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Raman spectroscopy for forensic purposes: recent applications for serology and gunshot residue analysis

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ABSTRACT

The realm of forensics is scientifically complex with multiple disciplines utilizing a plethora of analytical techniques to identify, detect, and differentiate between countless types of evidence for solving crimes. The rapid, highly-selective, and nondestructive method of Raman spectroscopy (RS) has shown continued promise for analysis of many types of forensic samples. The incorporation of chemometrics further enhances the specificity of the RS, and offers the opportunity of automatic data analysis and estimation of error rates, which are important requirements for modern forensic tools. Applications of RS in forensic serology and for the analysis of gunshot residue (GSR) were chosen for this review since RS promises significant advancement of these areas for practical forensics. The studies included here, particularly with the utilization of portable instrumentation, support how crucial RS is to the field of forensic science, and should help facilitate its incorporation for routine sample analysis in the near future.

Keywords: Forensic science, Chemometrics, Trace evidence, Body fluids, Serology, Gunshot residue, Surface-enhanced Raman spectroscopy

1. INTRODUCTION

Forensic science is a continually evolving component of the criminal justice system. With each subsequent year, new discoveries are made and advancements of old technologies come to light. Some are in the form of a proof-of-concept study while others may be a fully-validated technique ready for implementation in an accredited forensic laboratory. It is pertinent to stay at the forefront of emerging and established technologies, as well as establish guidelines to follow. In support of this, a relatively new endeavor by the National Institute of Standards and Technology (NIST) was the establishment of the Organization of Scientific Area Committees (OSAC) for forensic science, which targets the streamlining of forensic disciplines to have more structured

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