The Identification of Controlled Substances by TSERS

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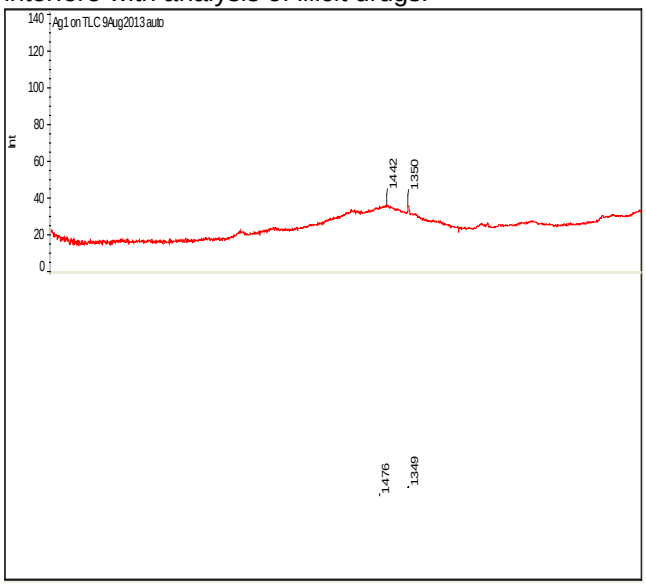
Department of Forensic Sc TJ -0.006 Tc 0.045 Tw -13.554 -1.145 Td [(t)-5(i)-17(m)13(e)-8(,)-9(

The methods used in this research follow these SWGDRUG recommendations. Thin layer chromatography (TLC) from category B and Raman spectroscopy from category A were used to separate and identify the drug samples.

TLC is commonly used as a screening tool in forensic science because it is rapid, inexpensive, and efficient when separating and analyzing components of a mixture. TLC is categorized as a category B technique by SWGDRUG, and is commonly used in forensic laboratories as a screening tool in the examination of controlled substances. This chromatography technique involves depositing the sample onto a planar stationary phase (often silica gel on glass), and using a liquid mobile phase that travels up the stationary phase by capillary action. The components of the sample move at different rates depending on the component's size and affinity for the mobile phase. The ending result is a plate of spots (separat

Figure 6:Normal Raman (red) and SERS (blue) spectra of a TLC plate showing no significantly intense peaks that could interfere with analysis of illicit drugs.



As expected, the SERS spectra for each of the drugs showed significant similarities to their normal Raman counterparts. Figure 7 demonstrates this consistency between the normal Raman and SERS spectra for cocaine. However, some differences can be expected because not all vibrational modes experience the same enhancement with the silver colloid, thus it is recommended that SERS reference spectra be used when doing a spectral identification.

Figure 7: Normal Raman (red) and SERS (green) spectra of cocaine. The normal Raman spectrum was collected from a solid cocaine sample mounted on an aluminum microscope slide; the SERS spectrum was collected on the same sample with the addition of a drop of the silver colloid.

All illicit drugs analyzed in this research proved that identification was not possible using TLC-Normal Raman spectrum due to the low concentration of the drugs after TLC analysis and separation. However, the enhancement provided by the silver colloid enabled direct drug identification on the TLC plate via SERS. In addition, the TLC-SERS spectra were consistent with those of SERS alone, which demonstrated that the process of TLC does not affect a drug's spectrum. These results are shown in Figures 8, 9 and 10 for the illicit drugs cocaine, MDMA and methamphetamine, respectively.

Figure 8: TLC-Raman (green), TLC-SERS (blue) and SERS (red) spectra of cocaine.

Figure 9: TLC-Raman (green), TLC-SERS (purple) and SERS (red) spectra of MDMA.

Figure 10: TLC Raman (purple), TLC-SERS (blue) and