UTILISATION OF ULTRAVIOLET LIGHT FOR DETECTION AND ENHANCEMENT OF LATENT PRINTS

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ABSTRACT: Detection of latent fingerprints on wide surfaces and being able to develop them without damaging other evidences like body fluids, small fragments, hair or handwritings on questioned documents are two serious problems for the the crime scene examiner. Conventional dusting technique, though it is very flexible, may cause contamination in most cases. In addition, the result of the misapplication of dusts-including SPR, superglue fuming or ninhydrin aerosols may be a lost or irrevocably destroyed print.

In this study, we aimed to detect the latent fingerprints encountered frequently in laboratory examinations on smooth and non porous surfaces by using the reflected ultraviolet imaging system (RUVIS). This portable device, which makes use of a short wave ultraviolet lamp as the light source, seemed to be a good solution for the detection. On porous surfaces, for which RUVIS alone is not an effective tool, we had the chance to visualise prints after CA (cyanoacrylate) treatment.

KEY WORDS: Ultraviolet light; Reflected ultraviolet imaging system (RUVIS); Cyanoacrylate (CA).

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In forensic examination of evidences, scientists make use of all types of light sources. From narcotics to document examination, in all fields of forensic science, it is possible to practise techniques that are related to light.

Both for detecting and enhancing of the prints, different wavelengths of the spectrum are offered to the fingerprint examiner. Especially after cyanoacrylate treatment, for the visualisation of prints, almost every expert applies chemical dyes and fluorescence examination.

Some types of chemical constituents and contamination fluoresce in latent prints. As we know, fluorescence is a property of some chemicals that are able to absorb light and then emit this absorbed energy as light of different wavelength. Besides, it is probable to dye these prints with chemicals like basic yellow, rhodamin 6 G and with the help of additional filters to get better and sharper images.

In contrast, some chemicals like ninhydrin and blood absorb light but do not emit after that absorption. The prints that are treated with such chemicals can be seen as dark images on bright and fluorescent surfaces.

Therefore, the surface to be examined is illuminated with light in the short wavelength of the spectrum and viewed through filters that only transmit light of a longer wavelength. We can easily say that, in the case of using visible light, fluorescent treatment and enhancement by background fluorescence are generally more productive than fluorescence of untreated prints.

Since most of the developing methods need laboratory conditions, it is not always so easy to develop the fingerprints with chemicals at a crime scene. On the other hand, even though the classical dusting technique is very effective, the application of it on wide surfaces may cause a mess. At that point, ultraviolet light provides the fingerprint examiner with an easy solution for the detection of prints.

ULTRAVIOLET LIGHT

Ultraviolet light, in other words ultraviolet radiation, is a form of energy that occupies a small portion of the electromagnetic spectrum. This radiation is produced by natural sources, such as the sun, and artificial ones, such as black light tubes, mercury vapor lambs, and electronic flashes, and it is often accompanied by visible light.

Ultraviolet is characterised by its wavelength. Ultraviolet radiation extends from approximately 180 nm to 400 nm (visible light extends from 400 nm to 700 nm, and infrared radiation from 700 nm to 1200 nm).

The ultraviolet portion of the spectrum has been commonly divided into three regions:

- short wavelength – also known as far ultraviolet and extends from 180 nm to 280 nm. It is used in sterilisation, chromatography, mineralogy and photochemical reactions;
- medium wavelength – extends from 280 nm to 320 nm. Medium wave UV is not transmitted by ordinary photographic lenses; a quartz lens is required. Sun lamps are artificial sources for this type of radiation and it is used for cosmetic and therapeutic purposes;
- long wavelength – also known as near ultraviolet and extends from 320 nm to 400 nm. This UV region is produced by portable lamps and can be very beneficial to the forensic identification specialist.

