A133 The Effect of pH on Electroylyte Detection of Fingermarks on Cartridge Cases and Subsequent Microscopic Examination

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After attending this presentation, the attendees will learn the basics of fingerprinting on cartridge cases and the difficulties surrounding this field. Attendees will learn about a new fingerprint enhancement technique on fired and unfired cartridge cases without any damage to the subsequent microscopic examinations.

This presentation will impact the forensic science community by providing a novel fingerprint enhancement technique that works with both fired and unfired cartridge cases without any damage to the microscopic striations.

When cartridge cases undergo the firing process, fingerprints on the cartridge can degrade. Both fired and unfired cartridge cases may be found at crime scenes, or potentially linked to crime scenes, and may contain fingerprints deposited when the firearm was loaded. The metallic, non-porous surface does not retain fingerprints well and they are further degraded by the firing process. The two most common techniques used to enhance the clarity of fingerprints on fired and unfired cartridge cases are gunblue and cyanoacrylate fuming. These methods allow for enhanced visualization on unfired cases. Forensic identification officers, using techniques that work on unfired cartridge cases often apply them to fired cartridge cases without much success. However, fired cartridge cases are still encountered and are on the rise in crime scenes, especially homicides. However, there is currently no method for the visualization of fingerprints on fired cartridge cases. A recent study performed by Jasuja and colleagues demonstrated the use of electrolyte solutions to enhance fingerprints on general metallic surfaces including zinc, aluminum, iron, brass, copper, and non-metallic surfaces such as glass and plastic.[1] This technique has not; however, been applied to cartridge cases. Thus, the purpose of this study is to test the effects of pH electrolyte solutions on the enhancement of the clarity of fingerprints on fired and unfired cartridge cases. The effect of the solution on subsequent microscopic examination of striation was also examined. Microscopic examination (MSE) can determine whether the cartridge case originated from a particular firearm; it is therefore important that fingerprint development techniques do not interfere with MSE.

The experiments involved the immersion of both fired and unfired brass cases into various pH electrolyte solutions to enhance the clarity of deposited latent fingerprints based on the study performed by Jasuja over two time periods.[1] The time of immersion was kept constant. The effect of the fingerprint enhancement technique on the microscopic features on the fired cartridge cases by the Centre of Forensic Sciences (CFS) was subsequently examined.

Fired and unfired cartridge cases were immersed in six pH solutions for 24 hours for two trials. In the first trial, the cartridge cases were immersed into the solution three weeks after fingerprint deposition. In trial 2, the cartridge cases were immersed right after deposition. The fingerprint clarity was graded and MSE was performed. In trial 1, neutral pH was the optimal pH and trial 2, no optimal pH levels were found in fingerprint clarity enhancement on both types of cartridge cases. In terms of the first trial, it was found that neutral pH based on statistics worked the best; however, in the second trial, no optimal pH was found statistically. It was found later based on the percentage of developed fingerprints that were considered acceptable by the forensic identification officers, that the top two highest percentages were pH 1-3, 3-5. However, it was found based on these microscopic results that these two pH ranges also had the most adverse effects. The use of neutral pH level is suggested since immersion of the cartridge cases in pH 1-3, and 3-5 affects MSE. However, if MSE is not intended after fingerprint enhancements, pH 1-3, 3-5 should be used as it has the highest success rate in enhancing the fingerprints for both types of cartridge cases.

Reference:

1. Jasuja OP, Singh G, Almog J. Development of latent fingermarks by aqueous electrolytes. Forensic Sci Int 2011; 01 215-222.

Cartridge Cases, Fingerprints, Microscopic Striations

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