



K15 Rapid Drug Screening Using a Combination of Flow Injection Tandem Mass Spectrometry (FI/MS/MS) and the Quick, Easy, Cheap, Effective, Rugged, and Safe (QuEChERS) Method

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After attending this presentation, attendees will understand the usability of the combination of FI/MS/MS and the QuEChERS extraction method for rapid drug screening.

This presentation will impact the forensic science community by demonstrating a rapid detection method that reduces the time needed for the total drug screening process to approximately ten minutes. Using this method, toxicological findings can be returned to forensic pathologists during the autopsy process. Thus, the QuEChERS-FI/MS/MS combination method will facilitate determination of the cause of death and allow law enforcement to solve cases more quickly.

There is a compelling need for the rapid diagnosis of drug poisoning in both forensic and clinical toxicology. Currently, several drug-screening methods are available. For example, immunoassay techniques such as the Triage® kit are favored in forensic and clinical toxicology because results are obtained in a short time and sample pretreatment is not required; however, such methods can only be used to assay urine samples and can identify the class of drugs present, but not the drug of interest itself. Furthermore, these methods cannot measure all types of drugs and poisons and they have low sensitivity. Analytical methods such as Liquid Chromatography with Tandem Mass Spectrometry (LC/MS/MS) are also commonly used for drug screening; however, although these techniques have high sensitivity and selectivity and can detect a wide range of drugs and poisons, they usually require time-consuming sample pretreatment and column separation. From the start-up of the instruments to the reporting of the result, including analysis of the blank sample, a period of more than two hours is typical. While many studies have reported rapid drug screening methods using LC/MS/MS, in practice most of these methods require considerable time from the start-up of the instruments to the reporting of the results. Additionally, the use of these techniques is somewhat difficult for less-experienced analysts. Therefore, the limiting factors were addressed by developing a reliable and simple analytical technique using a combination of the QuEChERS method and an FI/MS/MS system, which returns results within 10 minutes.

Whole blood samples were collected from practical forensic cases (N=79) and pretreated using the QuEChERS method.¹ Briefly, 0.5mL of whole blood was diluted three-fold with distilled water. The diluted sample was placed in a plastic tube with 0.5g of the pre-packed extraction kit reagent, a stainless steel bead, and 1mL of acetonitrile. The mixture was shaken for 30sec and centrifuged for 1min. The supernatant was transferred to a 2.0mL centrifuge tube containing the solid-phase extraction sorbent for sample cleanup. The tube was mixed for 10sec and centrifuged for 1min. The extract was analyzed by both LC/MS/MS and FI/MS/MS (analysis time=1.5min). All product ion spectra obtained by FI/MS/MS were automatically processed by Library View™ software, and the results were compared with those of the LC/MS/MS analysis using Dice's coefficient.

The combination of QuEChERS and FI/MS/MS enabled completion of the entire drug screening process, from the start-up of the instruments through the extraction process and data analysis, within 10min. For actual forensic cases (N=79), the qualitative results roughly matched (96% concordance rate) with the results obtained with the standard LC/MS/MS technique. The false-positive rate with the combined QuEChERS-FI/MS/MS method was 3.4% and the false-negative rate was 3.9%. Although some drugs present at low concentrations were not detected in the analysis of forensic cases, the QuEChERS-FI/MS/MS method was able to detect a wide-range of drugs in whole blood in a relatively short time.

Reference:

1. Usui K, Hayashizaki Y, Hashiyada M, Funayama M. Rapid drug extraction from human whole blood using a modified QuEChERS extraction method. *Legal Med* 2012;14: 286-296

Flow Injection MS/MS, QuEChERS Extraction, Rapid Drug Screening