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A Study on The Comparative Effectiveness of Commercial and Wood-Burnt Charcoal Powder in the Development of Latent Fingerprints on Non-Porous Surfaces.

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CHAPTER I - INTRODUCTION

INTRODUCTION

India holds the honour of having an active involvement in the creation of the fingerprint science. Fingerprint embossing was extensively done on clay tablets/seals in the Indus Valley civilization. Fingerprints along with palm prints termed "PANJA" were employed for several centuries in Bengal. Fingerprints were made thousands of years before Christ on pottery as an indication of the manufacturer and brand of the pottery.

In the early part of the 12th century, there was a Chinese writer named Shi-nain-gan who authored various detective stories collectively titled "The story of the river bank". In one of his stories, he had mentioned the utilization of fingerprints in crime identification.

Palms, fingers, and soles of the foot inclusive of the toes are covered with a unique skin known as friction skin. It seems that the purpose of creating such a specialized type of skin by nature is to give us a firm grip and protection from slipping off. Friction skin shows many elevations and depressions that look like hills and valleys. Elevation lines on skin surface are known as ridges while depression lines are called furrows or grooves.

The skin is a combination of two overlapping layers, namely epidermis and dermis.

The Sweat Gland secretes sweat that includes water, salts, and urea while the Sebaceous Gland secretes oils to be put on the surface of the skin. The products of both glands form the fingerprint, which is a pattern left behind whenever we make contact with an object.

Pioneers work on fingerprints:

- Sir Francis Galton contributed immensely to forensic science due to fingerprint identification.
- Dr Nehemiah Grew (1641-1712): One of the earliest fingerprint observations outside Europe was presented in 1684.
- Sir William Herschel (1833-1917): He was the first person to use fingerprints as an identification technique in India in 1858-1878.
- Dr Henry Faulds (1843-1930): He discovered fingerprints on Japanese pottery, which he later compared to his natives' fingerprints in 1877.

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Principles of fingerprints:

- Permanency: The ridge formations that occur before birth do not undergo any changes except when they decompose at death.
- Individuality: Two fingerprints can only be similar when they are formed from one finger of the same individual.
- Universality: Every human being has distinctive friction-ridge formations on his fingers, palms, and soles. No consideration of race, sex, and nationality can affect this biological factor of the fingerprint.
- Simplicity of recording: In the recording stage, it is natural for fingers which are dirty or sweaty to record themselves unknowingly.
- Simplicity of classification: The classification technique developed by Sir Edward R. Henry is simple and convenient. It is used universally.

Types of Fingerprints:

- Visible fingerprints: Visible fingerprints refer to fingerprints that are seen by naked eyes due to some staining substances like blood ink, paints, and other colored materials.
- Plastic fingerprints: Plastic fingerprints refer to those fingerprints that are formed when a finger touches or makes contact with a plastic surface, thereby forming a negative cast of ridges on the surface.
- Latent fingerprints: Latent fingerprints refer to fingerprints that are not very clear and distinct. These are formed by oily substances or sweat secreted from the fingers.

Classification of fingerprints:

- Plain Arches (A): In a plain arch fingerprint, all ridges pass directly from one end of the fingerprint to another without any upward thrust, without a backward bend, and also without any formation of delta.
- Tented Arch (T): Tentative Arch fingerprint is mostly of arch fingerprint but in this type of arch, there must be a distinct upward thrust of the ridges in the centre.
- Whorl (W): Whorl is a type of fingerprint, where there will be ridges forming a full circle surrounding its core.
- Central Pocket Loop (CP): This kind of pattern has the majority of ridge forming a loop, but some or few (up to three or four) ridges recurving in the middle forming a full circle around the core thus creating a pocket.
- Twined Loop (S): This type of fingerprint consists of two loop fingers, with one loop enclosing another loop finger in such a way that core lines of these two loops exit in opposite direction and one of the deltas divides them.
- Lateral Pocket Loop (LP): In this type, there are two loops of fingers with one on top of another, and the upper loop acts like a pocket for the lower loop.
- Accidental (X): An accidental pattern is one that cannot be classified under any of the other specific types of patterns.

Terminology of fingerprints:

- Fingerprint: A fingerprint refers to the replica of the ridge formation on the finger in the print left behind.
- Pattern: The design made by the ridge formation in a fingerprint is called a pattern.
- Pattern area: The part of a loop or whorl fingerprint that bears cores, deltas, and ridges relevant to fingerprint classification is the pattern area.
- The type lines refer to two innermost parallel lines that then diverge to enclose the pattern area.
- Divergence refers to the widening gap between two lines that were previously parallel or close to parallel.
- Delta: Delta refers to a triangular plot that is formed as a result of bifurcated ridge formation or from the divergence of two parallel ridges. These two parallel ridges act as the type lines.
- Core: Core refers to the innermost or centre of a fingerprint and I.T (inner terminus) refers to the point of the core.

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Development of latent fingerprints:

The technique of converting latent fingerprints to visible fingerprints through the use of either powder or chemical agents is referred to as fingerprint development.

The quality and stability of latent fingerprints largely rely on atmospheric factors, the physical state of the individual, and the type of surface.

The composition of sweat is mainly water along with many organic and inorganic compounds like sodium chloride, potassium chloride, fat, and amino acids.

The principal function of latent fingerprints development is to facilitate the conversion of latent fingerprints to visible fingerprints in order to enable their preservation and comparison.

Powder Fingerprint Development: powder test is the easiest and most widely used method for developing latent fingerprints.

Black Powder: is applicable to all light-coloured surfaces in order to increase the visibility of friction ridges on the surface following fingerprint development. Graphite, charcoal, lamp black, photocopier toner, and anthracene are some of the substances used in making black powder.

White Powder: a typical white powder includes haddonite white, which is a dusting agent comprising titanium dioxide, kaolin, and French chalk, or alternatively titanium dioxide, purified talc, and Kadin lenis.

Grey fingerprint powder: Made up of aluminium dust and is used on dark-coloured surfaces. Also used on mirrors and metallic surfaces that have been highly polished to make them look like mirrors, since they reflect black in photos.

