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Indian Journal of Forensic and Community Medicine

Journal homepage: <https://www.ijfcm.org/>

Case Report

Soil: forensic interpretation some cases study

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ARTICLE INFO

Article history:

Received 08-08-2024

Accepted 17-09-2024

Available online 23-10-2024

Keywords:

Physical evidences

Soil

Forensic interpretation

ABSTRACT

While investigating a crime scene related to murder, hit-and-run accidents, road accident analysis, vehicles collisions, rapes and burglaries, forensic soil examination is used for linking the suspect or an object to the crime scene.

Comparison of soil provide information about location and place where from picked up by an automobile tire (location) with the soil sample taken from the crime site may help to prove that the suspect automobile may have been used in crime (place of happening). Similarly, soil or mud found adhering to clothing or shoes of a person may provide the clue that can link a suspect to a particular crime site.

In the present study we reported the importance of soil and their interpretation as forensic evinces. The study has been reported with the help of cases study to provide exemplary explanation.

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1. Introduction

Soil is relatively a thin mantle over the land surface of earth which is comprised of main five components that are minerals, living organisms, organic matter, gas and water. It is a porous material and having many properties. Its solid phase consists of organic products of flora and fauna and inorganic products of weathered rock or transported material. And it is porous phase holds the water and gases together. Some of the soil products has its remnants in the form of sand, stones, leaf, and grains but others like clay minerals.^{1,2} During the chemical changes occurred between organic and inorganic material during the soil formation the soil becomes humus and the resulting soil can varying in the range of texture from sandy soil to clayey material and also changed in its organic content. Soil has its types. Mainly four types of soils are present on the earth these are sandy soil, slit soil, clay soil, and loamy soil. Peat soil and chalk

soil are also the types of soil. The different types of soil are present at different places. Its properties can vary from places to places over the earth's surface. The properties also vary from top to bottom through the succession of horizons or layers that constitute the soil profile.³

In this study we reported the soil case importance in forensic interpretations, which is present all over the land and provide vital information about the presence of victim, criminal and suspects at the place of occurrence. The soil present on the shoes of the criminal, or on the clothes of the criminal, or anyone who present at crime scene. It can be applied almost each type of crime and crime scene which to investigate many crimes such as hit-and-run accidents, rapes, burglaries, automobile collision, primary or secondary spot, and etc.

Forensic soil examination is used for linking the suspect, victim and their presence to the crime scene. Forensic investigators picked the soil from the crime scene as a controlled soil and picked the soil from the tyres of car, shoes and clothes of the victim and criminal and then

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comparison of soil is done by various methods to investigate the case.^{3,4}

2. Concept for Forensic Importance of Soil

Areas of exposed soil in or around a crime scene raise the possibility of soil being transferred to the suspect's shoes or tires upon entry or departure. Impacts in hit and run accidents frequently result in the deposition of underbody dirt or mud (on the street). Two factors are of primary importance when looking to soil as possible associative evidence:

1. The time elapsed from contact with the crime scene soil to apprehension of a suspect.
2. The nature of the soil itself.

Assume the ideal situation of a muddy flower bed below the point of entry in a burglary through which the suspect has walked. Following departure from the scene, the adhering soil will begin to come off and new materials, possibly other soils, will be picked up on the suspect's shoes.⁵ The likelihood of success for a soil comparison decreases rapidly with the passage of time after the incident. Soil is a complex mixture of weathered rock, minerals, salts, organic matter, microorganisms, and moisture. Soils adjacent to places of human habitation have varying degrees of individuality through debris or treatments introduced into the soil. Oil, insecticides, peat moss, sawdust, metal shavings, industrial materials, and colored rock are all examples of possible soil inclusions.⁶

3. Collection and Preservation of Soil Samples

1. Shoes with dried mud adhering to them should be marked and sealed in a plastic bag.
2. Soil adhering to objects that are not convenient to impound should be removed, placed in a plastic bag, carton or vial then sealed and marked.
3. Comparison samples from the suspected source should be collected not only from the point of contact but also from a number of adjacent areas. These samples from the surrounding area will enable the laboratory to determine the variability of the soil in that area. They should be collected at comparable soil depths that the questioned soil sample would have been picked up on the shoes or tires.
4. The suspect should be questioned as to the source of the mud or soil adhering to his shoes or tires. In the event he offers an explanation, samples should also be collected from this area for comparison purposes.
5. Flooring, wall scraping and blood stains may also be sent for analysis to compare as well as to analyze the possibility of corroborative evidences, from the scene of crime.

4. Separation of Soil from Various Exhibits

Clear and direct soil exhibits submitted for analysis are always easier to analyze. But in most of the cases soil is adhered with another sample like blood smeared soil, blood smeared clothes, weapons, shoes, types etc. To separate soil from these various materials is tricky and requires experience; some techniques are reported as under –

1. Blood smeared soil – For this, it is suggested to wash the soil with saline water and run the soil with ultra sonic vibration at least 30 minutes, so the blood adhered to the soil, would leave the bonding and soil separated from blood, then wash it again and use for further examinations.
2. Blood smeared clothes or clothes – In the case of clothes; these are two folded; i) when the clothes were blood smeared along with soil and ii) clothes were only soil smeared. In i) cases; it is suggested to separate by spreading the clothes on white sheet of 4 x 4 sq. feet paper sheet (may be use as the size of clothes), apply gentle toothbrush or any paint small brush to separate soil on the sheet, then collect and again apply the techniques suggested in the point 1. Blood smeared soil separation techniques. In ii) cases; it is comparatively easy, spread the clothes on the paper sheet, separate the soil using brush, use to compare and examine for further analysis.
3. Type/Shoes or any tools – in these cases, it is suggested to use more harder brush (using plastics or metallic(sometime)), so that the soil entangles in the tyre ridges can be separate out and use to examine further.

