B102 The Development of Microfluidic Approaches to the Detection of GHB

Maiko Kusano, BA, and Bruce R. McCord, PhD, Florida International University, Department of Chemistry, 11200 SW 8 Street, Miami, FL 33199*

The goal of this poster is to provide the forensic community with novel indirect detection methods of GHB using capillary electrophoresis, and further to develop microfluidic approaches to the detection of GHB in biological samples. The development of microfluidic devices for rapid iso- lation and detection of GHB and other drugs of abuse will provide a simple, inexpensive, and disposable "mini-instrument" with wide ranging forensic applications.

This presentation will impact the forensic community and/or humanity by showing the forensic community the importance of devel- oping rapid, sensitive, and reproducible detection methods of GHB and other drugs used in drug-facilitated sexual assault. Indirect fluorescence detection eliminates the need of derivatization of the drug prior to analysis. Development of the microfluidic approaches to this detection method will allow extremely rapid detection and isolation method with minute amount of sample.

The increasing abuse of illicit drugs over the past years has raised the demand for forensic laboratories and researchers to develop faster and more sensitive analytical methods of detection. With the rise of illicit drugs used for recreational purposes and drug facilitated sexual assault, there is a constant push for the development of better detection techniques. This is especially true with the popular "date-rape drug" gamma-hydroxybutyrate (GHB), as incidents of GHB abuse and GHB-related emergencies and deaths have become frequent.

Several issues exist with GHB detection. The small size and polar nature of the GHB molecule makes the drug difficult to separate from bio- logical specimens. Gas chromatography, coupled with various modes of detection, has been employed as the analytical methods of detection and quantitation of GHB. However, in order to perform GC analysis, the GHB molecule must be derivatized prior to injection, as its polar nature results in thermal instability at the heated injection port of the gas chromatograph. Capillary electrophoresis (CE) has become a viable alternative to the tradi- tional screening methods such as gas chromatography and immunoassay due to its simplicity and sensitivity. CE has very high efficiencies, per- mitting a complex array of molecules to be separated simultaneously. CE system also requires only minute amounts of the sample and can be used as a quantitation tool with minimal pre-treatment of the sample, which is ideal for forensic analysis. Furthermore, CE is a good candidate for miniatur- ization that could be applied to the microfluidic systems.

The main goal of this research is to develop a rapid, sensitive, and reproducible detection method of GHB using indirect fluorescent detection techniques with capillary electrophoresis. Indirect fluorescent detection eliminates the need of derivatization, the most time-consuming step in the analytical method. This research utilized eosin, a fluorescent dye, as an indirect anionic probe. Since most drugs do not naturally fluorescence, when a drug is present in the detection zone, the drug displacing the fluo- rescent electrolyte produces a negative response.

Previous studies have been published on the indirect fluorescent detection of inorganic and organic anions, arsenic compounds, fatty acids, and polysaccharides. However, this method has not yet been extended to the detection of acidic drugs such as GHB. In this study, a Beckman Coulter P/ACE MDQ CE system was used. The capillary used was an uncoated fused silica with an inner diameter of 75µm. Argon-ion laser was used for indirect laser-induced fluorescence detection (excitation at 488nm). Samples were injected electrokinetically and the analytes were separated using 12kV. The run buffer contained sodium borate, boric acid, DETA, and eosin as the fluorescent probe. Anion standards have been detected using the eosin buffer, and small acidic drugs such as GHB are expected to show similar effects. In addition, the potential for performing the indirect fluorescent detection on the microchip was investigated. The microfluidic device used was the Micralyne Microfluidic Tool Kit instrument consisting of high-voltage power supplies coupled with a Nd:YAG diode-pumped solid-state laser detection system (532nm). Eosin dye in TBE buffer was successfully detected, demonstrating its compati- bility with the green laser system in addition to the argon-ion laser system. The dye was then used as the background fluorophore in the microfluidic system.

GHB, Microfluidics, Indirect Fluorescence

 ** Presenting Author*