Fluorescent fingerprint powder: Helps in improving the visibility of latent prints on multi-coloured or patterned surfaces when illuminated by UV or alternate light sources. Normally consists of a carrier base along with fluorescent eyes such as rhodamine B, rhodamine 6G, acridine yellow, etc. Chemical means of developing fingerprints include the iodine fuming process, cyanoacrylate fuming process, ninhydrin method, silver nitrate method, etc.

Physical methods for the development of latent fingerprints include fluorescence of contaminants due to illumination by high-intensity lasers and the use of powder that sticks to the grease or dirt in the print.

Tests that are based on chemicals include the oxidation-reduction test, known as the redox test, and the acid-base test.

Generally speaking, the fingerprint used in identification is highly reliable despite all efforts to eliminate errors.

CHAPTER II - REVIEW OF LITERATURE

REVIEW OF LITERATURE

Review of literature is an overview of previous scholarly work conducted on specific subject matter that is based on reading scholarly books, articles, papers, journals etc. and understanding what research has been carried out so far and gaps that exist in it.

The literature review plays an important role in laying down foundations of research paper/thesis/dissertation because it provides insight into the present state of knowledge about the subject matter. This is critical because through literature review one is able to identify the gaps in previous research, avoid repeating past research, validate research question and hypothesis and many more.

These are arranged in chronological order based on the year of publication. In the cases of same year, arranged alphabetically according to the authors names.

A study conducted by ***Ms M. Saraswathi et al. (2025) on the title "Development of Latent Fingerprint using Non-Conventional Powders"*** to evaluate sacred ash, sandalwood, tooth powder, and wheat flour. The universe of the research involved latent fingerprints developed on non-porous surfaces through an experimental research

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design. Eighty fingerprints were taken from the age group of 18-25 from different students on the surfaces of glass and metal employing the technique of powder dusting and analysing photographs. It was found out that Hindu sacred ash yielded the best result regarding ridge pattern and minutiae formation, followed by sandalwood, and wheat flour performed the poorest among them. The study suggests that sacred ash can be used as a low-cost, non-toxic alternative to conventional powders in resource-limited forensic settings.

A Study conducted by ***Vaishnavi Vivek Sawant et al. (2025) titled "Latent Fingerprint Development on Multiple Surfaces: A Comparative Analysis using Black Sindhoor, Red Sindhoor, and Sandalwood Powder"*** to evaluate commercial natural powders. The population universe considered for this study comprised latent fingerprints on both porous and non-porous surfaces through the experimental research methodology. The sample size comprised 100 latent fingerprints from ten persons on 10 various surfaces, which were acquired through the technique of powder dusting, and evaluated on the basis of ridge detail visibility. The results found were that black Sindhoor powder provided good results on all types of surfaces while the other two samples did not provide satisfactory results on porous surfaces. The study suggests black Sindhoor is a highly effective, low-cost alternative for forensic practice.

A study conducted by ***Chauhan et al. (2024) titled "A Research on Developing Latent Fingerprints on Human Skin with Cosmetic Powders"*** to test the suitability of talcum, vermilion, and eye shadow powders. The universe of the experiment consisted of latent fingerprints of living human skin based on the use of an experimental research approach. The sample contained 72 latent fingerprints from twelve subjects in three age categories obtained by powdering and adhesive method from the areas of the forearm and forehead. Results indicated that eye shadow powder was found to provide more than 80% visibility of the prints, especially for the young age category, whereas talcum powder proved to be the least suitable. The study suggests cosmetic powders are safe, non-toxic, and cost-effective tools for developing prints on human skin during investigations.

A study conducted by ***Impana R et al. (2024) on the title "A Study on Development of Fingerprint Powders Using Natural Sources for Latent Fingerprint Visualisation on Non-Porous Surfaces"*** to develop eco-friendly powders. This study was aimed at creating environmentally friendly fingerprint powders. The population under consideration consisted of latent fingerprints on non-porous surfaces, while the experimental research design was used for the study. The sample comprised latent fingerprints on mobile screens and ceramic plates, utilizing powders created from betel leaves, turmeric, charcoal, beetroots, and orange peels. It was found that betel leaves, turmeric, and charcoal were effective, but the beetroots and orange peels failed to show any results. The study suggests that natural sources provide non-toxic and economical alternatives for latent fingerprint development, particularly in resource-limited forensic environments.

A Study conducted by ***Prem Ranjan Kumar et al. (2023) titled "Development of Dark Powder by Coconut Spathe Ash for Latent Fingerprint Visualisation"*** to develop a non-toxic, inexpensive alternative powder. The universe was the latent fingerprints available on different surfaces in the crime scenes with the use of experimental research methodology. Fifty fingerprints belonging to fifty donors were used from nine different surfaces after being collected by the traditional dusting technique. The finding revealed that coconut spathe ash is efficient in visualizing the minutiae and ridges, and worked well on non-porous surfaces as compared to porous ones.

A Study conducted by ***Roy et al. (2023) titled "Development of Latent Fingerprint using Carbon Powder"***, aiming to develop fingerprints using candle-derived carbon and evaluate its effectiveness. Universe was latent fingerprints present on porous and nonporous surfaces typically found at crime scenes. Experimental research design was used. Sample comprised fingerprints found on almirahs, mobile glass, and wood surfaces. Data collection entailed gathering soot powder from a flame of a candle and applying it on the fingerprints. Key results indicate that candle carbon powder yields visible ridge details and adheres well to both dark and light surfaces up to 4 days. The study suggests that candle-based powder is a simple, non-toxic, and readily available alternative for latent fingerprint development.

A study was conducted by ***Hameed et al. (2022) titled "Comparative Study between Activated Carbon and Charcoal for the Development of Latent Fingerprints on Non-porous Surfaces"*** which compared commercial charcoal and Alhagi-derived activated carbon. This research adopted a descriptive and experimental design, which concentrated on latent fingerprints on non-porous substrates such as cardboard, glass, and aluminium foil. Both male and female volunteers participated as part of the samples in this research. Fingerprints from them were lifted

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through powder dusting and activation of chemically activated carbon using central composite design (CCD). Results indicated that the use of activated carbon was superior as it helped achieve higher ridge visualization for 15 days compared to charcoal that only lasted 7 days without being applicable for developing fingerprints on plastic substrates. The study suggests that plant-based activated carbon is an eco-friendly and cost-effective option for forensic development.

