B15 Forensic Drug Analysis by Thermal Desorption and Pyrolysis Combined With Direct Analysis in Real Time-Mass Spectrometry (TDP/DART®-MS)

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After attending this presentation, attendees will understand the value of a TDP device combined with DART®-MS for the rapid identification and screening of forensic drugs in biological and autopsy specimens (e.g., urine and blood).

This presentation will impact the forensic science community by explaining how DART®-MS can be effectively applied as an identification and screening technique for the forensic drugs present in biological and autopsy specimens.

Drugs present in biological and autopsy specimens cannot be detected without first selecting the pretreatment and analytical conditions appropriate for the drugs. Thus, it is extremely important to investigate the analytical conditions suitable for specific compounds and samples; however, recently several new substances that threaten society have appeared one after another, including New Psychoactive Substances (NPS). It is very difficult to individually examine the analytical conditions that are appropriate for each new substance. Thus, a comprehensive analysis system for drugs that requires minimal investigation of pretreatment and analytical conditions is greatly desired. This study investigates an analytical technique for directly analyzing drugs in blood and urine that does not require any pretreatment.

The samples were standard drug mixture solutions and drug mixture-loaded blood and urine (i.e., blank blood and urine samples with several types of drug mixture added). Mass spectra were obtained by using a quadropole Time-Of-Flight (qTOF) mass spectrometry equipped with a DART® ion source and a TDP unit. The TDP unit was mounted between the DART® ion source and the mass spectrometry. This study assessed whether drugs could be detected by using this analytical system. Mass spectra were measured in positive-ion mode as the samples were heated from ambient temperature to 600°C at a rate of 100°C per minute.

Each drug was separated and detected through thermal gradient heating for all samples, and thermal desorption profiles were highly reproducible for individual drugs. The detected ions were correctly identified according to their measured accurate mass and product ion spectra. Moreover, this analysis system was deemed to have the potential of quantitative analysis for drugs, as the drug's ion intensity was increased with increasing drugs concentrations in the samples; however, the drug's ion intensity was decreasing in the order of standard drugs solution > urine-added drugs > blood-added drugs, even at the same drug concentration, with the drug's ion intensity being markedly reduced in blood in particular. Accordingly, the blood samples that were pretreated by using dispersive solid-phase extraction for removing phospholipid were analyzed, whereupon the drug's ion intensity was dramatically improved. Future research should continue to investigate pretreatment conditions and mass spectrometry conditions in order to further improve the detection sensitivity, with eventual application in real samples.

Forensic Drugs, DART®-MS, Thermal Desorption

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