E7 High Resolution Accurate Mass (HRAM) Liquid Chromatography/Mass Spectrometry (LC/MS) Screen for Prostaglandins Found in Consumer Products

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The goals of this presentation are to: (1) identify a class of pharmaceuticals found in unapproved consumer products; and, (2) evaluate the differences in detection and fragmentation between an ion trap mass spectrometer and the high-resolution Thermo Q-Exactive™.

This presentation will impact the forensic science community by bringing awareness to the fact that prostaglandins can be found in consumer products and are detected differently based on the MS being used.

Prostaglandins are used in both human and veterinary pharmaceutical products to treat a variety of symptoms including Raynaud's disease, erectile dysfunction, and glaucoma. Prostaglandins are also used in products to induce childbirth and increase eyelash length. Previously, the Forensic Chemistry Center developed a screening method for prostaglandins to analyze potential counterfeit and unapproved consumer products using LC/MS/MS with a Thermo Linear Trap Quadrupole (LTQ) MS with low-energy Collision-Induced Dissociation (CID) for fragmentation. Incorporating new technology into the screen, the method has been updated using a Thermo Q-Exactive with Higher-Energy Collisional Dissociation (HCD) to obtain new fragmentation patterns of the prostaglandins.

Standards were injected into a Thermo Q-Exactive™ MS with an HCD cell using an Electrospray Ionization (ESI) source, which was used to analyze the standards in both positive and negative mode. The sheath gas was set to ten, the auxiliary to five, and sweep gas was zero. The spray voltage was set to 3.5eV. Fragmentation was conducted utilizing a 4Da window in the targeted mode and the normalized collision energy varied from 10% to 55%. An Agilent® 1200 Ultra High-Performance Liquid Chromatography (UHPLC) with a C18 column was used to introduce the prostaglandins into the MS.

Nine of the prostaglandin standards were analyzed via infusion using an ESI source, which will represent four different prostaglandin classes: E1, E2, F2α, and I2. Once the analyte of interest was detected, fragmentation was performed using All-Ion Fragmentation (AIF), as well as using a targeted mass window. It was found that using the AIF mode created MS/MS spectra with too many peaks that were not associated with the ion of interest. Therefore, a specific LC/MS method was developed, listing the masses of the prostaglandins and incorporating a small mass window for fragmentation, in order to obtain the most useful MS/MS spectra for compound identification. Because prostaglandins found in pharmaceutical products have very low dosage levels, it is important to optimize the mass spectrometric conditions to obtain the highest sensitivity for a given analyte. All of the standards were run in positive mode only, then negative mode only, and peak intensities were measured to optimize sensitivity. Infusing the standards, bimatoprost provides a higher intensity in positive mode using the Q-Exactive™, but a higher intensity in negative mode using the LTQ, indicating that the current LC/MS method may need to be re-evaluated. In addition, new limits of detection will be determined using the new Thermo Q-Exactive™ MS. As expected, utilizing HCD on the Q-Exactive™ gave different fragmentation patterns with more fragment ions for each of the prostaglandins studied than those obtained using CID, eliminating the need to collect MS3 data. An updated LC method combined with optimized MS conditions was applied to detect prostaglandins in consumer products using the Q-Exactive™.

Mass Spectrometry, Prostaglandins, Unapproved Consumer Products

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