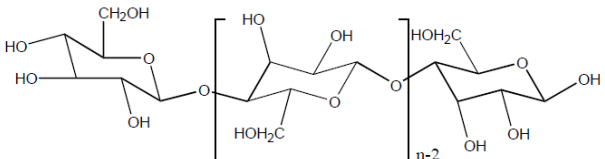
Viscose		Hydroxyl group (-OH)	Soft, breathable, silk-like feel
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Table 2.2 shows the chemical formulas for cotton, polyester, and viscose, which highlight the functional group and properties of each fiber. Cotton and viscose are more breathable than polyester because of the presence of the hydroxyl group and B-1,4 glycosidic bond in the formula structure of cotton and viscose. An ester bond or covalent bond that is present in the polyester can make the fiber more durable because a covalent more strong than an intermolecular bond like a hydrogen bond.

2.3.3 The effect of corrosive agents on textiles

Based on Katare's (2023) study on the effect of corrosive sulphuric acid on glace cotton, denim jeans, and terin. There are different results for each textile when applied to the concentrated sulphuric acid since every textile has different properties. *Table 2.3* shows the result observation the effect of concentrated sulphuric acid on different textiles. From the result, most of the dyed cloth underwent decolorization because the dye is destroyed by the concentrated sulphuric acid. Additionally, all the cloth results in degradation after 24 hours of treatment with a corrosive agent (Katare & Goutam, 2023). This study gives a few pieces of information about the effect of corrosive agents on textiles; however, this study only focuses on the treatment of concentrated sulphuric acid on textiles.

Table 2. 3: The observation of samples A, B, and C after treatment with Concentrated Sulphuric Acid (Katare et al,2023)

Sample	Cloth Type	Original Colour	Effect after 1 hour	Effect after 4 hours	Effect after 24 hours
A	Glance Cotton	Torquoise	Moistened	Oily patch, decolorized	Degraded and charred, adhere to the glass surface
B	Denim Jeans	Bluish white lining	Moistened	Blackish – brown spot	Degraded and Charred, adhere to the glass surface
C	Terin	Greyish Black	Blackish Moistened spot	Moistened, decolorized	The affected area became stiff and plastic-like, a material of Buff color

Besides that, Śmigiel-Kamińska (2014) also studied the damaging effect of corrosive agents (36% hydrochloric acid, 98% sulphuric acid, 65% nitric acid, sodium hydroxide, and sodium hypochlorite) on textiles (cotton, wool, polyamide knit made, polyester, and polyacrylonitrile). The corrosive agents are selected based on ease of access and are commonly used by criminals in Poland in acid attack cases. The result shows there is very little change when 36% hydrochloric acid is applied to textiles, perhaps due to the low percentage among other corrosive agents. While 98% sulphuric acid shows a destructive effect on all textiles. 65% nitric acid, sodium hydroxide, and sodium hypochlorite have different effect for each textile (Śmigiel-Kamińska, 2014).

Therefore, it is very crucial to understand the damaging effects of the corrosive agents on different textiles in the forensic investigation. It can help an investigator to differentiate between the clothing damage effect because of corrosive agents or other tools, such as a knife, nail, and

hammer. Since clothing damage analysis is one of the examination that give crucial information regarding the crimes.

CHAPTER 3: METHODOLOGY

3.1 Introduction

The purpose of this chapter is to explain and describe the research methodology in this study. By understanding the methodology of the study, the research was conducted systematically. This chapter describes the research design, sample preparation, and experimental design as well as data analysis.

This study used a qualitative approach involving archival and content analysis, experimental laboratory analysis, and chemical analysis. Qualitative analysis is able to help people to gain a deep understanding of real-world problems by generating hypotheses for further analysis. This analysis can explain and quantify the process or pattern of a subject that is difficult to quantify using an observation or interview approach to collect data for further analysis (Tenny et al., 2022).

3.2 Archival and media content analysis

Archival and content analysis are techniques that simplify and examine the past to gather information on a specific subject (Shammi et al., 2022). In this study, archival and content analyses are conducted on past English-language online news platforms related to acid attack cases that happened in Malaysia, such as News Straits Times, The Star, SinarDaily, and MalayMail, that were published from 2015-2025. By reviewing English-language online news platforms, it can

generate the trend of the acid attack that happens in Malaysia, including motive, triggers, and legal issues.

