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1. Learning Outcomes

After studying this module, you shall be able to know about-

- Photographic Chemistry
- Application of Photography to different crime scene
- Photographic Specific Crime Scenes

2. Introduction

Today, a digital camera or mobile phone etc. has revolutionised our thoughts and made it most convenient for us to take a picture of any person, accident or crime site or any other special situation, which we want to record in a better way and quality is much better. The same image or picture can be uploaded on to the net (website) and can be shared with our friends in just a moment. But when photography started, it used to spend hours and a lot of money to take a photograph without any guarantee of good quality, which would come out very blurred.

3. Photographic Chemistry

In Photographic chemistry, the photographic film and paper was treated with the chemicals after exposing them to light to produce a negative and positive image. This chemical processing transforms the latent image into a permanent visible image. Practical photographic chemistry was first devised in 1830 by Louis-Jacques-Mandé Daguerre of France and by William Henry Fox Talbot of England. According to method of Daguerre's, a silver iodide-coated silver plate was exposed to light in a camera, which decomposed the exposed silver iodide to metallic silver and iodine. A clear permanent image was obtained by treating the plate with the vapors of mercury i.e. by amalgamation of the silver. The remaining silver iodide was removed by rinsing it with a strong salt solution. A positive image become visible by holding this "Daguerreotype" in oblique light against a dark background, so that the amalgamated silver zones appeared bright and the silver plate appeared dark.

Photographic film was made up of a nitrocellulose strip. Many layers of silver iodide were also coated - each layer with a different dye. Each dye responds to light of a certain colour only.

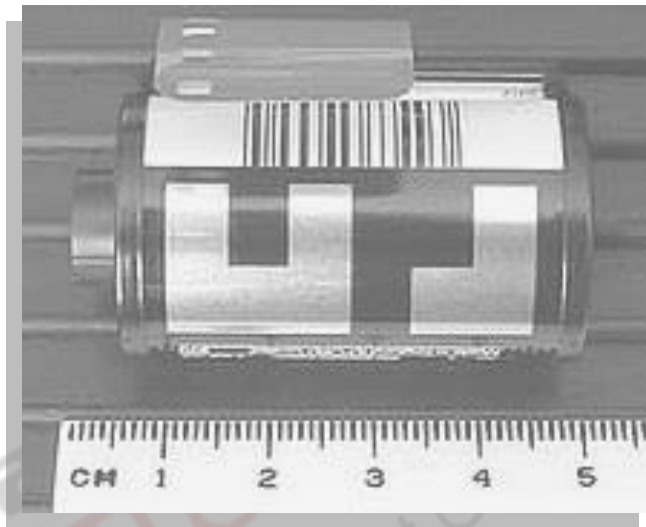


Fig-1: Showing Film Cartridge Case



Fig-2: Showing Black And White Film (135)

How an image is formed?

Film was media to record image in cameras. Photographic film was discovered in 1727, when Johann Henrich Schulze mixed chalk, silver, and nitric acid in a flask to make silver nitrate. When this solution was exposed to sunlight, colour changed from white to purple. As mentioned above Louis Daguerre, after creating a photographic process in which iodine liquid was placed over a silvered copper plate, and exposed to light. The liquid iodine in the form of emulsion, or light-reactive chemical and the copper plate become the base for these photographs are called “daguerreotypes”. Daguerreotypy was the ‘wet plate’ process was little awkward and cumbersome to use.

Film placed in a camera has a chemically reactive material that records a fixed image, when the film is exposed to light. It is prepared by coating the base with a hot suspension or emulsion of silver (Ag) salts and allowed it to cool. The light-sensitive emulsion basically consists of silver (Ag) salts grains suspended in gelatin. After this the gelatin was allowed to dry to form a thin hard layer. The salts used were silver chloride (AgCl), silver bromide (AgBr), and silver iodide (AgI). They could be used individually or in combination.

When a light falls on the silver halide particles some of the light is absorbed at places where silver halide grains are present, becomes activated. The activation of some of the Ag halide grains in the emulsion produces the latent image. Similarly, the places lacking any silver halide grains don't undergo any light absorption which leads to formation of latent image when exposed to daylight. The latent image was not directly visible so it needs to be treated chemically before it can be exposed to light, viewed, and preserved. This step of the process is known as development.

4. Development of the Film

The following items are required to develop the photographic film:

1. Exposed film roles
2. Developing tank
3. Thermometer
4. Scissors to cut the film roll from the cassette
5. Can opener
6. Developing solution
7. Fixing solution
8. Hypo cleaning solution
9. Beaker or measuring cup
10. Containers to mix chemicals
11. Negative carrier

After collecting all the required accessories, developing and fixing solutions are prepared. The photographic film has to be developed with developer chemicals (diluted with water as per instructions). The developer acts on the activated silver halide grains, and further reduce them to metallic silver leaving unexposed part unchanged. Thus the exposed part appears black and the unexposed part appears white or grey. The contrast between these two types of particles forms the silver image.