4.1. Examination methodology

To examine the soil, we perform preliminary examination as observing the colour of the soil and its nature particularly size and shape. Also some time is query related to trace out foreign element as paper pieces, leaves, grass, seed, brick fragments, glasses, animal and wooden matters is also noted. After pre-examination, the soil is being separated for sample preparation and further analysis like microscopic examination, chemical test and density gradient test, particle size analysis, ignition test and pH test are being applied as available in the working manual of Physics Division, Central Forensic Science Laboratory, DFSS, New Delhi.⁷

5. Cases

5.1. Murder case

In a murder case, soil provides great information about the happening at spot and on the suspect belongings. In this case, a son murdered his father at night and throws the dead body outside his house. He beat his father with a bamboo rod so many times on his head and overall body.

Due to so many strikes on head he dead at place and then his son throw the body outside of his house and leave. Next morning when investigating team arrives, they start investigation and collect the evidences from crime scene like blood smeared soil from below the victim's body, control soil sample from near the victim's body, blood smeared clothes of victim's, and blood smeared bamboo. These evidences were sent in forensic science laboratory for examination of blood samples. The examining of the blood sample by the serology and DNA Divisions, the soil sent for further and necessary examination to Physics division along with controlled sample.

On the basis of examination, compared the questioned soil sample with controlled soil sample, provide the evidences that he (son) killed his father (victim) in side house and thrown the body outside the house.

5.2. Transported soil/body from primary to secondary scene of crime

5.2.1. Case I

In Jaipur, last Dec 2023, first information received from the SHO, Jothwara that one tunnel has been created by burglars near a bank from as underground shop, vegetable shop. The suspect persons run from the spot. They use tractor to transport the digger soil and they use clothes put in the underground area. Police trace those evidences on the basis of soil transported from one place to another and clothes worn by the suspect.

5.2.2. Case II

In a murder case, Aman is stabbed by knife on highway road and hit by stone on head. His dead body found near the high way track. His brother identifies the dead body of victim and he called investigating agency. After investigation at the scene of crime the investigating team collect some evidences from crime scene. Blood smeared soil, control soil near dead the body, watch wore by victim, blood smeared stone, hair sample, and blood smeared garments of victim. After 10-12 days, suspects were traced by investigating officer. The spotted different place for committing crime, IO asked to forensic evidences to in Forensic science laboratory for further investigation. The soil samples were sent to the physics division to compare the blood smeared soil and control soil that they were match, to verify the location of primary and secondary crime scene. Blood on all other evidences provide information about the victim and suspect connection. Only soil of crime spot and soil from the victim's worn clothes provided the confirmation of primary and secondary crime scene Locations.

5.2.3. Case III

5.2.3.1. More than 05 or 06 criminal committed a crime and spot is similar. There was a case where 17 persons

encroach in their relative's house. In the house one man and his wife were present. The people enter in the house forcefully and start beating the man with axe, sword, knife, and with other things on his head and body and also beat his wife and taking out all money and other belongings of the man. After complain received by Police, investigating team arrives and take out such evidences like blood smeared cemented floor pieces, control cemented floor pieces, saree of woman, garments of victim and other evidences.

Those person run away from spot, run through a muddy soil area and farm area, police collected soil from each suspected person shoes and send to FSL analysis. We find 13 people run through the farm area, which proved the evidences of presence of 13 people at spot.

6. Discussions

The value of soil as positive evidence is limited, particularly when no contaminants or unusual features are present. The soil in the Phoenix area is from a large flood plain, in desert area mainly having similar in composition from one area to another. A soil sample must have a degree of uniqueness from contaminants, soil additives, or industrial components in order for a comparison to indicate a high probability of common origin. The results also earlier reported in our study.⁸ Traces of soil discovered on footwear were historically among the first types of evidence used by crime scene investigators as reported in many a literature. These type (footwear, tire and tools) of evidence has been re-discovered recently, as the application of powerful analytical techniques developed in recent years and providing quantitative characteristics of the soil (bio/organic and inorganic) chemical composition.⁹

The benefit of complementary analytical approaches in assessing provenance and of presentation as evidence is discussed.¹⁰ The continued new research and developments have developed potentially the role of soil in the crime scene investigation and forensic interpretations in both civil and criminal legal contexts.¹⁰

7. Conclusion

In this study we can conclude that two soil samples can be excluded as having a common source and such a negative finding can be useful in disproving an alibi. The careful collection of soil control samples from several adjacent areas is essential to any comparison.

8. Source of Funding

None.

9. Conflict of Interest

None.

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Cite this article: Bansal K, Sharma M, Daga SS. Soil: forensic interpretation some cases study. *Indian J Forensic Community Med* 2024;11(3):126–129.