Bloodstained Footwear Impressions: Leuco Crystal Violet Development Compared to Digital Infrared Photography[1]

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The purpose of this presentation is to compare the use of Leuco Crystal Violet (LCV) to digital infrared photography to enhance blood stained footwear impressions. Latent and partially visible blood stained footwear impressions are difficult to visualize on dark or multi-colored fabric due to a lack of contrast between the dark colors and blood which could easily be overlooked. Digital infrared photography, a nondestructive technique, should be used to enhance blood stained footwear impressions on dark fabrics before chemical tests are applied. Leuco Crystal Violet can be used to enhance blood stained footwear impressions after digital infrared photography. This presentation presents the results of a study that evaluated enhancing blood stained footwear impressions on dark or multi-colored fabric utilizing digital infrared images and Leuco Crystal Violet. Where blood evidence is present there is an increased probability of locating footwear impression evidence when both digital infrared photography and LCV can be used to process the crime scene.

In this experiment, 20 footwear impressions were prepared for infrared photography and subsequently treated with a solution of Leuco Crystal Violet. The colorless solution of LCV in the presence of hydrogen peroxide reacts with the hemoglobin in blood and turns violet in color. A variety of fabrics including multi-colored designs and floral prints were selected for testing. All of the fabric samples tested was 100% cotton. The fabric samples were cut into pieces15.24 cm by 35.56 cm (6 in x 14 in) in size.

Blood stained footwear impressions on the fabric samples were collected using the following procedure. A piece of 100% white cotton fabric was placed in a Teflon coated container 22.86 cm by 33.02 cm (9 in x 13 in) and saturated with bovine blood. Each impression was created by contacting the footwear outsole with the presoaked blood stained cotton fabric located in the Teflon coated container. Next, the blood stained footwear outsole was blotted on cardboard. Then the outsole was impressed against a precut fabric sample. The sample impressions were allowed to air dry at 20° C (68° F) for 24 hours. Once dry, both color and infrared digital photographs were taken to enhance the impressions.

The samples were then treated with a solution of LCV. The LCV solution was prepared by adding10 grams of 5-sulfosalicylic acid in 500 mLs of 3% hydrogen peroxide and 4.4 grams of sodium acetate. 1.1 grams of Leuco Crystal Violet was added and mixed. Each sample was sprayed with the LCV solution using a spray bottle while holding the sample in a glass dish at a 45-degree angle. The samples were then dried at 20° C (68° F).

Digital infrared images were made with a 35 mm Nikon D-70 camera with an 18-70 mm f 3.5 Nikkor lens and a 67 mm Tiffen #87 infrared filter. The jpeg fine setting with a medium image size was used to record the exposures. The image file size for this

combination of settings is approximately 1.6 mega bytes per image. Experimental camera settings were used to determine the most effective exposure. The lens-to-object distance was 22.86 cm (9 in). The shutter speed was approximately 2 seconds at f - 3.5 using daylight illumination. This procedure provided optimum digital infrared images of the blood stained footwear impressions.

Of the 20 footwear impressions, 7 (35%) had some detail visible without enhancement and 13 (65%) of the impressions had no detail visible without enhancement. Using infrared photography, 9 (45%) were enhanced and 11 (55%) were not. All 20 (100%) impressions were enhanced with LCV. Impressions from19 (95%) of the LCV enhanced images produced visual detail superior to the infrared enhanced images. There was 1 (5%) infrared enhanced image that produced visual detail superior to LCV. Recording LCV enhanced blood stained footwear images is an effective procedure for enhancing blood stained footwear impressions on dark colored fabrics. Leuco Crystal Violet enhanced images of blood stained footwear impressions on fabric produced detailed images more frequently than infrared photography. In view of these results, when infrared photography is unsuccessfully produces detailed images of blood stained footwear impressions and the blood stained impression is not needed for other evidentiary purposes, LCV could be employed to enhance blood stained impressions on dark or multi-colored fabric.

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