



B161 Detection of Recent Handling of Firearms

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Attendees will learn how to detect recent handling of firearms by a simple and sensitive color test. The reasons for differences between various individuals in the quality of the marks developed on their palms.

This presentation will impact the forensic community and/or humanity by increasing the number of serious crimes, which are resolved by scientific techniques.

Several physiological and environmental factors that affect the outcome of the Ferrotrace technique have been thoroughly studied. Consequently, two improvements, which greatly enhance sensitivity, have been suggested.

Handling of a gun results in the formation of invisible impressions, caused by transfer of iron traces to the skin surface. Visualization of these impressions is possible by spraying the palms with a solution of 3-(2pyridyl)-5,6-diphenyl-1,2,4-triazine (PDT), which forms a magenta complex with iron(II) residues.

Quantitative data are reported for the first time on the amounts of iron transferred to the hand upon holding a firearm. Iron levels between 21–315 ng/cm² were found on volunteers' palms after a single holding of a handgun. Determination of the iron traces was accomplished spectrophotometrically using PDT as a chelating agent. The transfer of iron from firearms to the palm was found to be, by and large, a chemical (dissolution) rather than mechanical dislodgement. The prime factor that determines the amount of iron transferred from the firearm to the hand is the moisture level on the palm. More factors, however, are involved in this process. Three time-dependent factors have been studied with relation to their effect on the developed mark: the gripping duration of the weapon; the time that elapses from the moment of contact; and the rate of iron dissolution in aqueous solutions containing sweat components in physiological concentrations.

It was found that the amounts of iron transferred to the palm depend on both, the gripping period and the levels of palmar moisture. Thus, only a few seconds of gripping were required for good marks to develop (corresponding to 80 ng·cm⁻² of iron) on highly-moistured hands ("good acceptors"). Much longer gripping periods were necessary for marks of similar intensity to develop on relatively dry hands ("poor acceptors"). Experiments aimed at studying the effect of sweat components on metallic iron dissolution were carried out in aqueous solutions. It was found that chloride ions in physiological concentrations remarkably enhanced the dissolution, while L-serine, the major amino acid in palmar sweat, had a detrimental effect on this process. These findings are likely to be of importance in courts of law, as well as in the war against terrorism and serious crime.

Two modifications, which have been suggested – splitting the development process into two subsequent steps, and exposing the hand to water vapor – greatly improve the sensitivity of the method.

Several cases that were resolved by the Ferrotrace reagent will be demonstrated.

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