A Study was conducted by ***Kavleen Kaur et al. (2020) titled "Development of Submerged Latent Fingerprints on Non-Porous Substrates with Activated Charcoal-Based Small Particle Reagent".*** This study aimed to establish the efficacy of SPRs in aqueous conditions. The population of the study was latent fingerprints on non-porous substances, and the researchers used an experimental study design. Samples comprised 20 sets of glass slides and aluminium foils having prints of five people analysed using the small particle reagent technique and Staszewski scale. The results revealed that activated charcoal-based SPRs were able to develop fingerprints on submerged non-porous substances, especially aluminium foils submerged in pond water. The study suggests activated charcoal-SPR is a reliable, cost-effective technique for submerged forensic evidence.

A study was conducted by ***Madkour et al. (2017) titled "Development of Latent Fingerprints on Non-Porous Surfaces Recovered from Fresh and Sea Water.*** The research focused on determining the best technique for enhancing latent fingerprints obtained from non-porous surfaces that have been submerged in water. Glass, plastic, and metal were the substrates used. Five donors' latent fingerprints were taken from the researchers and immersed in fresh and seawater for various durations. The development of latent fingerprints was done through the use of black powder, small particle reagent, and cyanoacrylate fuming. A scoring system was utilised to determine the results. It was concluded that cyanoacrylate fuming performed well, and the fingerprint quality deteriorated with the duration of immersion. The study recommended that submerged evidence should still be checked for fingerprints.

A study conducted by ***Seerat et al. (2015) titled "Comparative Study of Different Natural Products for the Development of Latent Fingerprints on Non-Porous Surfaces"*** to compare various natural powders. The universe consists of latent fingerprints on non-porous surfaces like tiles and mirrors, using an experimental research design. The population is latent fingerprints found on non-porous surfaces like tiles and mirrors using the experimental method. The sample comprised of 76 latent fingerprints created on non-porous surfaces like glass, plastics, and stainless steel using the powder dusting method. The results indicate that the development was best done using mustard oil soot followed by turmeric powder, while marigold and red chilli powder proved ineffective. The study suggests that natural powders serve as cost-effective and non-toxic alternatives to chemical-based conventional fingerprint powders.

After going through the studies done by various scholars, it is observed that there have been several different types of natural and charcoal powders used to develop latent fingerprints. However, there has not been any standardized comparison of quantified data on the effectiveness of commercial charcoal powder as compared to home-made wood-burnt charcoal powder. In addition to this, there has not been much research conducted regarding the performance of these powders on regular surfaces. Moreover, there has been no information provided regarding factors like clarity of the ridges, and their visibility, when the charcoal comes from different sources. It is evident that the methods employed for the preparation of wood-burnt charcoal powder have not been compared to standard commercial charcoal powders. Thus, a major gap prevails in this regard, which is addressed in this study.

CHAPTER III - METHODOLOGY

METHODOLOGY

Research methodology refers to the procedure that a researcher employs in carrying out a study. It involves the techniques to be applied, the methods and the equipment to be utilized during data gathering and data analysis stages. It involves many kinds including qualitative, quantitative and mixed method researches. It forms the core of any study since it guides the process of collecting, analysing and interpreting information.

3.1 Need for the study:

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Fingerprints are distinctive and important sources of evidence, with latent fingerprints being the most common type discovered at crime scenes. Although the powdering technique is ideal due to its non-destructive nature, commercially produced professional powders have been found to be costly, harmful and difficult to access, especially in distant and emergency forensics investigations. It has therefore become extremely necessary to look for harmless and affordable solutions that can be easily produced using readily available resources within a short time.

The current study is quite relevant in assessing the efficiency of locally made burnt wood charcoal and commercial charcoal in fingerprint development on different non-porous substrates. Standardizing both the powders to 75 microns allows the research to determine their ability to produce clear ridge patterns, good contrast and distinct minutiae features.

In case of success in the process, this study would offer a credible and ecological means of developing fingerprints for forensics even in situations where the use of standard means may not be possible.

3.2 Aim of the study:

This research aims to assess and compare the efficiency of commercially available charcoal powder (Nature onus 100% coconut shell charcoal powder) and homemade wood-burnt charcoal powder for the formation of latent fingerprints, as an alternative method using natural resources and cost-effective techniques without any toxic material, compared to traditional fingerprint powder.

3.3 Objectives:

- To develop latent fingerprints on different non-porous surfaces using commercial and wood-burnt charcoal powder.
- To evaluate and compare the effectiveness and overall performance of both powders in the development of latent fingerprints.
- To qualitatively assess and compare the fingerprint quality based on ridge clarity, visibility of core, delta, ridge characteristics and contrast.

3.4 Research Statements/ Research Questions:

- Is there any difference between the commercial and the wood-burnt charcoal regarding developing latent fingerprints?
- Which is the better powder in terms of the clarity of the ridges and minutiae details?
- Does the particle size (75 microns) affect the fingerprint development?
- How do both of the above powders perform on different non-porous surfaces?
- As the wood-burnt charcoal can act as an alternative to commercial charcoal, which is one of the ingredients of conventional fingerprint powder.
- Then, is it capable of producing results as efficient as conventional fingerprint powders?

3.5 Research design:

Research design is the structure or layout of the entire research work. The research design means the decision-making process that occurs before a situation in which a decision needs to be made. It can be described as the blueprint of the research that shows a clear method of how to collect, measure and analyse data so as to achieve the expected result. It assists in organising the data with respect to the requirements of the study.

This research study adopted an experimental, comparative research design with a qualitative approach to test the effectiveness of commercially available charcoal powder (Nature onus 100% coconut shell charcoal powder) and wood-burnt charcoal powder in developing latent fingerprints. The variables involved in this study include: independent variables, which are both commercial and wood-burnt charcoal powders, while the dependent variables are: clarity of ridge flow, visibility of core and delta and visibility of ridge characteristics.

This research study involved controlled experiment because the independent variables in this case are the two types of powder that will all be standardised to a particle size of 75 microns for a consistent measurement. This study involved an examination of how effective the two powders are in fingerprint development on non-porous surfaces such as glass, steel, tiles, ceramics and plastic surfaces.

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By making the application technique constant (brushing technique) this study investigates the effectiveness of using nature-based, non-toxic, eco-friendly and inexpensive charcoal powder as a fingerprint powder.

