



B192 Examination of Fentanyl and Fentanyl Analog Samples in Canada: Trends and Strategies for Analysis

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Learning Overview: After attending this presentation, attendees will understand the trends in fentanyl and fentanyl analog samples submitted for analysis to the Drug Analysis Service Laboratories over the past several years. Additionally, attendees will be introduced to liquid chromatography-based methods for the identification and quantitation of fentanyl and fentanyl analogs.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing information on the recent trends of fentanyl and fentanyl analog samples submitted for analysis in Canada. Additionally, this presentation will impact the forensic science community by providing an introduction to Liquid Chromatography coupled with Triple Quadrupole Mass Spectrometry (LC/TQMS) and Liquid Chromatography coupled with quadrupole Time Of Flight Mass Spectrometry (LC-qTOF/MS) for the identification and quantitation of fentanyl and fentanyl analog samples.

Fentanyl and fentanyl analogs have become a major concern in Canada. Since 2012, there has been an almost 4,100% increase in the number of fentanyl and fentanyl analog samples being submitted to the Drug Analysis Service Laboratories for analysis. Not only has the number of samples increased, but the composition and type of samples have also changed dramatically over this same time period. The changes in sample type and composition have necessitated a change in the type of analysis performed. The fentanyl and fentanyl analog samples tend to be low-dose/high-potency samples and traditional methods of analysis, such as Gas Chromatography coupled with Flame Ionization Detector (GC/FID) and Gas Chromatography coupled with Mass Spectrometry (GC/MS), may not be sufficient on their own to identify these compounds. As a result, the Drug Analysis Service Laboratories have incorporated the use of LC/TQMS and LC/qTOF for the identification and quantitation of these samples.

The low concentration of the fentanyl and/or fentanyl analogs present in the samples submitted provided challenges to their analysis. The increase in sample preparation concentration needed to obtain a positive result also increased the risk to the analysts themselves during sample handling. The high sensitivity of the LC/TQMS allowed for lower concentration samples to be effectively analyzed, thereby reducing the risk to the analyst during sample preparation. The new LC/MS/MS method allowed for the identification of 27 fentanyl and fentanyl analogs. These compounds are fentanyl, acetylfentanyl, butyrylfentanyl, β -hydroxythiofentanyl, furanylfentanyl, carfentanil, 4-ANPP, meta-fluorofentanyl, para-fluoroisobutyrylfentanyl, para-fluorobutyrylfentanyl, alpha-methylfentanyl, isobutyrylfentanyl, cis-3-methylfentanyl, trans-3-methylfentanyl, W-18, cyclopropyl fentanyl, crotonyl fentanyl, methoxyacetylfentanyl, acrylfentanyl, para-chlorofentanyl, para-chloroisobutyrylfentanyl, 4-methoxybutyrylfentanyl, ocfentanil, valerylfentanyl, alpha-methylbutyrylfentanyl, W-15, and U-47700.

As a result of the high volume of quantitation requests, discussed below, a method was developed using LC/qTOF to assist the LC/TQMS with the identification of these types of samples. The method developed on the LC/qTOF is able to identify approximately 36 different fentanyl and fentanyl analogs. With the exception of 4-ANPP, this method is able to identify all the fentanyl compounds identified by the LC/TQMS identification method plus 4-APP, benzoylfentanyl, benzylacrylfentanyl, benzylcarfentanil, benzylfentanyl, ortho-methylfuranylfentanyl, para-chlorofuranylfentanyl, U-48800, U-49900, and U-5174.

Due to the increase in overdose deaths, more and more law enforcement agencies inquired as to whether it would be possible to determine the concentration or amount of fentanyl and/or fentanyl analog present in the samples submitted for analysis. Consequently, a quantitation method was developed on the LC/TQMS that is currently capable of quantifying five different fentanyl and fentanyl analogs. These compounds include fentanyl, acetylfentanyl, carfentanil, furanylfentanyl, and cis-3-methylfentanyl. The five compounds selected for inclusion in this method were based on the samples submitted for analysis. Additional fentanyl analogs can be added should the need arise.

The nature of the samples submitted to the Drug Analysis Service Laboratories for analysis have changed over the years. This is especially true for those samples containing fentanyl-related compounds. The high sensitivity of LC/TQMS and LC/qTOF provides the forensic drug chemist additional tools in the identification and quantitation of these types of samples.

Fentanyl, LC/TQMS, LC-qTOF