



Criminalistics Section - 2016

B200 The Effect of Skin Debris on Gunshot Residue (GSR) Detection

Bryan R. Burnett, MS*, Meixa Tech, PO Box 844, Cardiff, CA 92007-0844

After attending this presentation, attendees will understand that skin debris (keratinized epithelial cells derived from the normal process of desquamation by the skin and skin oil) interferes with detection of backscatter electrons in the Scanning Electron Microscope (SEM) from particles on adhesive samplers.

This presentation will impact the forensic science community by showing GSR particles in an SEM analysis of adhesive hand samplers are missed due to overlying skin debris attenuating or blocking backscatter electrons.

GSR particles as large as ten microns are hidden by skin debris when viewed in the SEM by backscatter imaging with an acceleration voltage of 20kV or 30kV. A bleach solution made of sodium and calcium hypochlorite is used to effectively remove the skin debris revealing GSR particles on the adhesive sampler surface. The GSR particles are unaffected by this treatment.

There are two mechanisms for particle adherence on an adhesive SEM sampler. *Primary transfer* of skin debris and particles occurs while the adhesive surface of the sampler remains sticky. This has been noted to be approximately 30 dabs. *Additive transfer*, where particles accumulate on epithelial surfaces, starts with the second dab and increases with additional dabs. With more than 30 dabs, additive transfer predominates as a means for particle transfer from skin. GSR particles adhering to skin debris are removed from the samplers by the bleach treatment; however, there appears to be little risk of removal of the adhesive-entrained particles from the sampler surface by the bleach solution. The bleach treatment described here should only be used after analysis of an untreated sampler due to loss of particles that are adherent on epithelial cell surfaces.

It is apparent an automated SEM analysis at an acceleration voltage at 30kV of a GSR sampler will reveal more particles than at 20kV; however, particles still may be undetectable (below backscatter electron detection threshold) at 30kV due to the attenuation of backscatter electrons by overlying organic material. The bleach removal of the organics on a GSR sampler will reveal previously undetected particles, regardless of the acceleration voltage.

Hidden GSR may be present for a negative-result sampler due to covering by skin debris. It will take reports of actual case analyses (two analyses: before and after bleach treatment) to ascertain whether it is worthwhile to routinely perform the bleach treatment prior to an initial analysis.

Perhaps in that high-profile case, in which the initial analysis is not significant for GSR, an additional analysis with bleach-treated samplers will change that result.

Gunshot Residue, Skin Debris, Backscatter Electron Imaging