3.6 Universe, sample size, and techniques:

- Universe: This includes latent fingerprints present on various non-porous surfaces belonging to healthy human subjects residing within the jurisdiction of Mangaluru city.
  Specifically, this research studied only considered healthy human subjects aged 18 to 40 years. The reason why this age group has been selected is that it tends to minimise the variations in the clarity of the ridge, its flow, as well as the secretions of oil.
- Sample size: The total sample size is 30, consisting of 60 latent fingerprints that was later paired.
  Sample size determination was based on experimental variables that include:
  a. Independent Variable 1 (2 Powder types): Commercial charcoal powder (Nature onus 100% coconut shell charcoal powder) and homemade wood-burnt charcoal powder.
  b. Independent Variable 2 (Substrates): Glass, Steel, tile, ceramic, and Plastic.
  c. Replication: A sample size of 30 pairs of latent fingerprints (60 latent fingerprints) was studied. The 60 latent fingerprints are applied on 5 surfaces with 6 pairs of latent fingerprints per surface, developed using commercial and wood-burnt charcoal powder.

  This allowed for the scientific analysis of latent fingerprints developed by commercial and wood-burnt charcoal powder.
- Techniques: The purposive sampling technique was used in this study, which is a non-probability sampling technique. In the current study, participants or donors for the fingerprints was not chosen randomly but purposefully; that is, according to a characteristic. Here, the characteristic considered was that donors have to be healthy human beings aged between 18 and 40 years. This was done because the fingerprints obtained from such individuals would provide good ridge clarity due to consistent oil production in the skin.
  The fingerprints obtained should come from individuals who do not have any scars or skin conditions on their fingers.
  The focus was more on developing the latent fingerprints using the two kinds of powders.
  Thus, scientific comparison of latent fingerprints using commercial and wood-burnt charcoal powder can be done.

3.7 Tools for data collection and procedure:

In this particular study, the tools used was primarily related to the particle size of the powder used, i.e., the standardisation of both commercial and wood-burnt charcoal powder. To ensure uniformity in particle size of both types of powders, a sieve having a mesh size of 75 microns was used.

Tools for the development of latent fingerprints consist of:

Application tools: A well-made camel hair brush to apply the powders to the surface under investigation, and an ostrich feather brush to gently remove any extra powders.
Substrates: This includes different surfaces such as glass, steel, tile, ceramic and plastic non-porous substrates.
Documentation: Camera used to document a clear image of the developed latent fingerprints.

Procedure: In the experimental study, there was a continuous process undertaken to investigate and analyse the performance of two distinct powders on different substrates. Commercial powder used consists of 100% charred coconut shells from the company called Nature Onus in their received form. For the wood burnt charcoal powder, the burning of the wood of coconut tree was done till the process of carbonization ends. This was then left to cool down naturally, after which the charcoal content was ground using the mortar and pestle. To ensure the same quality and fineness of powders, sieving of both these powders was done using a 75-micron sieve.

For the experimental process, five nonporous surfaces, such as glass, steel, tile, ceramic, and plastic, was cleaned and dried. The deposition of latent fingerprints was achieved through pressing fingertips on the surfaces after obtaining informed consent. The procedure of fingerprint development starts with the application of a powder through a camel hair brush onto the areas where fingerprints was suspected; the next step involved the removal of excess powder using an ostrich feather brush after it sticks to the latent oily residues. The final step involved

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taking images of the developed fingerprints using a camera mounted perpendicularly at 90 degrees to ensure high-resolution pictures.

3.8 Inclusion and exclusion criteria:

The inclusion criteria include the following:

• Healthy individuals aged between 18 to 40 years was considered.

• Healthy skin of fingertips with no skin diseases and no cuts.

• Informed consent of participants.

• Latent fingerprints was developed only on non-porous surfaces (ceramic, glass, plastic, steel and tile)

• Fingerprints was collected in experimental conditions.

• Commercial and home-made wood-burnt charcoal powders was used.

• Powders was sieved and standardised to 75 microns.

• Fingerprint development was done through the dusting technique with powdered substances.

The exclusion criteria include the following:

- The participants whose skin is either excessively dry or too sweaty was not included.
- Samples that exhibit inadequate deposition because of incorrect pressure and handling of fingerprints.
- Interference by the environment (such as dust, moisture, or other contamination of fingerprints).
- Samples that are degraded or old compared to the controlled time period in the study.
- Samples with cross-contamination in the process of collection or development.
- Inappropriate equipment usage or faulty brushes for powder deposition on fingerprints.

3.9 Data coding, presentation and analysis:

For the latent fingerprints that had been developed through the use of commercial and wood-burnt charcoal powder, there was a close observation of these. In order to maintain a level of consistency when carrying out the observations, the Bandey (HOSDB) score guide was used for each latent fingerprint. According to this scale, each score was assigned between 0 and 4 depending on the ridge visibility, visibility of the core/delta, ridge characteristics, and contrast. These scores was used for reference purposes since they were translated to descriptors such as poor, moderate, good, and excellent.

Tabular representation of coding scale along with its interpretations:

Code	Interpretation
0	Not developed latent fingerprint
1	Poor development of latent fingerprint (no visibility of ridge detail)
2	Moderate development of latent fingerprint (some ridge details are visible)
3	Good development of latent fingerprint (2/3 of the mark)
4	Excellent development of latent fingerprint (clear ridge detail)

The data collected was then coded according to key aspects identified during observation, such as clarity of ridges, contrast, ridge characteristics, and visibility of the core/delta, fingerprint. The data was represented in tables using these descriptors without any numbers. Therefore, a comparison could be easily carried out between the effects of these powders on the fingerprints.

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The analysis method used in this research was thematic analysis. There was identification of themes based on repeated patterns and observations. The main focus of this research is descriptive rather than statistical because of the use of this approach of analysis.

3.10 Report design:

Report design is the arrangement of the research study done in a systematic way into different chapters for clear understanding and presentation. The present study is categorised into five chapters. Chapter 1, includes the history and major concepts of fingerprints. Chapter 2, includes previous studies related to the development of latent fingerprints using different natural powders. Chapter 3, includes the need, aim, objectives of the study, data collection, and its analysis. Chapter 4, deals with tabular formation and statistical methods. Chapter 5, highlights the findings, suggestions, and conclusions of the study.

