



B29 The Chemical Composition of Gunshot Residue (GSR) of Commonly Encountered Samples in Shooting Events in Kosovo by an Optimized and Validated Scanning Electron Microscopy With Energy Dispersive X-Ray Spectroscopy (SEM/EDS) Method

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Learning Overview: The goals of this presentation, based on the presented results and discussions, are to gain knowledge about the state-of-the-art in the field of GSR analysis and applied classification in different countries, to increase awareness of the forensic scientist regarding the chemical composition of ammunition encountered in shooting events in the Republic of Kosovo, to initiate GSR database development in Kosovo, and to initiate discussion on the classification of GSR particles currently applied in Kosovo.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by exerting a positive effect by describing the current state of GSR analysis in the Republic of Kosovo and the capabilities of the legal science lab in the optimization and validation of the SEM/EDS method, as well as by critically summarizing the findings on the chemical composition of GSR samples commonly encountered in Kosovo. This initiated preliminary study on the GSR database in Kosovo could provide additional information to forensic scientists worldwide.

This work is focused on optimization and validation of the SEM/EDS method for inorganic GSR analysis in samples commonly encountered in shooting events in the Republic of Kosovo. The effect of accelerating voltage (12.5–30kV), working distance (8–14.2mm), spot size (3.5–8), acquisition time (1–30sec), and detector resolution (Amper time 0.12, resolution 179.88, Amper time 3.84, resolution 128.32) were optimized to obtain accurate and reliable GSR identification and composition data. The partially optimized method was validated according to the requirements of the American Society for Testing and Materials (ASTM) 1588-08. The repeatability and within lab reproducibility for Lead, Antimony, and Barium (PbSbBa) particles of 0.5 μ m diameter was 8% Relative Standard Deviation (RSD). The RSD of 100 total PbSbBa particles was 2% in a 4-week study by two operators. The trueness was estimated by bias and sensitivity. Mean sensitivity of the 4-week study was 95% (SD 2) and bias was -5% (SD 2), no false positive was detected, the number of false negatives was between 3 and 7, and the number of true positives was between 96 and 100. The partially modified ASTM 1588-08 method was proved fit for purpose.

Chemical composition of GSRs found in shooting events in Kosovo was determined by the validated SEM/EDS method. Both characteristic three component particles and consistent two components particles were considered. A survey on the chemical composition of particles from shooting events encountered in Kosovo in the past three years was presented.

The results have shown that recently non-toxic ammunition has been used in the Republic of Kosovo. The use of lead-free ammunition has spread worldwide; however, the classification of particles as GSR is still not widely agreed upon. On one hand, the ASTM standard applied in Kosovo states that PbSbBa has spherical morphology to classify particles as a GSR. On the other hand, the European Network of Forensic Science Institutes (ENFSI) standard applied in the European Union (EU) additionally included as characteristic for GSR the particles containing the phases of Gadolinium (Gd), Titanium (Ti), and zinc (Zn) or the phases of Gallium (Ga), Copper (Cu), and Tin (Sn). Currently, ASTM qualification is applied in Kosovo. However, careful study of samples from shooting events in Kosovo revealed the increasing number of cases in which lead-free ammunition was used. This fact requires reexamination of the standards in GSR forensic standards used in the Republic of Kosovo. Moreover, some non-routine elements were also detected in the studied samples. The comparison between GSR composition and chemical composition of cases or cartridges could provide additional information to forensic scientists.

Gunshot Residues, SEM/EDS, Validation