

USE OF ULTRAVIOLET LIGHT IN CRIMINOLOGY INVESTIGATION

General Information

The Nature of Black Light - Black light is longwave ultraviolet radiation suitably filtered to eliminate most of the visible portion of the spectrum produced by the light source. The Blak-Ray® lamp is a source of longwave ultraviolet (black light) radiation in the range of 3200 to 4000 Angstrom (Å) units with a peak of 3600 Å units. This is also known as 365 nanometers (nm).

Luminescence - When an object absorbs energy, either visible or invisible, and converts this energy into visible light, this conversion of energy is called luminescence, or "cold light". The types of emission seen emanating from luminescent object are normally either fluorescence or phosphorescence.

1. **Fluorescence** - Fluorescence is visible light produced by an object instantaneously. When the exciting source of energy is removed, the light produced will cease instantaneously. Fluorescent emission is the phenomenon normally encountered in inspection work.
2. **Phosphorescence** - Phosphorescence is the continued emission (afterglow) of visible light by an object after removal of the exciting source of energy. Heat and cold sharply influence this phenomena.

Distinguish Fluorescence from Non-Fluorescence - The longwave lamp, utilizing a filter to remove visible radiations of light, will allow a small degree of visible blue light to pass through the filter. The blue light, which is reflected from a white surface may be mistaken for blue or purple fluorescence. Observe the daytime colors of the object being inspected and you will soon be able to distinguish the difference between the reflected light and fluorescence.

Operating Current - Current: Blak-Ray lamps operate on 115V, 50-60 Hz AC. 230V units are also available. Battery Operation: Portable Lamps operate on two 6-volt batteries (non-rechargeable) and Rechargeable Lamps operate via the standard operating current or the internal lead acid battery, which is rechargeable by plugging the lamp into a wall outlet or with the 12V adapter plugged into an automobile cigarette lighter. Refer to UVP's catalog for lamp specifications.

Maintain Uniform Technique of Inspection - Color and brightness of fluorescence are affected by the distance between the Blak-Ray lamp and the fluorescent materials. This variation should be considered in inspection of similar materials. When experience has taught an inspector what distance gives the sharpest and brightest fluorescence, this distance should be maintained in subsequent inspections of similar materials.

Properly Classify Fluorescent Color - Many fluorescent colors have a whitish appearance. It is best to describe the color seen as light or deep bluish-white rather than to call the colors light or deep blue. A specific color should be used in descriptions only when the sharpness and hue of that color is clearly distinguishable by sight. Color discrimination of a fluorescing object can be made very exacting by viewing through the Wratten filters such as Red A No. 25, green B No. 58, blue C5 No. 47. If the fluorescent objects can be seen through one of these filters, the fluorescent emission definitely contains color radiations which are within the transmission band of that particular filter.

Determine Influence of Background on Fluorescent Color - Fluorescent colors, emitted by material under black light, are in many cases modified visually and chemically by the nature and color of the background against which it is viewed. Detection of rodent urine stains on sacking is a good example of this effect. On unbleached muslin, it will fluoresce a yellowish white. On bleached muslin it will fluoresce a bluish-white because of the fluorescence of the surrounding treated cloth. On dark colored burlap sacking, it will fluoresce an obvious yellow white with less brightness than on the white sacking. Care should be taken to analyze the influence of surrounding objects and materials.

Use a Confirmatory test when Possible - Black light serves as a means of identifying fluorescent objects or of indicating trouble and contamination. Chemical tests, bacteriological tests, or fluorescent tracers should be used wherever possible as a secondary means of identification. Example: the black light fluorescence will point up a source of contamination, i.e., fluorescent droplet pattern characteristic of rodent urine. A secondary chemical test should then be made to confirm this observation, i.e., the presence of urea can be tested by the use of bromothymol blue urease test paper. The black light, in this case, located the contamination., The chemical test will prove the presence of the urine. Only by the following this procedure will black light inspection become a more exacting science.

Inspection of Clues - Under ultraviolet light many clues will reveal a good deal of important information about the criminal. When the object is examined under ordinary light -- lipstick traces, for example, too minute to be seen, will fluoresce under black light. There are over 3,000 substances that have a characteristic fluorescence, so it is advisable to inspect all clues and objects at or near the scene under ultraviolet black light. Oil and grease spots fluoresce distinctly as do tires. In some cases, tire tracks may become visible under black light. Sputum, semen and urine that may not be seen unassisted become easily traceable under black light.

Tiny particles, too small to be noticed ordinarily, will reveal themselves under black light. Hair, skin particles, cosmetics, and material lodged under fingernails may hide fluorescent clues.

Also, not to be overlooked are the mineral characteristics of the soil in the area of the crime which may be identifiable by their fluorescent qualities and compared with soil from suspect's shoes, clothing, tires, etc.

CRIMINOLOGY APPLICATIONS

Detection of Persons Sounding False Alarms - Alarm boxes can be dusted with invisible fluorescent powders or pastes provided in these kits. Other items include unburned hydrocarbon oil, paraffin or almost any other wax.

By inspecting suspect's hands under UV light, fluorescent powder, paste, etc, will identify the culprit. Most persons sounding false alarms have been known to stay in the vicinity of the alarm box and the use of Blak-Ray Lamps can be used to check hands and clothing of people in the vicinity.