- Chapter I: Introduction

The introduction is the initial section that provides a brief overview and basic understanding of the topic. It includes a brief history and concept of fingerprints, pioneers' work on fingerprints, principles of fingerprints, types and classification of fingerprints, different terminologies and development of latent fingerprints.

- Chapter II: Review of literature

A review of literature refers to a systematic study that provides an overview of existing knowledge in a particular field of research. This chapter includes studies on the development of latent fingerprints using different powders. These are arranged in chronological order based on the year of publication. In the cases of the same year, arranged alphabetically according to the authors' names.

- Chapter III: Methodology

Research methodology refers to the overall strategy and approach used in the research study to collect, analyse and interpret the data whether qualitative or quantitative. This chapter includes the need for the study, aim of the study, objectives, research statements/research questions, research design, universe, sample and sample techniques, tools of data collection and procedures, inclusion ad exclusion criteria, data coding, data presentation and analysis.

- Chapter IV: Data analysis

Data analysis refers to the systematic process of using statistical and analytical tools to describe, summarise, and to draw conclusions from the data sets.

It includes a tabular presentation of data with different variables and observations made based on visibility of ridges, visibility of core/delta, visibility of ridge characteristics and the contrast

- Chapter **V**: Findings, suggestions and conclusions

These are the major components of a research study. This chapter highlights the outcome of the study based on comparative analysis of commercial and wood-burnt charcoal powders and outlines the effectiveness of a natural, low-cost alternative for the development of latent fingerprint. It includes the findings after analysis of the data, major results obtained, and also provides relevant suggestions for future study or research and concludes the overall outcome of the study.

3.11 Limitations:

- The experiment was carried out using a small number of samples, which would limit the scope of the findings obtained.
- Only non-porous substrates, including ceramic, glass, plastic, steel, and tile, were examined; no porous or semiporous substrates were tested.
- Environmental variables like temperature and humidity were not regulated, which could have an impact on fingerprint development.

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- There were only two kinds of powder examined in this experiment, and other fingerprint development processes were not taken into account.
- There was no advanced technique involved, like digital imaging analysis or instrumental analysis.

CHAPTER IV - DATA ANALYSIS

DATA ANALYSIS

Data analysis refers to the systematic arrangement, examination, and interpretation of the findings to establish certain patterns or trends in order to make appropriate conclusions. In this particular case study, the fingerprints developed were closely observed and interpreted. The Bandey (HOSDB) scale served as a guide for consistency when making observations. Some of the parameters include ridge visibility, core/delta visibility, ridge characteristic, and contrast. However, the number values (0-4) in the scale were not applied; rather, descriptions such as poor, moderate, good, and excellent were employed.

About the organisation of the collected data, the surfaces (ceramic, glass, plastic, steel, and tile), as well as the types of powder applied (commercial charcoal and wood-burnt charcoal) were labelled. The fingerprints developed through the use of both kinds of powders were observed and compared. These were coded on the basis of certain observations made, such as clarity, contrast, distribution, and visualisation.

4.1 QUALITATIVE ANALYSIS OF THE DEVELOPED LATENT FINGERPRINTS USING COMMERCIAL CHARCOAL POWDER ON VARIOUS NON-POROUS SURFACES:

This table presents the qualitative analysis of the latent fingerprints developed through the use of commercial charcoal powder on various non-porous surfaces, including ceramic, glass, plastic, steel, and tile. There are 6 samples per surface. Two fingerprints were taken per sample with commercial charcoal powder and wood-burnt charcoal powder. Thus, there are 12 observations of fingerprints. But since these fingerprints are taken from one sample, they are considered as paired observations and not two separate samples. The description of these observations is made according to the visibility of ridges, cores/deltas, and ridge qualities, as well as their contrast. These descriptions are taken from the Bandey (HOSDB) scale.

Surface	Commercial charcoal powder					
	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6
Ceramic	Moderate ridge, core/delta and ridge characteristics visibility with poor contrast	Good ridge, core/delta and ridge characteristics visibility with good contrast	Moderate ridge, core/delta and ridge characteristics, visibility with moderate contrast	Good ridge visibility, excellent core/delta and ridge characteristics visibility with good contrast	Good ridge visibility, excellent core/delta visibility and good ridge characteristics and contrast	Excellent ridge, core/delta and ridge characteristics visibility with good contrast
Glass	Excellent ridge, core/delta and ridge characteristics visibility with moderate contrast	Good ridge visibility, moderate core/ delta and ridge characteristic visibility with moderate contrast	Good ridge, core/delta and ridge characteristics visibility with good contrast	Good ridge visibility, moderate core/delta and ridge characteristics visibility with moderate contrast	Good ridge, core/delta and ridge characteristics visibility with moderate contrast	Good ridge, core/delta and ridge characteristics visibility with good contrast
	Good ridge visibility, moderate core/delta and	Good ridge visibility, excellent core/delta	Good ridge visibility, excellent core/delta	Excellent ridge, core/delta, ridge characteristics visibility with	Good ridge, core/delta, ridge characteristics	Good ridge, core/delta visibility with moderate ridge

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Plastic	ridge characteristics visibility with good contrast	visibility, good ridge characteristics visibility with moderate contrast	visibility, good ridge characteristics visibility with excellent contrast	excellent contrast	visibility with good contrast	characteristics visibility with good contrast
Steel	Moderate ridge, core/delta and ridge characteristics visibility with good contrast	Good ridge, core/delta visibility, moderate ridge characteristic with good contrast	Excellent ridge, core/delta visibility, good ridge characteristic visibility with good contrast	Moderate ridge visibility, good core/delta visibility, poor ridge characteristics visibility with moderate contrast	Good ridge, core/delta, ridge characteristic visibility with good contrast	Good ridge, core/delta, ridge characteristic visibility with moderate contrast
Tile	Good ridge visibility, excellent core/delta visibility, good ridge characteristics and contrast	Excellent ridge, core/delta and ridge characteristic visibility with good contrast	Moderate ridge visibility, poor core/delta visibility, moderate ridge characteristic and contrast	Moderate ridge, core/delta and ridge characteristic visibility with excellent contrast	Good ridge visibility, excellent core/delta visibility, good ridge characteristic and contrast	Good ridge visibility, excellent core/delta visibility, good ridge characteristics and contrast

TABLE NO. 4.1.1

The data presented in Table No. 4.1.1 indicates the development of latent fingerprints using commercial charcoal powder, showing variations in ridge visibility, core/delta visibility, ridge characteristics, and contrast on different non-porous surfaces.

