Introduction
Forensic crime labs are responsible for the qualitative confirmation of drugs of abuse for use in court cases. Gas chromatography mass spectrometry (GCMS) has been the gold standard for confirmation of cocaine, procaine, and morphine in confiscated illicit drugs. GCMS analysis requires extraction, derivatization, and long run times. In this study, pseudo drug mixes were made to mimic typical composition of street drug mixtures. We demonstrate the use of ultra-high performance liquid chromatography coupled to electrospray time-of-flight mass spectrometry (UHPLC-ESI TOF MS) for confirmation of cocaine, procaine, and morphine in pseudo drug mix in 1 min. Using high resolution and exact mass capabilities of a TOF mass spectrometer coupled to uHPLC we can rapidly confirm the identity of drugs of abuse in complex mixtures.

Method
A PerkinElmer Flexar™ FX-15 LC pump with PerkinElmer AxION™ TOF MS was used for separation and detection of cocaine, procaine, and morphine.

Sample preparation: Morphine and cocaine standards were obtained from Restek (Bellefonte, PA) with concentration of 1 mg/ml in 100% methanol. Samples were diluted 1:1000 with 50/50 methanol/water with 0.1% formic acid to make a final concentration of 0.001 mg/ml. Procaine standard was obtained from Sigma Aldrich (St. Louis, MO) and was prepared to a concentration of 1 mg/ml in 50/50 methanol/water with 0.1% formic acid to make a final concentration 0.003 mg/ml. Morphine was found to be <2 ppm for the drugs of abuse in pseudo drug mixes. This aided the ability to confirm the chemical formula of the TOF.

Liquid chromatography conditions:
- Pump type: Flexar FX-15
- Column: PerkinElmer Brownlee Hres column C-18 (1.9µm, 2.1 x 50mm)
- Mobile phase: A: Water with 5 mM Ammonium Acetate and 0.1% Formic Acid
- B: Acetonitrile with 0.1% Formic acid
- Column temp: 50°C
- Flow rate: 0.8 mL/min
- Injection volume: 1 µL
- Gradient conditions:
  - Time (min): %A %B
  - 0 85 15
  - 1 5 95

Mass spectrometer conditions
The ESI TOF MS was operated in positive ion mode (m/z 100 - 1500) at 3 spectra/sec for detection with capillary exit voltage set to +90V.

Results
The high mass accuracy capabilities of the PerkinElmer AxION™ TOF MS provides exact masses of cocaine (RT 0.7 min) and procaine (0.5 min) standards with <2 ppm mass accuracy. By using the PerkinElmer Flexar™ FX-15 LC pump with PerkinElmer AxION™ TOF MS and EICs to extract out cocaine and procaine we are able to provide 2 modes of identity confirmation required for positive identification for crime labs in less than 1 min per sample with little to no sample prep.

A) Total ion chromatogram (TIC) of pseudo drug mix 1
B) Extracted ion chromatogram (EIC) of probenecid (peak 1) and cocaine (peak 2) from pseudo drug mix 1 and averaged mass spectra under the EICs.

A) TIC of pseudo drug mix 2
B) Extracted ion chromatogram of morphine from pseudo drug mix 2 and averaged mass spectra under the EICs.

Summary
Cocaine, procaine, and morphine standards were analyzed by PerkinElmer Flexar™ FX-15 LC pump with PerkinElmer AxION™ TOF MS. The chromatographic retention time combined with the accurate mass of <2 ppm for all reference standards was found to be within 2 parts per million (ppm) of the isotopic pattern matching. This aided the ability to confirm the chemical formula of the drugs in a complex matrix that could not be done with traditional methods of GCMS or LCMS. The combination of chromatographic separation by UHPLC and the accurate mass of the TOF should satisfy the SWGDRUG recommendations for drugs of abuse analysis recommending 2 separate confirmations such as UHPLC retention time and exact mass of the TOF.

The DSA – TOF source adds an additional benefit of a no sample prep analysis workflow for a quick confirmation of presence of compounds such as cocaine on dollar bills.

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