THE APPLICATION OF UV FOR THE DETECTION OF FINGERPRINTS

From the researchs performed at the laboratory we know that UV itself alone is not an effective tool for detecting untreated prints. However RUVIS, the acronym used for reflected ultraviolet imaging system, makes the visualisation of untreated or superglue fumed latents possible. Ruvis has been developed by the Japanese National Police and extends forensic examination capabilities into the portion of light spectrum below 360 nm. A 105 mm ultraviolet lens and an intensifier are the main parts of this device. As the light source we make use of a portable short wavelenght (254 nm) UV lamp.

We can observe and detect the untreated prints on smooth and non porous surfaces just by using UV and the main unit of RUVIS. From the experiments carried out we know that 90% of all untreated prints on smooth and non porous surfaces can be visualised with this technique. If we want to photograph them it is easy to connect a camera to the main unit.

As we all know, the instruments used in forensic examinations are becoming more and more computerised everyday. So, the main unit may be integrated with a computer and the images can be captured. This way is also appropriate for laboratory usage.

THE HAZARDS OF ULTRAVIOLET RADIATION

Ultraviolet light is invisible and prolonged exposure of unprotected eyes and skin can be very dangerous. Any damage will be dependent upon the exposure time, intensity of radiation, the wavelength and the individual's sensitivity.

This radiation can cause photokerato-conjunctivitis (arc-eye), which is painful but does not usually result in permanent damage. Ultraviolet and infrared promote the formation of cataracts. There are several means of preventing eye damage. We may wear UV protective goggles or we may use protective shields both for eyes and the face. Even when the eyes are protected, no one should ever stare directly into the beam.

Ultraviolet also causes erythema (reddening of the skin) and is responsible for some incidence of particular types of skin cancer. For the safety of hands and skin, latex gloves, long sleeves, and lab coats should always be worn.

CONCLUSION

As we mentioned above, florescence examination of fingerprints with visible light sources is carried out by almost all forensic laboratories. Examination with visible light needs chemical developments, such as application of cyanoacrylate and chemical dyes, which means laboratory conditions and consumption of time. It is not possible to carry out this type of florescence examination at the crime scene. For this reason, the crime scene examiner should perform it in the laboratory.

However, for the crime scene examiner it is not so easy to send all types of evidences that have fingerprints on them. The facility to detect and to visualise the prints at the crime scene helps the examiner save time and provides more safety for the protection of prints by eliminating the risk that may occur in packaging and transportation process. RUVIS gives the fingerprint examiner an opportunity to visualise the untreated print on a smooth and non porous surface.

If we do not have the chance to visualise an untreated print just by using RUVIS alone, it is possible to apply CA (cyanoacrylate) and obtain the image of it after that treatment. The application of superglue is easier with portable superglue devices and superglue bags now, and these treatments can be carried out at the crime scene. The imaging process by using RUVIS is so successful that in the research we carried out all the prints treated with CA could be imaged in that way. Images of the latents on porous surfaces can also be acquired in most cases with RUVIS after CA treatment.

The application of fingerprint powders may contaminate biological residues. However, UV does not interfere with forensic examinations carried out for the detection of body fluids (we do not have enough data about its effects on DNA profiling). In addition to this benefit, on multi-colored surfaces we may obtain clear images without computerised enhancements, which means saving time.

When we examine prints imaged with UV and visible light, we can easily observe that the ridges of the fingerprints which enhanced with fluorescence technique shine and lose their clearness. A light bulb is a good example of it. The bulb can be observed by the examiner very easily, but the sides of it are not as sharp as any other object that can only be seen because of reflection of the light produced by surrounding sources. However, ridges of the prints imaged with UV can be seen as sharper images, just like the objects which we observe due to reflection of light.

TABLE I. ADVANTAGES AND DISADVANTAGES OF RUVIS

ADVANTAGES	DISADVANTAGES
Available for crime scene examination. Can be carried out in a short time. Initial examination is more productive than other techniques. Does not interfere with forensic examinations of body fluids (no data about DNA profiling). On multi-colored surfaces we may obtain clear images without computerised enhancements. The ridges of the print can be seen sharper.	Personal protection is of great importance and more difficult than the examination with visible light.