B98 A Micellar Electrokinetic Screening Method for Common Sexual Assault Drugs

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The objective of this analysis was to develop a simultaneous method of detection for benzodiazepines and gamma-hydroxybutyric acid (GHB) analogs using micellar electrokinetic chromatography.

Much attention has been given to benzodiazepines and gammahydroxybutyric acid (GHB) related compounds owing to their widespread use as date-rape drugs. The rapid metabolism and lethargic effects of these compounds make them perfect weapons for an assailant. Many of the current screening methods for benzodiazepines involve immunoassays that have insufficient cross reactivity with low-dose metabolites, while current methods for the detection of GHB can involve complex derivatization. Since either of these drugs is possible in a case of drug facilitated sexual assault, toxicologists would greatly benefit from a screening method that allows the simultaneous detection of both groups of substances.

Capillary zone electrophoresis (CZE) is often compared to gas chromatography (GC). Advantages of using CZE over traditional GC are that it does not require extensive extraction or derivatization steps. While CZE is limited in its ability to detect neutral compounds, micellar electrokinetic chromatography (MECC) permits the analysis of uncharged molecules by providing a secondary separation through the addition of a surfactant that forms into micelles. These aggregates will interact with the analytes of interest and carry them countercurrent to the electroosmotic flow, enabling greater separating power.

Optimization of the borate buffer was carried out using a set of standards containing 8 benzodiazepines, GHB, GBL, and the internal standard, sulfanilic acid. The optimal buffer was found to contain 20 mM SDS and 7% acetonitrile at a pH of 9.2. In the case of an interfering peak, the buffer containing 30 mM SDS and 10% acetonitrile may provide a better separation.

The benzodiazepines were calibrated with concentrations ranging from 2.5mg/µL to 100µg/mL. GHB was run at 0.1 to 2.5 µg/mL, while the GBL concentrations were from 0.5 to 10 µg/mL. The method was shown to have a detection limit of less than 2 µg/mL for five out of eight benzodiazepines. The detection limits for GHB and GBL were 32 µg/mL and 150 µg/mL, respectively.

In many cases of drug-facilitated sexual assault, the drug has been placed into a victim's beverage. For this reason, a series of GHB spiked beverages were monitored to determine the effects of time on the drug analysis. After 48 hours, there was no observed degradation of GHB in any of the analyzed beverages. Possible interfering peaks from drugs of abuse and artifacts from a variety of different drink combinations were also studied in detail. The analysis of GHB involved a simple 1:10 dilution of the beverage sample and so any interferences were present at very low levels. In the beer sample, there was a peak that eluted with the GHB. Using the 30 mM SDS/10% acetonitrile buffer, the two were separated. For the benzodiazepines, a liquid-liquid ethyl acetate extraction was used. Using the two optimized buffers, it was shown that a variety of interfering drugs have distinguishable mobilities in comparison to GHB and the benzodiazepines.

The method shows good separation of all benzodiazepines as well as GHB and provides a rapid screening for many of the common sexual assault drugs and other club drugs. When encountering an unknown sample, the recommended procedure is to dilute an aliquot 1:10 as described for GHB analysis. A second aliquot should be prepared for extraction to detect the drugs that may be present at lower concentrations. We believe this method would provide an excellent overall screening tool for the detection of date-rape drugs.

Benzodiazepines, GHB, MECC

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