B140 High-Throughput Analysis of Controlled Substances: Combining Multiple Injections in a Single Experimental Run (MISER) and Liquid Chromatography/Mass Spectrometry (LC/MS)

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After attending this presentation, attendees will understand how the application of MISER to LC/MS can provide an efficient, high-throughput method of analysis for seized drug submissions.

This presentation will impact the forensic science community by demonstrating the efficiency, simplicity, and versatility of MISER LC/MS analysis of controlled substances, especially when applied to multiple-unit and/or multiple-component submissions.

Forensic drug laboratory personnel are frequently faced with the challenge of efficiently managing cases and evidence backlogs while also performing high-quality analyses that will fulfill jurisdictional and other requirements. Conclusions of analysis must be scientifically supported by the use of reliable and robust analytical techniques. Furthermore, analytical results need to be generated in an efficient and timely manner. The ability to perform high-throughput analysis is therefore a crucial need in today's forensic laboratories. This is especially true for state, local, and federal laboratories that routinely receive multiple-unit exhibits, as jurisdictional requirements often involve the testing of a large number of individual units in order to make an inference on the entire seizure, or on a high proportion of it.

MISER is an ideal technique for the rapid analysis of multiple-unit drug exhibits. It is a variation of flow-injection analysis in which samples are analyzed by direct injection into an eluent flow provided by a liquid chromatograph. In combination with an autosampler, samples can be continuously injected, allowing the rapid evaluation of their contents. The collection of results from multiple samples within a single chromatogram (misergram) also allows simple evaluation of data. Contrary to routine Gas Chromatography (GC) or LC applications, the proportion of strong solvent employed during MISER analysis should be sufficiently high to ensure only minimal interaction with the stationary phase, thus accelerating the passing of the analyte(s) through the column. Although sample components are not separated on the basis of retention time, this apparent limitation in selectivity is easily remedied by the use of an MS detector.

Included in this presentation are the results of several experiments in which the MISER technique was utilized in combination with LC/MS in the analysis of controlled substances. In one experiment, the analysis of 28 randomly selected units from a large cocaine submission was completed in approximately 36 minutes, demonstrating the time-saving advantages MISER offers. Isocratic solvent flow conditions were optimized for both rapid elution and minimal separation of the primary constituents present in the samples, and the samples were able to be injected every (approximately) 1.2 minutes.

Another drug submission consisting of oxycodone tablets was analyzed using similar solvent flow conditions, but with the mass analyzer programmed to perform three types of experiments on each sample: (1) full mass analysis (m/z 50-500); (2) then Tandem Mass Spectrometry (MS/MS) on the most intense ion detected during the full mass analysis scan; and, (3) followed by Triple Mass Spectrometry (MS/MS/MS) analysis on the most intense

fragment ion detected during the MS/MS. This experiment sequence provided additional fragmentation information for the oxycodone present in the tablets, since the MS/MS analysis resulted in too few ions for unambiguous characterization.

In addition to multi-unit drug submissions, MISER LC/MS is well-suited for multiple-component mixtures, as demonstrated by the analyses of opium samples. Solvent conditions in one example were shown to produce slight separation of the major constituents while maintaining rapid elution; however, a much simpler misergram was produced when the eluent flow contained a higher proportion of organic solvent such that all sample components co-eluted. Furthermore, co-elution of multiple components did not preclude the ability of the mass analyzer to provide structural information on each individual substance present in the samples.

This presentation will benefit the forensic science community by offering a versatile and highly efficient screening method for multiple-unit and multiple-component seized drug submissions.

Controlled Substances, MISER, LC/MS