B85 An Electrochemical Analysis of Fentanyl and Fentalogs Toward a Rapid Screening Assay

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Learning Overview: After attending this presentation, attendees will have information on an electrochemical technique to analyze fentanyl, as well as a stronger understanding of the electrochemistry of fentanyl.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by demonstrating exploration into alternative methods to detect fentanyl using electrochemistry and how that could facilitate the screening of fentanyl analogs. This presentation will also showcase another example of how electrochemistry can be used as an analytical technique in forensic investigative sciences.

The use of opioids is on the rise nationwide, and the potential danger of an unintentional exposure is increasing. One of the current deadliest synthetic opioids is fentanyl.[1] There are also numerous fentanyl analogs that have been synthesized, often illicitly, that are hazardous, especially as some of them are more potent than fentanyl itself.[2] There are many laboratory-based methods used to detect fentanyl, but they lack the portability and rapid response necessary for early detection in the field. One of the major issues with detecting fentanyl analogs is their number and the difficulty to characterize them and establish standardized methods as fast as new illicit analogs are encountered in street samples.[2]

The focus of this project is to use electrochemistry as a fast detection method answering those needs and allowing for early detection of fentanyl and fentanyl analogs. In the body, fentanyl undergoes an oxidative N-dealkylation reaction which generates metabolites.[3] The electrochemical reaction of fentanyl appears to be mimicking this process, with an irreversible oxidation, generating metabolites in solution, which can also be observed by electrochemistry.[4] It is hypothesized that this N-dealkylation would be common to fentanyl and its analogs, thus generating a standard method for the fentalogs. Different electrochemical techniques are being utilized and optimized to detect fentanyl, including cyclic voltammetry, square wave voltammetry, and differential pulse voltammetry. Using these techniques, the irreversible oxidation peak of fentanyl is being monitored. The intensity of the oxidation decreases over subsequent scans, concomitant to the development of additional peaks for the metabolites. Fentanyl and fentanyl metabolite peaks are visible in multiple supporting electrolytes such as sodium chloride, potassium chloride, and Phosphate Buffer Saline (PBS). The conditions to analyze fentanyl such as concentration of supporting electrolyte, potential range, and pH are explored and optimized. The long-term goal of this project is to develop a method common to fentanyl and fentanyl analogs to allow for a rapid detection of these drugs in one test that will benefit in-field techniques.

Reference(s):

1. Green, Traci C., Ju Nyeong Park, Michael Gilbert, Michelle McKenzie, Eric Struth, Rachel Lucas, William Clarke, and Susan G. Sherman. "n Assessment of the Limits of Detection, Sensitivity and Specificity of Three Devices for Public Health-Based Drug Checking of Fentanyl in Street-Acquired Samples. *International Journal of Drug Policy* 77 (2020): 102661.
2. Jannetto, Paul J; Helander, Anders; Garg, Uttam; Janis, Gregory C; Goldberger, Bruce; Ketha, Hemamalini. The Fentanyl Epidemic and Evolution of Fentanyl Analogs in the United States and the European Union. *Clinical Chemistry* 65, no. 2 (2019): 242-53.
3. Saiz-Rodríguez, Miriam, Dolores Ochoa, Coral Herrador, Carmen Belmonte, Manuel Román, Enrique Alday, Dora Koller, et al. Polymorphisms Associated with Fentanyl Pharmacokinetics, Pharmacodynamics and Adverse Effects. *Basic & Clinical Pharmacology & Toxicology* 124, no. 3 (2019): 321-29.
4. Goodchild, Sarah A., Lee J. Hubble, Rupesh K. Mishra, Zhanhong Li, K. Yugender Goud, Abbas Barfidokht, Rushabh Shah, et al. Ionic Liquid-Modified Disposable Electrochemical Sensor Strip for Analysis of Fentanyl. *Analytical Chemistry* 91, no. 5 (2019): 3747-53.

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