Tampered Documents Detection - Invisible fluorescent powder may be sprinkled over documents in question. Any tampering with documents will reveal evidence to that effect. Examination of suspect will reveal traces of powder even after hands have been washed, as the powder will cling to fingers and through contact, may get on clothing and into the hair of the culprit.

Inspection of Questioned Documents - Analysis of documents, letters, etc. under ultraviolet lamp, or viewing cabinet, will bring out faded signatures, erasures, changes in original copy, and invisible markings, codes or messages. The ultraviolet lamp and/or viewing cabinet may also aid in the identification of similar paper and disclose some invisible artificial water marks. Invisible codes or messages are usually written with such fluorescent substances as quinine, lemon juice, egg white, aspirin, urine a centanilide (cold tablets), or specially prepared inks. In penal institutions, prisoners may also use saliva, milk soap suds limewash from walls, ferrous sulphate, and potassium ferricyanide.

Autopsy - An important aid in both personal identification and in determining cause of death. Ultraviolet light fluoresces scar tissue and also aids in determining its cause.

Stigmas and other characteristics relating to the occupation of the deceased (calluses, for example) are frequently more easily apparent under UV light an ordinary light. Nasal secretions, fatty generative tissues, burns, stains, trauma of various types, obliterated tatoos, and semen are also fluorescent.

Coin Box Tampering - The interior of coin boxes of public telephones, soft drink dispensers and other coin operated machines can be coated with invisible fluorescent powders or pastes included in criminology kits. Suspect's hands and clothes under examination with Blak-Ray Lamps will determine guilt. In-plant security also may use variations of this method to prevent recurring vandalism or sabotage.

Money Transactions - Narcotics transactions, kidnapping, blackmail, counterfeiting, gambling, smuggling and other crimes in which it is essential to prove the actual payment of money may be served with the use of invisible fluorescent powders, inks, pastes or invisible markings on the bills being exchanged. Invisible ultraviolet markings on the bills being exchanged will definitely establish the money as that used in the illegal transaction. If fluorescent powders are used, the powder will also be visible under black light on the hands, wallet or pocket of the recipient of the money.

Use of Firearms and Weapons - Again, role of powders and pastes can play an important part in establishing the facts regarding injuries or fatalities. Fluorescent pastes applied to blackjacks, for example, will establish whether the injury was caused by the officer or one of the participants of a brawl. Examination under ultraviolet light will reveal fluorescent particles in the wounded area if the injury was caused by the officer's blackjack or night stick. Fluorescent pastes applied to the nose of bullets similarly aids in establishing whether the injury or fatality was caused by the officer's gun.

Silver Nitrate Acceleration - can also be accomplished with the aid of the UV lamp. By shining the lamp on silver nitrate applied to the weapon in question, the UV radiation will substantially shorten the reaction time.

Repeated Burglaries - The use of invisible fluorescent pastes or powders at locations where contact is probable, points of entry, floors, window sills, safe doors, etc. has proved most valuable in apprehending burglars. If left undisturbed, the past or powder will remain active for more than a year. Patrol cards equipped with portable UV lamps can spot fluorescence on clothing or hands of suspects.

Petty Theft/Shoplifting - Fluorescent pastes or powders placed on articles frequently involved in petty thefts or shoplifting are invaluable in establishing both the thief and the theft.

Sex Crimes - The fluorescence of semen under UV light can assist in determining whether or not rape took place. Other clues which show distinct fluorescence under UV light, oil stains, hair cosmetics, for example, can also be compared to determine a suspect's guilt.

Narcotics - Crops of marijuana can be dusted with fluorescent powders and kept under surveillance until it is sold. The fluorescence under UV light will offer positive evidence of the source of the marijuana. The use of fluorescent powders to prove a transaction in narcotics is discussed under "Money Transactions".

Espionage agents must use some form of communication to receive orders and pass on information, written material is usually involved. Under UV light, secret markings are usually apparent, for on most papers, writing with pure water, alters the paper so there is a detectable difference under the lamp. Many chemicals that

appear colorless and invisible in sunlight or artificial white light become visible when exposed to UV light.

Kidnapping - UV lamps and invisible marking aids can be of great service in apprehending the kidnapper without jeopardizing the life of the victim. Ransom money can be invisibly marked for identification and the area surrounding the contact point dusted with invisible fluorescent powders. Banks equipped with UV lamps can aid in tracing the passer of the money, and the invisible powder on their shoes, clothing, hands or hair of a suspect can place him at the scene of the crime.

Forgeries and Altered Checks - Any tampering with checks becomes immediately apparent under ultraviolet inspection. In addition, where an invisible ink ...

Censorship - In penal institutions secret messages are easily detected if ultraviolet lamps are used scan mail to and from prisoners.

Theft - In high crime areas where suspected or obvious theft is committed, window sills, file cabinets, door handles and drawer handles, in addition to the items of importance or value may be coated with invisible fluorescing material that would not only rub off on the clothing, shoes, hands of the thief, but indicate to the security agent, who periodically examines "traps" that someone has entered or broken into the area or building in question.