B157 The Development of a Method to Extract Opium Poppy (*Papaver Somniferum* L.) DNA From Heroin

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Learning Overview: After attending this presentation attendees will be aware of the ability to purify poppy DNA from heroin samples. It will also educate attendees on alternative means to extract DNA from exceedingly low level or difficult samples including techniques to maximize yield and combat PCR inhibitors.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by demonstrating the ability to obtain poppy DNA from heroin samples, opening a door to new types of analyses that could involve DNA-based opioid identification and drug geosourcing. It will also stimulate conversation regarding alternative methods of DNA extraction including using methods that are not commonly used in forensic science.

This study is the first to report the successful development of a method to extract opium poppy (*Papaver somniferum* L.) DNA from heroin samples. Determining of the source of an unknown heroin sample (forensic geosourcing) is vital to informing domestic and foreign policy related to counter narcoterrorism. Current profiling methods focus on identifying process-related chemical impurities found in heroin samples. Changes to the geographically distinct processing methods may lead to difficulties in classifying and attributing heroin samples to a region/country. This study focuses on methods to optimize the DNA extraction and amplification of samples with low levels of degraded DNA and inhibiting compounds such as heroin. The authors compared modified commercial-off-the-shelf extraction methods such as the Qiagen Plant, Stool and the Promega Maxwell-16 RNA-LEV tissue kits for the ability to extract opium poppy DNA from latex, raw and cooked opium, white and brown powder heroin and black tar heroin. Opium poppy DNA was successfully detected in all poppy-derived samples, including heroin. The modified Qiagen stool method with post-extraction purification and a two-stage, dual DNA polymerase amplification procedure resulted in the highest DNA yield and minimized inhibition. This study describes the initial phase in establishing a DNA-based signature method to characterize heroin.[1]

Heroin has been identified as the single greatest drug threat in the United States.[2] The number of individuals using heroin approached one million by the end of 2014, an increase from previous years and, in 2016, has led to an estimated 15,469 deaths, more than a 600% increase since 2002.[3-5] The 2016 National Forensic Laboratory Information System report identified heroin as the 4th most common drug case (11.2%). The number of heroin cases submitted to forensic laboratories has recent spiked, with over a two-fold increase in 2015. This is in contrast to trends observed with Cocaine, MDMA, and Cannabis.[6] The heroin epidemic extends beyond domestic health issues. The 2016 United Nations Office on Drugs and Crime report estimated that 1,600 organized criminal organizations in the European Union are involved in drug trafficking making it the predominate illegal activity among human trafficking, fraud, and smuggling.[6] The link between heroin and national security is evident, affecting the health and well-being of Americans, as well as their security. Thus, understanding the flow of drugs from source to end-point becomes critical on federal, state and local levels.

The United States has prioritized the monitoring and diversion control of heroin and other opiates through the assembly of task forces and programs on all governmental levels. These include: the High Intensity Drug Trafficking Areas program, Organized Drug Enforcement Task Force, the Heroin Signature Program, and the Heroin Domestic Monitoring Program. These programs have led to significant gains in the understanding of international and domestic drug trafficking patterns and have aided in the control of the heroin epidemic. The development of a method to isolate poppy DNA from heroin will enable a means of heroin identification that augments the current suite of assays used by the Heroin Signature program and ultimately lead to further insights into drug trade and related insurgent activities.

Reference(s):

1. Marciano, M.A., S.X. Panicker, G.D. Liddil, D. Lindgren, and K.S. Sweder. "Development of a Method to Extract Opium Poppy (Papaver Somniferum L.) DNA from Heroin." *Scientific Reports* 8 no. (2018):1-15, https://doi.org/10.1038/s41598-018-20996-9.
2. Finklea, K. Heroin Trafficking in the United States. *CoCongressional Res. Serv.* (2016).
3. 2016 National Survey on Drug Use and Health (NSDUH). (2016).
4. Hedegaard, H., Warner, M. & Miniño, A. M. Drug Overdose Deaths in the United States, 1999–2016. (1999).
5. Drug Enforcement Administration, U. & Control Division, D. National Forensic Laboratory Information System: 2016 Annual Report. (2015).
6. United Nations. The Drug Problem and Orghanized Crime, Illicit Financial Flows, Corruption and Terrorism. (2017).

Heroin, DNA Extraction, Opium