B151 The Development of a Unified Gas Chromatography/Mass Spectrometry/Flame Ionization Detector (GC/MS/FID) Method to Determine Various Classes of Synthetic Drugs Using Retention Indices

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After attending this presentation, attendees will understand the method used to separate, identify, and quantify different classes of synthetic drugs using GC/MS/FID. The benefits of identifying these drugs using a library of retention indices rather than simply relying on a mass spectral library will be demonstrated. This retention index library can then be used by the forensic science community to identify synthetic drugs in street samples.

This presentation will impact the forensic science community by providing a more systematic and efficient method for the identification and quantification of various classes of synthetic drugs, which will allow for faster scheduling of these drugs and will allow crime laboratories to stay up-to-date on this growing problem.

The purpose of this research was to develop a single method using GC/MS/FID that would allow various classes of synthetic drugs, including synthetic cannabinoids, synthetic cathinones, piperazines, 2Cs, synthetic opiates, and benzodiazepines to be identified and quantified. This is important due to the growing abuse of emerging synthetic drugs in this country as an alternative to more historic illegal forms. To prevent this abuse, many states have passed laws banning these drugs, and the Drug Enforcement Agency (DEA) has begun scheduling and/or temporarily scheduling these drugs; however, as soon as one synthetic drug is scheduled, its structure is modified so that the new compound does not fall under DEA regulations. Due to the growing number of synthetic drugs being produced and the lack of research being conducted, crime and clinical laboratories are having difficulty identifying and analyzing these drugs efficiently. Therefore, developing a single analytical method to identify and quantify different classes of synthetic drugs using common instrumentation is needed so crime laboratories can analyze these drugs quickly and increase their productivity.

GC/MS was used to identify the synthetic drugs and a library of retention indices was created from reference standards as a better form of identification rather than relying on mass spectral libraries alone. GC/FID was used to quantify the drugs due to the documented reactivity of some of the synthetic drugs when using MS.[1] To separate these drugs, an Rtx-5 Amine column along with a base-deactivated split inlet liner with base-deactivated wool was used as it demonstrated the best inertness for this wide range of compounds. The method successfully separated six classes of synthetic drugs and was used to identify and quantify synthetic drugs in street samples; however, it was determined that derivatization of the 2Cs was needed for optimal separation performance due to the reactivity of the compounds. To date, only two of the synthetic cathinones posed a problem of co-elution, and thus could only be semi-quantified. For determination of the retention indices of the drug compounds, the Massachusetts (MA) Extractable Petroleum Hydrocarbon (EPH) Aliphatic Hydrocarbon Standard mix was used. Method precision (as percent of Relative Standard Deviation (%RSD)) was relatively low for all the compounds, with the synthetic cannabinoids showing the best precision and the synthetic cathinone, methylone, showing the poorest. Retention indices were calculated for all compounds, but extracted ion chromatograms were needed to calculate 2C-N's retention index.

With this method, six classes of synthetic compounds and street samples were able to be separated, identified using retention indices, and quantified. Utilizing retention indices has been demonstrated to be a clearly better method for identification than reliance on mass spectral data alone, especially for compounds that are isomers and have similar mass spectra. This is because retention indices are more specific to the target compound than retention times and mass spectra. The retention index library can then be expanded to include more synthetic drugs, and additions will need to be made as new synthetic drugs are uncovered in recreational use. This will provide a more systematic and efficient method for the identification and quantification of synthetic drugs, allowing for faster scheduling of these drugs and allowing crime laboratories to keep up with this growing problem. Also, once these compounds are identified, more toxicological research can be conducted on the drug effects at certain doses.

Reference(s):

1. Leffler A.M., Smith P.B., de Armas A., Dorman F.L. The analytical investigation of synthetic street drugs containing cathinone analogs. *Forensic Sci. Int.* 2014, 234, 50-56.

Synthetic Drugs, Retention Indices, Gas Chromatography