Expose the film to intense light convert all of the remaining Ag halide to Ag. To develop permanent image it should be fixed with *photographic fixer solution* mixed with hypo solution as per instructions mentioned. It dissolves halides and removes it from the emulsion without affecting the Ag. Then the fixer is thoroughly washed out of the film so that no traces of fixer are left, before the film is dried. Now the image becomes permanent. Commonly used fixer is sodium thiosulphate.

After removing it, negatives are hanged in a clean dust free area so that nobody touches the negatives with dry fingers, but wet your hands in solution and lightly run fingers along drying film to remove excess water. Negatives will be ready to be used at least after 2 hours again.

5. Development of the Film as a Positive

The photographic negative is directly converted to positive by bleaching rather than fixing it. In the bleaching step a chemical is used which dissolves the Ag grains and removes them from the emulsion leaving the Ag halide behind. The areas which have Ag appear transparent after this treatment. In the next step, the remaining Ag halide is exposed to light to activate it so that it can be developed to yield a dark silver image in the areas that received no light during the original exposure. Hence, a positive transparency is formed.

Printing

The most common means of producing photographic positives is through printing. Printing is much like re-photographing the negative. Since the second photographic process produces a negative of the negative, the result is a positive. The simplest printing process is contact printing. Here the negative is placed in contact with an unexposed light-sensitive material such as film or an emulsion-coated paper as the first step in producing a contact print. The light-sensitive material is then exposed by shining light through the negative. The areas that receive the light are those that lie under the clearer areas of the negative. These appear as the darker areas in the print and correspond to the darker areas in the original subject. The exposed material result is processed which forms a positive.

To have comparatively bigger image and the process is called enlarging/magnification is used. Here the negative is placed in a special projector known as an enlarger. The enlarged image of the negative is projected onto a piece of sensitive material, such as photographic paper, which is then developed to produce a print.

A selection of printing papers is available in different contrast grades. This allows the photographer to control the contrast during printing. Additional control of contrast is possible by careful selection of exposure and development times during printing. A nearly infinite number of combinations of exposure and development times can be used to produce an image of normal density (degree of darkness) in the print. However, the contrast can vary markedly depending on the particular combination used. In general; short exposure times coupled with longer development times results in increased contrast, whereas longer exposure and shorter development times produces the opposite effect. The use of this means of controlling contrast coupled with the use of different strength developers and the availability of a selection of papers with different contrast grades provides the photographer with the means of controlling contrast over a considerable range.

6. Modern Photography

Photography now a day's uses cameras containing arrays of electronic photo detectors to capture images focused by a lens. Two major types of image sensor used nowadays are CMOS and CCD. Sensors are performing the similar function as was done by the film in early days, in the sense that like film the sensor is exposed to light that comes through the lens and it records that exposure. The exposure is then processed and saved to flash memory (generally an SD or Compact Flash card). The caliber and size of the sensor are also very important, as these things significantly impact the quality of photos.

7. Application of Photography to different crime scenes

A. Purpose of Crime Scene Photography

1. One of the best means to record crime scene.
2. To record the original scene i.e. exact location of crime scene and related areas.
3. To record the initial appearance and exact location of physical evidence at the crime scene.
4. To record the point of Entry
5. Recognised and marked evidences can be photographed first before the collection process start.
6. It will provide investigators and others with permanent visual record of the whole crime scene for later use in the investigation.
7. Photographs are also produced in court trials and hearings to authenticate the verbal statements.
8. In case of accident scene, the photographs should be clicked to fix the location where accident took place; registration number of the vehicle involved; and other marks which can be useful in finding the cause of accident
9. All the close-photographs must be taken by putting at least one scale if not two.
10. If possible two or three photographs of the viewer must be taken.
11. To record the point of Exit
12. Vehicle used to reach and get away from the crime scene
13. Track Marks if any

B. Admissibility of photographic evidence

The photographs must qualify the following major points to be admitted by the court of law:

1. Photographs of the objects must be material or relevant to the point of issue.
2. The close up photograph must be taken by putting one or two scales and should not appeal to the emotions or tend to prejudice the court or jury.

3. There shouldn't be any alteration, distortion and not misrepresent the scene in the photograph or the object it purports to reproduce.
4. There shouldn't be any alteration in the photographs.

8. Photographic Specific Crime Scenes

Each and every crime scene is unique and has unique characteristics. So, different types of photographs are required for different crime scenes and these are always decided by the investigator present at the crime scene and based on his experience.

