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## Simple multispectral imaging approach for determining the transfer of explosive residues in consecutive fingerprints

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### Abstract

This novel investigation focused on studying the transfer of explosive residues (TNT, HMTD, PETN, ANFO, dynamite, black powder,  $\text{NH}_4\text{NO}_3$ ,  $\text{KNO}_3$ ,  $\text{NaClO}_3$ ) in ten consecutive fingerprints to two different surfaces – cotton fabric and polycarbonate plastic – by using multispectral imaging (MSI). Imaging was performed employing a reflex camera in a purpose-built photo studio. Images were processed in MATLAB to select the most discriminating frame – the one that provided the sharpest contrast between the explosive and the material in the red-green-blue (RGB) visible region. The amount of explosive residues transferred in each fingerprint was determined as the number of pixels containing explosive particles. First, the pattern of PETN transfer by ten different persons in successive fingerprints was studied. No significant differences in the pattern of transfer of PETN between subjects were observed, which was also confirmed by multivariate analysis of variance (MANOVA). Then, the transfer of traces of the nine above explosives in ten consecutive fingerprints to cotton fabric and polycarbonate plastic was investigated. The obtained results demonstrated that the amount of explosive residues deposited on successive fingerprints tended to undergo a power or exponential decrease, with the exception of inorganic salts ( $\text{NH}_4\text{NO}_3$ ,  $\text{KNO}_3$ ,  $\text{NaClO}_3$ ) and ANFO (consists of 90%  $\text{NH}_4\text{NO}_3$ ).

**Keywords:** Explosive residues, transfer, fingerprint, multispectral imaging

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