In the case of the ceramic surface, excellent results were observed in sample 6, where ridge visibility, core/delta visibility, ridge characteristics, and contrast were extremely clear and well defined, followed by good results seen in samples 2, 4, and 5, where ridge visibility, core/delta visibility, ridge characteristics, and contrast were good to excellent. Moderate results were obtained for samples 1 and 3, where ridge visibility, core/delta visibility, and ridge characteristics were fairly clear, and the contrast was moderate to poor.

In the glass surface, excellent results were obtained for sample 1, where ridge visibility, core/delta visibility, ridge characteristics, and contrast were extremely clear and visible, followed by good results seen in samples 3 and 6, where ridge visibility, core/delta visibility, ridge characteristics, and contrast were good. Moderate results were obtained for Samples 2, 4, and 5, where ridge visibility, core/delta visibility, and ridge characteristics were fairly clear, and contrast was moderate (average).

For the plastic surface, excellent results were observed in sample 4 with excellent visibility for the ridges and core/deltas, excellent ridge characteristics, and excellent contrast, followed by good results seen in Samples 1, 2, 3, 5, and 6, with good visibility for the ridges and core/deltas, and good ridge characteristics with contrast varying between moderate and excellent. Moderate results were minimal and found in some samples, with some parameters having good visibility.

For the steel surface, excellent results were seen in Sample 3 with excellent ridge and core/delta visibility, good ridge characteristics, and contrast, followed by good results observed in samples 2, 5, and 6 with good ridge and core/delta visibility, good ridge characteristics, and contrast. Moderate results were achieved in Samples 1 and 4 with good ridge visibility, good ridge characteristics and moderate contrast in Sample 1, and poor ridge characteristics in Sample 4.

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On the tile surface, excellent, outstanding results were obtained on Sample 2, where highly visible ridges and prominent core-delta patterns were observed. Satisfactory results, i.e., good to moderate results seen in Samples 1, 5, and 6, where highly visible ridges were observed, and the contrast was also high. Fair (reasonably clear) results were achieved with Samples 3 and 4, where the ridges were not clearly visible; however, the contrast was reasonably clear.

Figure 1: Development of latent fingerprint on a ceramic surface using commercial charcoal powder

Figure 2: Development of latent fingerprint on a glass surface using commercial charcoal powder

Figure 3: Development of latent fingerprint on a plastic surface using commercial charcoal powder

Figure 4: Development of latent fingerprints on a steel surface using commercial charcoal powder

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Figure 5: Development of latent fingerprints on a tile surface using commercial charcoal powder

4.2 QUALITATIVE ANALYSIS OF THE DEVELOPED LATENT FINGERPRINTS USING WOOD-BURNT CHARCOAL POWDER ON VARIOUS NON-POROUS SURFACES:

This table presents the qualitative analysis of the latent fingerprints developed through the use of wood-burnt charcoal powder on various non-porous surfaces, including ceramic, glass, plastic, steel, and tile. There are 6 samples per surface. Two fingerprints were taken per sample with commercial charcoal powder and wood-burnt charcoal powder. Thus, there are 12 observations of fingerprints. But since these fingerprints are taken from one sample, they are considered as paired observations and not two separate samples. The description of these observations is made according to the visibility of ridges, cores/deltas, and ridge qualities, as well as their contrast. These descriptions are taken from the Bandey (HOSDB) scale.

Surface	Wood-burnt charcoal powder					
	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6
Ceramic	Excellent ridge, core/delta and ridge characteristics visibility with excellent contrast	Moderate ridge visibility, poor core/delta visibility, moderate ridge characteristics visibility with good contrast	Good ridge, core/delta and ridge characteristics visibility with moderate contrast	Excellent ridge, core/delta and ridge characteristics visibility with excellent contrast	Moderate ridge visibility, good core/delta visibility, moderate ridge characteristics visibility with excellent contrast	Excellent ridge, core/delta and ridge characteristics visibility with good contrast
Glass	Excellent ridge, core/delta and ridge characteristics visibility with moderate contrast	Excellent ridge visibility, moderate core/delta visibility, good ridge characteristics visibility with moderate contrast	Good ridge, core/delta and ridge characteristics visibility with good contrast	Moderate ridge visibility, poor core/delta and ridge characteristics visibility with good contrast	Moderate ridge visibility, good core/delta visibility, moderate ridge characteristics visibility with good contrast	Good ridge, core/delta and ridge characteristics visibility with good contrast

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Plastic	Good ridge and core/delta visibility, moderate ridge characteristics visibility with excellent contrast	Good ridge visibility, excellent core/delta visibility, good ridge characteristics visibility and contrast	Good ridge visibility, excellent core/delta visibility, good ridge characteristics visibility with good contrast	Good ridge visibility, excellent core/delta visibility, good ridge characteristics visibility with excellent contrast	Excellent ridge and core/delta visibility, good ridge characteristics visibility with good contrast	Excellent ridge and core/delta visibility, good ridge characteristics visibility with excellent contrast
Steel	Moderate ridge, core/delta and ridge characteristics visibility with good contrast	Good ridge, core/delta visibility, moderate ridge characteristic with good contrast	Excellent ridge, core/delta visibility, good ridge characteristic visibility with good contrast	Good ridge, core/delta and ridge characteristics visibility with good contrast	Good ridge, core/delta, ridge characteristic visibility with good contrast	Excellent ridge and core/delta visibility, good ridge characteristics visibility and contrast
Tile	Good ridge visibility, excellent core/delta visibility, good ridge characteristics with excellent contrast	Excellent ridge, core/delta and ridge characteristic visibility with excellent contrast	Good ridge visibility, excellent core/delta visibility, good ridge characteristics with excellent contrast	Moderate ridge visibility, good core/delta, moderate ridge characteristic visibility with excellent contrast	Good ridge visibility, excellent core/delta visibility, good ridge characteristic with excellent contrast	Excellent ridge, core/delta visibility, good ridge characteristics visibility with good contrast

TABLE NO. 4.1.2

The data presented in Table No. 4.1.2 indicates the development of latent fingerprints using wood-burnt charcoal powder, showing variations in ridge visibility, core/delta visibility, ridge characteristics, and contrast on different non-porous surfaces.

