A91 The Application of UV-VIS and Fluorescence Derivative Spectra in the Forensic Analyses of Illicit Drugs

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After attending this presentation, attendees can expect to have a more thorough understanding of the application of derivative Ultraviolet- Visible and fluorescent spectroscopy to the presumptive identification of controlled substances.

This research will impact the forensic science community by providing a method to improve the discriminatory power of Ultraviolet- Visible and fluorescent spectroscopy and evidence to consider upgrading the use of UV-VIS and fluorescent spectroscopy from Category C to Category B in the SWGDRUG guidelines. Furthermore, the ease of use and low cost associated with this method can provide smaller labs with an additional tool with which to analyze illicit drug samples.

Ultraviolet-Visible (UV-VIS) and fluorescent spectroscopy have long been used in forensic science due to the ease of operation and low start-up costs when compared to other instrumental methods, as well as the non-destructive nature of analysis. These methods have been used most frequently in the presumptive identification of illicit drugs due to their low discriminatory power. The current research provides indication that that these techniques may be underestimated in terms of their discriminatory power and therefore underutilized for this purpose. It has been shown that first and second derivative spectra can provide more discriminatory information than just the zero order spectra alone, especially when several different solvents are used. For this research, cocaine salt, crack cocaine, lidocaine, procaine, benzocaine, tetracaine, heroin, morphine, codeine, methamphetamine, 3,4- methylenedioxymethamphetamine (MDMA), methylenediethyl-methamphetamine (MDEA) methylenedioxyamphetamine (MDA), and lysergic acid diethylamide (LSD) were examined. Based on solubility, the drugs were analyzed in at least three of the following solvents: acetonitrile, 0.1M HCl, 0.1M NaOH, 0.1M phosphate buffer (pH 7), and acetonitrile. Samples were prepared to several concentrations ranging from 0.03 mg/mL to 0.0009375 mg/mL and analyzed from 200-400 nm. The resulting spectral minima, maxima, and crossover points for each derivative were tabulated along with the ratio absorbances at these wavelengths. The information gathered from the derivative data in the different solvents can, when used together, provide a much more thorough evaluation of each drug. In many cases, identification alone is not enough. This method has the potential to also be applied to estimating the quantity of illicit drugs in the presence of cutting agents. After spectral information was collected for each individual drug, spectral overlays were prepared for each drug-cutting agent combination to determine points of overlap. A blind study conducted by comparing solutions of unknown concentration containing both drug and cutting agent to a prepared calibration curve of the drug showed promising results. From this, an approximate concentration was calculated using Beer's Law.

Continued work in this area could provide substantial justification for the increased usage of UV-VIS and fluorescence spectroscopy in the analysis of illicit drugs. In the current SWGDRUG guidelines, UV-VIS and fluorescence spectroscopy are in Category C. Additional work in this area will continue to bring to light the abilities of UV-VIS and fluorescence spectroscopy, and may eventually present enough evidence to warrant the transfer from Category C to Category B. This shift, minor as it may be, could make adherence to the SWGDRUG guidelines more practical for smaller labs that are unable to purchase big-ticket items such as mass spectrometers or tandem mass spectrometers.

Ultraviolet-Visible Spectroscopy, Fluorescence Spectroscopy, Illicit Drugs

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