K53 A Wastewater Analysis for Tobacco and Drug Detection in New York City

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After attending this presentation, attendees will understand the utility of wastewater analysis to monitor tobacco and drug exposure in a certain community and will know how to perform the analysis of these types of samples by Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS).

This presentation will impact the forensic science community by demonstrating the applicability of utilizing wastewater analysis by LC/MS/MS to investigate tobacco and drug use in different communities in an urban location.

Recent changes in the drug scene, such as the current issues with prescription opiates and fentanyl, among other substances, have sparked an increased interest in new tools to monitor what drugs are coming onto the market in a faster, more efficient manner than conventional population surveys. Wastewater analysis is an innovative approach to testing the drug consumption in a geographical area by analyzing human excretion products (biomarkers) in wastewater, which is essentially a large urine pool. Wastewater can provide independent, low-cost, reliable, and nearly real-time information. This methodology has not been fully explored in the United States.

A method was developed to determine tobacco (nicotine and cotinine), cocaine (benzoylecognine, cocaethylene, and cocaine), amphetamines (methamphetamine, MDMA, MDA, and amphetamine), opiates (6-monoacetilmorphine, morphine, codeine, oxymorphone, oxycodone, hydromorphone, hydrocodone, fentanyl, norfentanyl, methadone, EDDP), and cannabis (delta-9-tetrahydrocannabinol, 11-nor-9-carboxy-tetrahydrocannabinol, and 11-nor-9-carboxy-tetrahydrocannabinol-glucuronide) biomarkers in 50mL of wastewater. Wastewater samples were filtered, extracted using mixed-mode cation cartridges, and analyzed by LC/MS/MS using positive Electrospray Ionization (ESI). All compounds were analyzed on a Kinetex® C18 column (with 0.1% formic acid in water and 0.1% formic acid in acetonitrile as mobile phases) using two different gradients (one for cannabinoids and another for the remaining compounds). Each compound was monitored by two Multiple Reaction Monitoring (MRM) transitions. Method validation included linearity (5ng/L-1,000ng/L for all compounds, except 10-1,000ng/L for tobacco biomarkers), limit of detection (1ng/L-10ng/L) and quantification (5ng/L-10ng/L), imprecision (<20%), accuracy (80%-120%), matrix effect and extraction efficiency, interferences, and auto-sampler stability. This study applied this method to wastewater samples collected from wastewater treatment plants in New York City (The Bronx, Brooklyn, Queens, and Manhattan) throughout one year. Wastewater samples were collected into Environmental Protection Agency (EPA) -certified sample containers and stored at −20°C until analysis.

This study emphasizes the method of analysis, particularly the use of LC/MS/MS in terms of its sensitivity and selectivity, as a means to detect licit and illicit drugs in wastewater samples. It also provides a means by which new drug trends could be tracked by testing wastewater, thus providing real-time results in different boroughs within New York City.

Wastewater, Cannabis, Opiates

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