In the case of ceramic surfaces, very clear, i.e. excellent results were observed in samples 1, 4, and 6, with excellent ridge visibility, excellent core/delta visibility, and excellent ridge characteristics with good to excellent contrast, followed by clear, i.e. good results were recorded in sample 3, with good ridge patterns and good contrast. Fairly clear, i.e. moderate results were observed in samples 2 and 5, where ridge visibility and characteristics were average, with contrast being from good to excellent.

On glass surfaces, very clear, i.e. excellent results were observed in samples 1 and 2, with excellent ridge visibility, excellent core/delta features, and good contrast. Clear, i.e. good and visible results were recorded in samples 3, 5, and 6, with good ridge visibility and characteristics, and good contrast. Fairly clear, i.e. moderate results were observed in sample 4, with average ridge visibility and unclear, i.e. poor core/delta visibility, but good contrast.

For plastic surfaces, sharp and well-defined results, i.e. excellent, were observed in samples 5 and 6, with excellent ridge visibility, excellent core/delta visibility, and excellent contrast. Clear, i.e. good results were obtained in samples 1, 2, 3, and 4, with good ridge visibility and characteristics, and good to excellent contrast.

On the steel surface, very well-defined i.e. excellent results were obtained in samples 3 and 6 with good ridge visibility, core/delta characteristics, and good contrast. Clear, i.e. good results were obtained in samples 2, 4, and 5 with good ridge visibility, characteristics, and good contrast and fairly well developed i.e. moderate results were obtained in sample 1 with poor ridge visibility, but good contrast.

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On the tile surface, excellent results were obtained in samples 2 and 6 with good ridge visibility, core/delta visibility, and good contrast. Clear, i.e. good results were obtained in samples 1, 3, and 5 with good ridge visibility, characteristics, and excellent contrast. Fairly well developed i.e. moderate results were obtained in sample 4 with poor ridge visibility but excellent contrast.

Figure 1: Development of latent fingerprint on a ceramic surface using wood-burnt charcoal powder

Figure 2: Development of latent fingerprint on a glass surface using wood-burnt charcoal powder

Figure 3: Development of latent fingerprint on a plastic surface using wood-burnt charcoal powder

Figure 4: Development of latent fingerprints on a steel surface using wood-burnt charcoal powder

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Figure 5: Development of latent fingerprints on a tile surface using wood-burnt charcoal powder

DISCUSSION

This study was done to test and compare the effectiveness of commercial charcoal powder and wood-burnt charcoal powder in developing latent fingerprints on different non-porous surfaces like ceramics, glass, plastic, steel, and tile surfaces. This study involved adopting a qualitative research approach, whereby observations were made by observing the ridges, the visibility of cores/deltas, characteristic ridges, and contrast. To ensure consistency in observations, the Bandey (HOSDB) scale was adopted, where values were then coded as excellent, good, and moderate, among others.

In each category of surfaces, there were 6 samples, which means that 2 fingerprints on each sample were developed using commercial and wood-burnt charcoal powders, respectively. In presenting the observations in tables, only one kind of powder was chosen. The data was then analysed thematically, meaning that comparisons were not made numerically but rather by looking at its visibility, clarity, contrast, etc.

Both commercial and wood-burnt charcoal powders have proven to be effective in developing fingerprints on the selected non-porous surfaces. However, the effectiveness has varied from surface to surface.

For the ceramic surface, both powder types produced ridge impressions of good to excellent visibility as well as core and delta visibility, meaning that smooth surfaces provide optimal conditions for the best powder adhesion.

For glass surfaces, the results were quite consistent, but there was some variation in the visibility of ridges and contrast. This means that the properties of transparency and texture can affect the development process on such surfaces.

The most consistent results were seen on plastic surfaces, particularly when using wood-burnt charcoal powder. Ridge visibility, core and delta visibility, and contrast were very clearly visible in many cases, indicating that plastic surfaces are suitable for powder development. For steel surfaces, results varied between average and excellent, depending on the ridge visibility.

There was also evidence of fingerprint development on tile surfaces, with a number of cases producing clear and highly visible ridge patterns and contrast. However, there were cases where ridge visibility was slightly inconsistent, possibly due to variations in powder adhesion or distribution.

In the comparison of both powders, the powder from wood-burnt charcoal proved to be superior as far as consistency of distribution, clear ridge patterns, and contrast were concerned. The finer nature and composition of this powder, which made it adhere well to the latent prints, might be the reason for its superiority. However, the commercial charcoal powder also proved itself reliable, although at times, it showed signs of uneven distribution.

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CHAPTER V - MAJOR FINDINGS, SUGGESTIONS AND CONCLUSIONS

MAJOR FINDINGS OF THE STUDY

Research findings are the basic results drawn from a research process, which indicate the most important results from the research and answer the research questions. Findings can show patterns, connections, or trends, either based on insights or statistical data.

Research findings form the backbone of a research study. They form the evidence that supports the findings of the researcher. Findings provide the proof of what the researcher has tried to prove. They confirm the achievement of the research objectives set by the researcher.

This study has a few findings, which are given below:

- The research indicated that the application of either commercially available charcoal powder or burnt charcoal powder is successful in creating latent fingerprints on non-absorbent materials such as ceramics, glass, plastic, steel, and tiles.
- The use of the Bandey (HOSDB) scale as a reference guide was useful in ensuring consistency when assessing the visibility of ridges, cores/deltas, ridge features, and contrasts qualitatively.
- Plastic materials exhibited the most consistent results when developing fingerprints, showing distinct ridge patterns, cores/deltas, and good to excellent contrasts in most cases.
- There were significant results in the development of fingerprints on ceramic and tiled materials, with numerous samples having visible ridge characteristics and contrasts.
- Fingerprints developed on glass surfaces were relatively consistent, with most samples having good visibility of ridges but average to good contrasts.
- Fingerprint development on steel surfaces was moderately consistent, showing average to excellent ridge characteristics and visibility.
- In terms of fingerprint development, wood-burnt charcoal powder performed better in achieving a consistent application, distinct ridge characteristics, and contrasts.
- Charcoal powder used in the commercial market proved equally efficacious but occasionally demonstrated some degree of unevenness or poor visibility relative to the wood-burnt powder.
- The nature of the surface seemed to play a crucial part in obtaining prints; non-porous and smooth surfaces yielded superior clarity and visibility.
- Fingerprints were usually obtained without using an ostrich feather brush, with tapping alone proving sufficient for adequate visualisation.
- In general, the two powders yielded equal results, and there did not seem to be any significant disparity between them in terms of efficacy for latent fingerprint development.

