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F.E. Ortega-Ojeda, M. Torre Roldán, C. García-Ruiz

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Short Wave Infrared Chemical Imaging as Future Tool for Analysing Gunshot Residues Patterns in Targets[☆]

F.E. Ortega-Ojeda[*1], M. Torre Roldán[2], C. García-Ruiz[3]

Department of Analytical Chemistry, Physical Chemistry and Chemical Engineering, and University Institute of Research in Police Sciences (IUICP).

fernando.ortega@uah.es

mercedes.torre@uah.es

carmen.gruiz@uah.es;

[*]Corresponding author:

ABSTRACT

This work used chemical imaging in the short-wave infrared region for analysing gunshot residues (GSR) patterns in cotton fabric targets shot with conventional and non-toxic ammunition. It presents a non-destructive, non-toxic, highly visual and hiperspectral-based approach. The method was based on classical least squares regression, and was tested with the ammunition propellants and their standard components' spectra. The propellants' spectra were satisfactorily used (R^2 > 0.966, and CorrCoef > 0.982) for identifying the GSR irrespective of the type of ammunition used for the shooting. In a more versatile approach, nitrocellulose, the main component in the ammunition propellants, resulted an excellent standard for identifying GSR patterns (R^2 > 0.842, and CorrCoef > 0.908). In this case, the propellants' stabilizers (diphenilamine and centralite), and its nitrated derivatives as well as dinitrotoluene, showed also high spectral activity. Therefore, they could be recommended as complementary standards for confirming the GSR identification. These findings establish the proof of concept for a science-based evidence useful to support expert reports and final court rulings. This approach for obtaining GSR patterns can be an excellent alternative to the current and traditional chemical methods, which are based in presumptive and invasive colour tests.

[☆] Edificio Polivalente de Química, University of Alcalá, Ctra. Madrid-Barcelona Km. 33.6, 28871 Alcalá de Henares (Madrid), Spain

[1] Phone + 34 91 8854928

[2] Phone + 34 91 8854907

[3] Phone: + 34 91 8856431. Website: www.inquifor.com.