The sample for this study was taken from acid attack cases that occurred in Malaysia from 2015 to 2025 as reported in English-language Malaysian online news platforms such as The Star, The Straits News, MalayMail, and SinarDaily. The reason to use this medium for archival and media content analysis because this medium is exposed to the public and provides easy access to information about the trend of acid attacks that happen in Malaysia. Besides that, the use of different online news platform because some acid attack cases that happen in Malaysia are not reported on other platforms. Additionally, the use of different online news platforms can provide various information regarding a case.

After collecting the news content, a few aspects of the trend related to acid attack cases in Malaysia were determined to understand the trend and pattern of the acid attack cases. Archival analysis is used to collect information from the online news platform about the motive, triggers, and the legal aspect involved.

Inclusion criteria for the sample:

- Acid attack cases in Malaysia from 2015 to 2025.
- Cases reported in English-language online news platforms.

Exclusion criteria for the sample:

- Duplicate reports of the same case.
- Unrelated to acid attack cases in Malaysia.

In the archival and media content analysis, the data and information were thoroughly examined for each category related to the trends of acid attacks that occurred in Malaysia, along with their motives and triggers, as well as the legal aspects involved. By categorizing each component, a clearer understanding of the trends surrounding acid attacks in Malaysia was achieved.

3.3 Laboratory Analysis

This section describes the apparatus that was used in the study, and the framework of the laboratory analysis, that involved which involved FTIR analysis for textile characterization and acid attack damaged evaluation.

3.3.1 Apparatus and Materials

This section describes the materials, chemicals, and instruments that were used in this study as show at *Table 3.1*.

Table 3. 1: The list of apparatus and materials used in the study

Category	Item	Specification/Concentration	Purpose
Textile	Cotton fabric	100%, white, plain	Sample preparation
	Polyester fabric	100%, white, plain	Sample preparation
	Viscose fabric	60% polyester – 40% cotton, white, plain	Sample preparation

Corrosive agent	Hydrochloric acid	37%	Sample preparation
	Sulphuric acid	95-98%	Sample preparation
	Nitric acid	65%	Sample preparation
	Formic acid	98-100%	Sample preparation
Reagent	Silver Nitrate	0.1M	Anion detection
	Barium Chloride	0.1M	Anion detection
	Ferrous Sulphate	1.0M	Anion detection
	Sodium Hydroxide	10%	Anion detection
	Ammonia solution	10%	Anion detection
Instrument	Analytical balance	$\pm 0.001\text{g}$	Mass Measurement
	Fume hood		Safe handling of corrosive agents and fumes
	Fourier Transform Infrared (FTIR) spectrometer	ATR-FTIR	Identification of the functional group of textiles and confirmation of the types of textiles
Apparatus and material	Test tube	10ml	Mix the reagents and the sample
	Beaker	50ml, 100ml	Place or prepare the chemical during the analysis
	Amber glass bottle	250ml	Store the reagent and corrosive agent
	Volumetric flask	100ml	Prepare the stock solution for the corrosive agent
	Glass Dropper		Drop a small amount of the reagent
	Measuring cylinder	50ml	Measure the liquid
	Spatula		Transferring small quantities of solid reagents
	Forcep		For handling textile samples safely without direct contact
	Distilled water		Clean and dilute the corrosive agent
	Weighing boat	Small, medium	Weigh the solid chemical before diluting

	Volumetric flask	1ml, 2ml, 10ml	Measure the reagents and corrosive agents
	Goggle		Protect eyes from splashed corrosive agent on textiles.
	Mask		For safety in the laboratory
	Glove		For safety in the laboratory
	Litmus paper		Measure the pH
	Parafilm		Secure the reagent and corrosive agent
	A4 frame size		Sample preparation

3.3.2 FTIR analysis for textile characterisation

The textiles can be ascertained by the analysis process using the Fourier Transform Infrared Spectroscopy (FTIR) to identify the chemical structure and functional groups of the textiles, as FTIR is commonly employed in simple, direct, and non-destructive ways to characteristics of forensic evidence. Hence, the textiles were analyzed first using FTIR to ascertain the materials of the textiles by identifying the functional group for each textile, which are cotton, polyester, and viscose. The sample was analyzed three times using FTIR to prevent systematic error. The textiles were then used for the evaluation of attack damage.

3.3.3 Acid attack damaged evaluation

To understand the effect of corrosive agents on textiles in this study, experimental laboratory analysis was used to measure the pattern when corrosive agents were applied to specific textiles, such as cotton, polyester, and viscose. In this study, the changes that happen on textiles was observed, which include the color changes on different types of textiles. If the corrosive agent