Different crime scenes and the types of photographs required have been discussed as follows:

- **Homicide**

1. Use colour photographs
2. Photographs (example: homicide inside a residence)
 - I. Exterior of the building
 - II. Evidence outside the building
 - III. Entrance into the scene
 - IV. Room in which the body was found
 - V. Adjoining rooms, hallways, stairwells
 - VI. Body from five angles
 - VII. Close-up of body wounds
 - VIII. Weapons
 - IX. Trace evidence
 - X. Signs of activity prior to the homicide
 - XI. Evidence of struggle
 - XII. View from positions witnesses had at time of the crime
 - XIII. Autopsy

- **Suicide or other dead body**

If there is any doubt, photograph the scene as a homicide and the marks pointing towards the suicide may be included.

- **Burglaries**

1. Photographs (residential or commercial burglaries)
 - a. Exterior of building
 - b. Point of entry
 - c. Entrance into scene
 - d. Interior views
 - e. Area from which valuable articles were removed
 - f. Damage to locks, safe, doors, tool marks.
 - g. Articles or tools left at the scene by the suspect
 - h. Trace evidence
 - i. Other physical evidences such as tool marks etc.

- **Assaults, injuries**

1. Photographing injuries
 - a. Face of victim in the photographs
 - b. Bruises
 - c. Bite marks
 - (1) Orientation shot
 - (2) Close-up at 90 degree angle to avoid distortion
 - (3) Ruler in same plane as bite mark
 - (4) Focus carefully
 - (5) Bracket exposures

2. Equipment
 - a. Always use colour film and no filter
 - b. Use colour charts and rulers
 - c. Flash unit with diffused lighting

- **Traffic Accidents and Hit and Run Cases**

1. Photographs at the accident scene

- a. Where the vehicles came to rest and its position
 - (1) Photographs should show the relationship of every vehicle with each other
- b. Damage to vehicles
 - Technical photographs of damage to a vehicle
 - Do not take any oblique or corner photographs to show damage for reconstruction purposes because they are not aligned with the axis of the vehicle. They tend to conceal the amount and direction of the damage.
 - Take six photographs. Take one of each end of the vehicle, straight on. If possible take one more from overhead.
 - Use electronic flash to fill in shadows within the damage
 - Debris or marks on the roadway
 - View each driver had approaching the key point of the accident.
 - View from the point a witness observed the accident, at witness eye level.

- **Sexual assault Cases**

- Photograph the scene
- Record the location of the crime scene
- Record the type and location of the vehicle used to reach crime scene
- Record the exact position of the articles including the furniture.
- Photograph the point of entry and other evidences like foot/foot wear print
- Photograph the point of exit and other evidences like foot/foot wear print
- Recording of position and location of the stains of blood, semen and pubic hair etc.
- Undergarments or clothes and condoms etc. if present
- Recording of semen stains with UV photography

- **Bride burning cases**

- Photograph the scene
- Record the location of the crime scene
- Record the type and location of the vehicle if used to reach crime scene
- Record the exact position of the articles including the furniture.
- Photograph the point of entry and other evidences like foot/foot wear print
- Photograph the point of exit and other evidences like foot/foot wear print
- Recording of position and location of the stains of blood, and hair etc.
- Original position and location of the body, if available
- Recording of the soot or signs of burning

- Type of accelerant used
- Sign of struggle
- Container used to bring accelerant, if available

- **Arson Case**

- Photograph the scene
- Record the location of the crime scene
- Record the type and location of the vehicle if used to reach crime scene
- Find exact point of origin. Type of accelerant used
- Container used to bring accelerant, if available
- Match stick, lighter etc. if available
- Record the exact position of the articles including the furniture.
- Photograph the point of entry and other evidences like foot/foot wear print
- Photograph the point of exit and other evidences like foot/foot wear print
- Recording of position and location of the stains of blood, and hair etc.
- Original position and location of the body, if available
- Recording of the soot or signs of burning.

9. Summary

1. In Photographic chemistry, the photographic film and paper was treated with the chemicals after exposing them to light to produce a negative and positive image. This chemical processing transforms the latent image into a permanent visible image.
2. Photographic film was made up of a nitrocellulose strip. Many layers of silver iodide were also coated - each layer with a different dye. Each dye responds to light of a certain colour only.
3. The photographic negative is directly converted to positive by bleaching rather than fixing it. In the bleaching step a chemical is used which dissolves the Ag grains and removes them from the emulsion leaving the Ag halide behind. The areas which have Ag appear transparent after this treatment.
4. The most common means of producing photographic positives is through printing. Printing is much like re-photographing the negative. Since the second photographic process produces a negative of the negative, the result is a positive.
5. Each and every crime scene is unique and has unique characteristics. So different types of photographs are required for different crime scenes and these are always decided by the investigator present at the crime scene and based on his experience.