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Advancing the Characterization and Quality Control of Botanical Extracts with Mass Spectrometry

Organization: Bio-Botanica
Technology: ACQUITY UPLC H-Class System, Xevo TQD Mass Spectrometer, and MassLynx Software

BACKGROUND

Bio-Botanica® is a leading manufacturer of 500+ quality botanical extracts for the cosmetic, personal care, pharmaceutical, and nutraceutical industries. The company operates a 140,000-square-foot botanical extraction facility which includes state-of-the-art R&D and QC laboratories. With a continuing focus on innovation, Bio-Botanica has pioneered numerous advancements in the botanical field over its 40+ year history. Major products include Albacan™ (skin lightening agent), BioPein®/NeoPein®/Suprapein® (natural preservatives), Fruitanical™ (fruit/vegetable extracts), Floraceutical® (standardized botanical extracts), Phytoplenolin® (anti-inflammatory, cell-renewing), Puresterol® (Menopause symptoms), and Zea-Botanicals™ (Botanical extracts in Zemea™).

Working in close collaboration with R&D, manufacturing, and QC, Bio-Botanica's Department of Pharmacognosy is a critical contributor to the company's product innovation strategy. The group is tasked with leveraging a variety of analytical technologies in order to provide comprehensive characterization of botanicals and help ensure final product quality.

UPLC-MS/MS is used to detect novel compounds that may have unique medicinal or cosmetics applications.

CHALLENGE

Bio-Botanica applies a holistic approach to the development of their botanicals products, striving to remove and identify as many constituents as possible in the natural ratios during the extraction process. Given the extreme complexity of botanical samples, compound quantification and qualification are particularly challenging endeavors.

The use of high performance liquid chromatography (HPLC) with ultra violet (UV) detection has allowed analysts to identify some of the botanical markers but does not provide full characterization. In order to better identify extract constituents, push the boundaries of botanical investigation, and meet the constant and diverse demands of a fast-paced laboratory environment, Bio-Botanica sought to implement a more advanced analytical technology.

SOLUTION

To help meet both their scientific and operational goals, including low level detection requirements, a broad range of analysis requests, and the need to maximize return on investment, Bio-Botanica's Department of Pharmacognosy implemented an analytical solution comprised of the Waters® ACQUITY UPLC® H-Class System with the Xevo® TQD Mass Spectrometer.
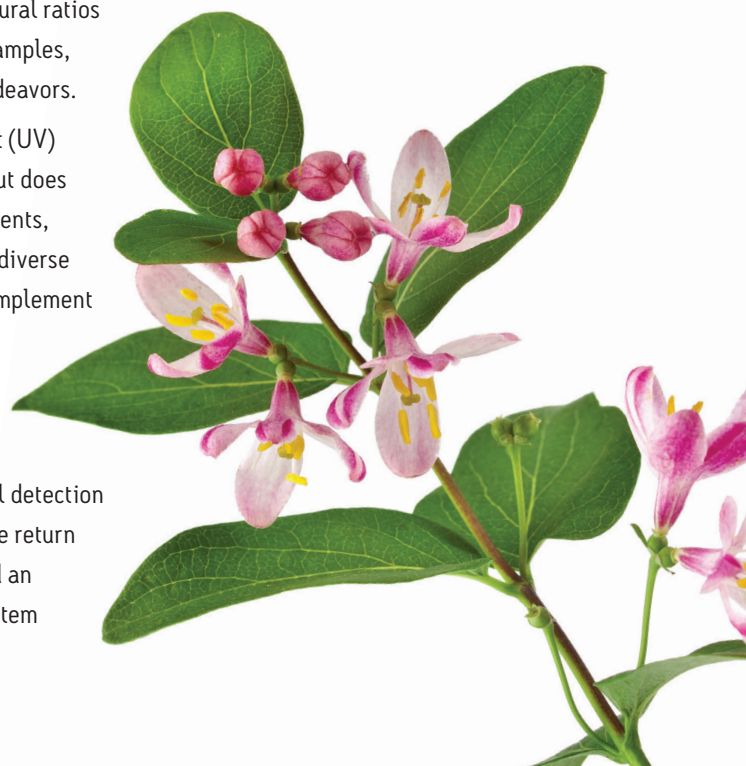
The ACQUITY UPLC H-Class System provides the flexibility of a quaternary-based HPLC with the performance advantages of UPLC.® H-Class enables users to continue running existing HPLC methods or transition to UPLC separations using integrated system tools and column kits that simplify migration. The Xevo TQD is a tandem (triple) quadrupole mass spectrometer designed to provide uncomplicated access to UPLC-MS/MS while maximizing throughput, accommodating a broad range of sample types and performing trace-level analyses. MassLynx® Software is used to manage all mass spectrometry data acquisition, processing, and reporting requirements.

The UPLC-MS/MS platform is now routinely used by the Department of Pharmacognosy to support a wide variety of analytical testing needs including those for product safety, R&D, final product QC, and various customer requests.

BUSINESS BENEFITS

With the addition of the Waters ACQUITY UPLC H-Class System and Xevo TQD Mass Spectrometer to Bio-Botanica's product commercialization process, the company has noted a number of business benefits impacting at both the laboratory and enterprise level, including:

- **Innovation and Brand**
  - The UPLC-MS/MS system represents a unique technological capability within the market sector that allows Bio-Botanica to strengthen its position as an organization at the leading edge of botanical product development.

- **Customer Experience**
  - The more rapid run times afforded by the system enable the acceleration of product shipments which help to maintain Bio-Botanica's high level of customer satisfaction.

- **Label Claim Confirmation**
  - UPLC-MS/MS is now used in support of Bio-Botanica's Quality Control group. The technology helps ensure that final product composition information is accurate — a critical step in customer order fulfillment.

- **Sample Throughput**
  - Moving analyses from traditional HPLC separations to UPLC has resulted in an approximately 75% decrease in run times.

- **Method Consolidation**
  - In the past, vitamins were analyzed separately with different methods — a time consuming task considering the complexity of many multivitamin products offered by Bio-Botanica. UPLC-MS/MS has allowed for the analyses to be combined into a two methods — one for fat soluble and one for water soluble vitamins — each with less than three minute run times, improving laboratory efficiency.

- **Contaminant Detection**
  - For Bio-Botanica the safety of their products is paramount. The adoption of UPLC-MS/MS has allowed for the development of in-house methods for the trace-level detection of pesticides in plant extract samples.

- **Compound Identification**
  - To support R&D efforts, UPLC-MS/MS is used to detect novel compounds that may have unique medicinal or cosmetics applications.

- **Process Monitoring**
  - Along with other technologies the new system is used to ensure that their in-process product is within desired specifications thereby decreasing production time and increasing product conformance.

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