K51 Utilization of a Pyroprobe Coupled to GC/MS in Drug Analysis and Toxicology

Melissa Gayton-Ely, BA, Diaa Shakleya, PhD, and Suzanne C. Bell, PhD, C. Eugene Bennett Department of Chemistry, West Virginia University, 217 Clark Hall, Morgantown, WV 26506*

The goal of this presentation is to illustrate the potential of pyrolysis as a tool for detecting biomarkers of abused drugs. This presentation will discuss the usefulness of a pyroprobe in detecting pyrolytic products of single drugs as well as mixtures of cocaine and methamphetamine. Attendees will become familiar with potential applications of pyrolysis to toxicology as well as understand the effects of varying experimental conditions and how they may alter the resulting pyrolytic products.

This presentation will impact the forensic community and/or humanity by demonstrating how pyrolysis coupled to GC/MS has the potential to model metabolism, therefore, with this method, a broad range of drugs may be analyzed in order to quickly detect metabolites that can be used in forensic laboratory analysis. This technique may be a potential tool to complement metabolic studies.

Smoked illicit drugs are of interest in forensic toxicology because smoking may produce unique biomarkers as a result of metabolism. Metabolic conditions can be partially modeled via pyrolysis, a process that decomposes a chemical compound by extreme heat. A pyroprobe is a thermal preparation device used to heat samples at high temperatures in order to breakdown the compounds into oxidation products. The pyrolytic products are then introduced into a gas chromatograph coupled to mass spectrometry (GC/MS) for identification. The present work employed a pyrolysis experiment with a pyroprobe coupled to a GC/MS. Advantages of this analytical technique include rapid sample analysis (on the order of 30 minutes) and minimal sample preparation. Pyrolysis has been used in forensic science for analyzing fibers, paints, photocopier toners and polymeric material. However to date, pyrolysis has not been used widely for toxicological research. This project will focus on the analysis of cocaine and methamphetamine and more generally, potential applications of pyrolysis to forensic toxicology. Pyrolysis has been previously carried out by heating an aluminum boat in a reference pan or by using an apparatus to simulate smoking of a tobacco cigarette laced with the analyte drug. Using such techniques, the primary pyrolytic product of cocaine is anhydroecgonine methyl ester (AEME) and methamphetamine is 1-phenylpropene, respectively. These pyrolytic products have been analyzed using both high performance liquid chromatography (HPLC) and GC coupled to MS. However, no research has been directed at simulating the metabolic conditions by pyrolysis. The ability to differentiate between inhalation via smoking versus exposure by an alternative method of ingestion is useful to the investigatory information. This study focused on the more commonly smoked drugs, cocaine and methamphetamine, along with the addition of certain cutting agents including lidocaine, caffeine, mannitol, starch and dextrose. Data obtained by pyrolysis was compared to the products from metabolized cocaine and methamphetamine reported by literature. The goal was to correlate degradation via pyrolysis to metabolic degradation as was feasible and appropriate. Several such correlations were identified and will be discussed. The effects of each of the following conditions were also studied:

1) Mixing cocaine and methamphetamine in various alternating ratios.
2) Altering methanol and ethanol as solvents.
3) Varying pyrolysis temperatures and GC conditions.

Pyroprobes, GC/MS, Toxicology

 ** Presenting Author*