SUGGESTIONS

The following are some recommendations based on the results and limitations of the study:

- Another type of study could be done by testing porous and semi-porous surfaces, making it possible to evaluate the application of these powders under varying forensic scenarios.
- Modern technology, such as digital imaging and microscopy, could be included to increase precision and minimise the degree of subjectivity in scoring.
- Comparison may also be made with other commercially produced fingerprint powders to identify which product would produce better results.
- As observed, commercial charcoal powder tends to form clumps and unevenly distributed particles; hence, its formula or storage method could be improved to yield better results.
- However, commercial charcoal powder is highly recommended for forensic investigation purposes due to its accessibility, standardisation, and existing protocols for its use.
- Wood-burnt charcoal powder may also be used as an alternative due to its economic and practical advantages.

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CONCLUSION

This study was conducted to evaluate and compare the effectiveness of commercial charcoal powder and wood-burnt charcoal powder in the development of latent fingerprints on non-porous surfaces. Based on the qualitative analysis, it was observed that both powders are effective in producing visible and identifiable fingerprints on surfaces such as ceramic, glass, plastic, steel, and tile.

The study showed that fingerprint development varied depending on the type of surface, with plastic, ceramic, and tile surfaces generally providing better clarity, well-defined ridge patterns, and good contrast. Glass and steel surfaces showed slightly variable results but still produced acceptable fingerprint development. The use of the Bandey (HOSDB) scale as a guiding reference helped in maintaining consistency in observation and interpretation.

Between the two powders, wood-burnt charcoal powder showed a slight advantage in terms of uniform distribution, clearer ridge characteristics, and stronger contrast in several samples. However, commercial charcoal powder also demonstrated reliable and satisfactory results, making both powders suitable for use in latent fingerprint development.

It was also observed that most of the fingerprints were successfully developed without the need for an ostrich feather brush, as simple tapping of the surface was sufficient for effective visualisation. Overall, the study concludes that both powders are effective, practical, and suitable for forensic applications, with wood-burnt charcoal powder serving as a cost-effective and efficient alternative.

BIBLIOGRAPHY

[1] Nayar, P. S. (2016). Fingerprint identification and procedure manual (1st edition.).

[2] Pandey, M. (2013). Research methodology (1st edition.)

[3] Chauhan, et al. (2024). Research on developing latent fingerprints on human skin with cosmetic powders. IP International Journal of Forensic Medicine and Toxicological Sciences, 11(3), 101-106.

[4] Madkour, et al. (2017). Development of latent fingerprints on non-porous surfaces from fresh and sea water. Egyptian journals of forensic sciences. 7:3.

[5] Hameed, et al. (2022). Comparative study between activated carbon and charcoal for the development of latent fingerprints on non-porous surfaces. Al-Khwarizmi Engineering journal, 18(4), 1-13.

[6] Impana, R., et al. (2024). A study on the development of fingerprint powders using natural sources for latent fingerprint visualisation on non-porous surfaces. International journal of forensic medicine, 6(1), 49-52.

[7] International Journal of Environmental & Agriculture Research. (n.d.). What is research methodology: Types, importance and examples. https://ijoear.com/what-is-research-methodology-types-importance-and-examples.

[8] Kaur, K., et al. (2020). Development of submerged latent fingerprints on non-porous substrates with activated charcoal-based small particle reagent. Indian Journal of Forensic Medicine and Toxicology, 14(3), 388-394.

[9] Kumar, P. R., et al. (2023). Development of dark powder by coconut spathe ash for latent fingerprint visualisation. Journal of emerging technologies and innovative research, 10(11).

[10] Roy, et al. (2023). Development of latent fingerprint using carbon powder. Medicolegal update, 23.

[11] Saraswathi, M., et al. (2025). Development of latent fingerprint using non-conventional powders. Journals of education, arts, law and multi-disciplinary, 15(5), 34-41.

[12] Sawant, V. V., et al. (2025). Latent fingerprint development on multiple surfaces: A comparative analysis using black Sindhoor, red Sindhoor, and sandalwood powder. Medicolegal update, 25(4).

[13] Seerat, et al. (2015). Comparative study of different natural products for the development of latent fingerprints on non-porous surfaces. International Journal of Social Relevance and Concern, 3(8), 9-12.

[14] BachelorPrint. (n.d.). Introduction in academic writing. https://www.bachelorprint.com/academic-writing/introduction/.

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[15] Monash University. (n.d.). How to write a literature review. https://www.monash.edu/student-academic-success/excel-at-writing/how-to-write/literature-review.

ANNEXURE

Commercial charcoal powder (Nature onus 100% Coconut shell charcoal powder)

Charcoal derived from burnt coconut tree wood

Test sieve of 75 microns

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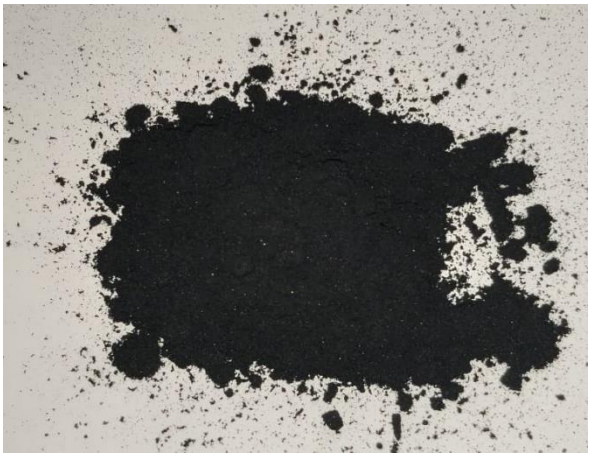
Commercial charcoal powder after standardized to the particle size of 75 microns



Wood-burnt charcoal powder after standardized to the particle size of 75 microns

Camel hair brush for the application powders

Ostrich feather brush for removing excess powders