

Serological and Biological Studies of Blood in Forensic Investigations

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Abstract

The serological methods are primary methods in forensic investigations. Scientific methods using immunological reaction, chemical methods, the serological test methods are considered to be the most important to confirm the results of investigations. Basic element for any study is blood, and the science of bloodstain analysis traditionally follows certain steps which adequately describe the various tests conducted. Blood retrieved from stained cloth, stained earth samples, the weapons used etc., acquired from crime scene are to be collected for sampling. The origin of the sample whether it is of human or animal to be ascertained. Here, an effort is made to review the use of blood in serological tests on the biological materials available at the crime scene.

Keywords: Serology, Blood sample, Forensic studies

Introduction

In 1901, Karl Land Steiner announced one of the most significant discoveries of the century-the typing of blood-a finding that won him a Nobel Prize after 29 years [1]. The most important biological fluids to identify in the form of stains in criminal cases are blood. Blood is the most common, well-known and perhaps most important evidence in the world of criminal justice today.

One of the first steps in the analysis of forensic evidence is the search for biological material that can subsequently be used for DNA extraction and profiling. Many types of body fluids on forensic evidence, originating from suspect or victim, can be used for DNA profiling, such as blood, semen, saliva, vaginal fluid, urine, and sweat [2]. Blood is a common body fluid detected on pieces of evidence found at crime scenes, especially at scenes of violent crimes. Before DNA profiling can be performed, the presence of a potential biological stain, for example, blood, needs to be visually detected. White light and the visible eye or a low-power microscope can be used for a standard examination of an item of clothing. However, when blood is present on a dark background, for example, a dark fabric, it might be invisible for the naked eye. Several visualization, presumptive, and confirmatory blood tests have been developed and evaluated [3-9]. The potential presence of blood on a dark background can be visualized by an alternate light source such as Polilight [10,11].

Materials and Methods

Detection of blood in stains

Preliminary screening tests

Principles

These tests are based on the observation that blood hemoglobin possesses peroxidase-like activity. Peroxidases are enzymes that accelerate the oxidation of several classes of organic compounds by peroxides. When a colorless reagent and hydrogen peroxide are added to the blood stain,

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the hemoglobin in blood will cause the formation of different colors. In luminal test the presence of blood is indicated by luminescence. Several methods as detailed below are practiced for detecting blood, present in minute quantities. Among them, Benzidine test is used in the laboratory.

Benzidine test

A small piece of stained thread or a small quality of stained material is taken on a white glazed porcelain tile. Two drops of benzidine reagent are added. Mixture is allowed to react for half a minute. Few drops of hydrogen peroxide are added (Figure 1).

Conclusion

The presence of blood is indicated by the development of intense bluish green color almost immediately

Confirmation test of blood

The presence of haemoglobin and its derivatives in blood stains indicated by the screening test is confirmed by any of the following tests.

Principle

These tests are based on the formation of crystals by haemoglobin derivatives. Haemen and Haemochromogen with different salts (acetate and nitrogen bases) in acidic or alkaline aqueous medium.

Two types of confirmatory tests are in use and are as described as:-

Teichmantest (Haemen Test)

A stain portion is taken in a porcelain dish and soaked in normal saline for few minute and a few drops of acetone are added. One drop of the extract is taken on the microscope slide. A drop of 10% Hydrochloric acid is added to it. The mixture is covered with a cover slip and observed under the microscope (Figure 2).

Conclusion

Brown rhombohedron shaped acetone chlor-haemin crystals are seen confirming the blood.

Haemochromogentest (Takayama Test)

A stained portion is taken in a porcelain dish and soaked in normal saline for few minute. One drop of the extract is taken on microscope slide. One or two drops of Takayama reagent are added. The mixture is covered with a cover slip and warmed gently and allowed to cool. Examine under the microscope (Figure 3).

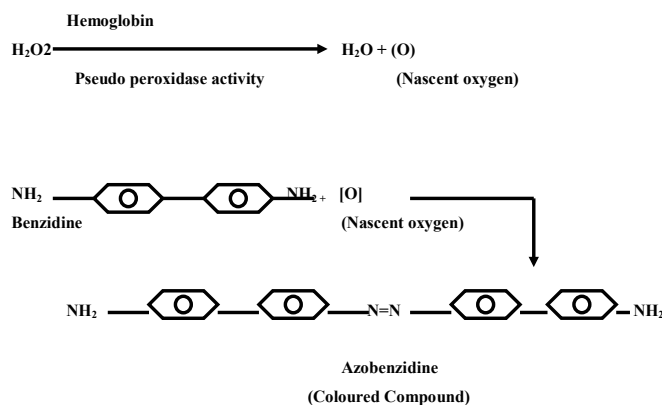


Figure 1: Benzidine test reaction mechanism.

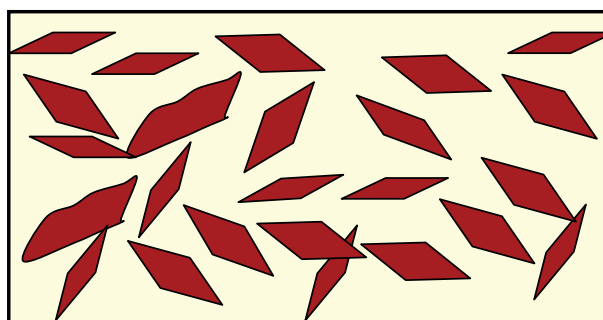


Figure 2: Haemin crystals.

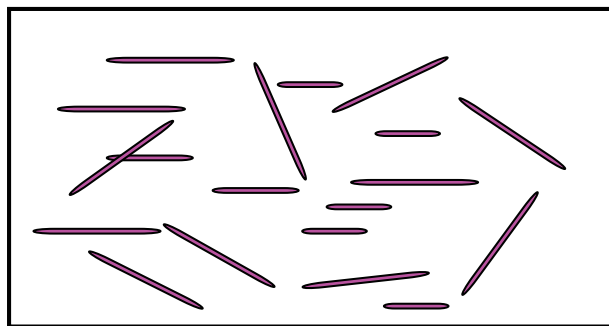


Figure 3: Haemochromogen crystals.

Conclusion

Salmon, pink colour niddle shaped crystal of pyridine haemochromogen are observed under microscope confirming the presence of blood.

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