Getting to the Root of Advanced Cannabis Pesticide Testing

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Today more than half of all US citizens -- and people from 44 other countries -- have access to legal medical cannabis. [1] As this market continues to grow and becomes more mainstream, calls for regulation and the need for the cannabis industry to ensure patient and consumer safety will similarly increase.

Be it in the form of flowers, oils or edibles -- or at the point of cultivation through production -- understanding and combatting pesticides as well as mycotoxins (not to mention heavy metals) is paramount.

Putting consumer safety first is particularly important for medicinal cannabis products, as they may be used by people with compromised immune systems.

Unique Requirements Call for Smart Science

Cannabis' unique testing and compliance environment demands that pesticide analysis solutions bring more than just an analytical technique.

Rules for cannabis safety testing are literally all over the map. California labs test for 66 pesticides and 5 mycotoxins (with laws in the other 32 US states differing from one another), while Canadian scientists are required to test for 96 pesticides down to a level of 20 parts per billion (ppb). Testing solutions must, therefore, be able to cover a wide range of analysis while maintaining the ability to deeply mine data -- all while keeping an eye on testing efficiencies that run at the competitive pace of the market.

At the same time, controlling where and how much cannabis comes into contact with pesticides is not an exact science -- think overspray from other agriculture practices -- so analysis must be done across various product forms and at various stages of readiness for the market.

Further, the chemical composition of the cannabis plant itself is complex. The challenge of analyzing a nonhomogeneous plant are innate. Add pesticides and contaminants to the cannabis testing picture -- not to mention oils or other additives -- and it gets even more involved. Unlike potency or terpene tests, which play a key role in the final product but are more straightforward, pesticide testing is like looking for a needle in a haystack -- with the haystack being the extremely complex environment of the competing chemical composition of the cannabis plant. As a result, testing technologies must be able to tackle complexity with ease.

Finally, there is a strong demand in the market for testing solutions that are easy to use, as many cannabis organizations may still be in the early stages of developing in-house scientific expertise and teams. For example, having software that can step users through the typical workflow -- from preloaded MS and LC methods, to batch list creation and final results viewer -- is pivotal to successful implementation in emerging labs.

Taking a New Approach with Two Ion Source LC/MS/MS

All of these factors lead to the need for highly sensitive, flexible, scalable and intuitive testing and analysis options. This is where new innovations are coming into play.

Traditionally, two instruments would be used to test pesticides in cannabis -- an LC/MS/MS (high-performance liquid chromatography mass spectrometer) and a GC/MS (gas chromatography mass spectrometer), as many pesticides aren't detected well with traditional electrospray ionization (ESI) on an LC/MS/MS alone.

A new approach, however, involves a single LC/MS/MS instrument that contains two ion sources, meaning there are two different options for ionization of the pesticide before detection by the MS/MS (Tandem Mass Spectrometry).

The first ion source is the more traditional ESI, with the other being an atmospheric pressure chemical ionization (APCI) source. The APCI source is highly valuable in the cannabis industry, as it allows analysts to overcome the prior challenges associated with the more hydrophobic or chlorinated pesticides (i.e. chlordane or pentachloronitrobenzene). This dual source approach enables the analysis of all California state-regulated pesticides using a single instrument (including pesticides that are harder to detect at trace amounts such as captan, chlorfenapyr, cypermethrine, naled and more.)

With this new, single instrument capability, a single prep method is all that's required for a full pesticide work-up in as little as 22 minutes – delivering both rapid and reliable results. Sensitivity is also at an all-time high with a dual ion approach so pesticides can be found at present parts per trillion (ppt) – helping today's labs not only meet current regulatory demands, but also ensure they can meet even lower trace requirements in the future if needed.

Thinking Beyond to Standardization

In addition to thinking about advanced instruments and software, standardization is also important in

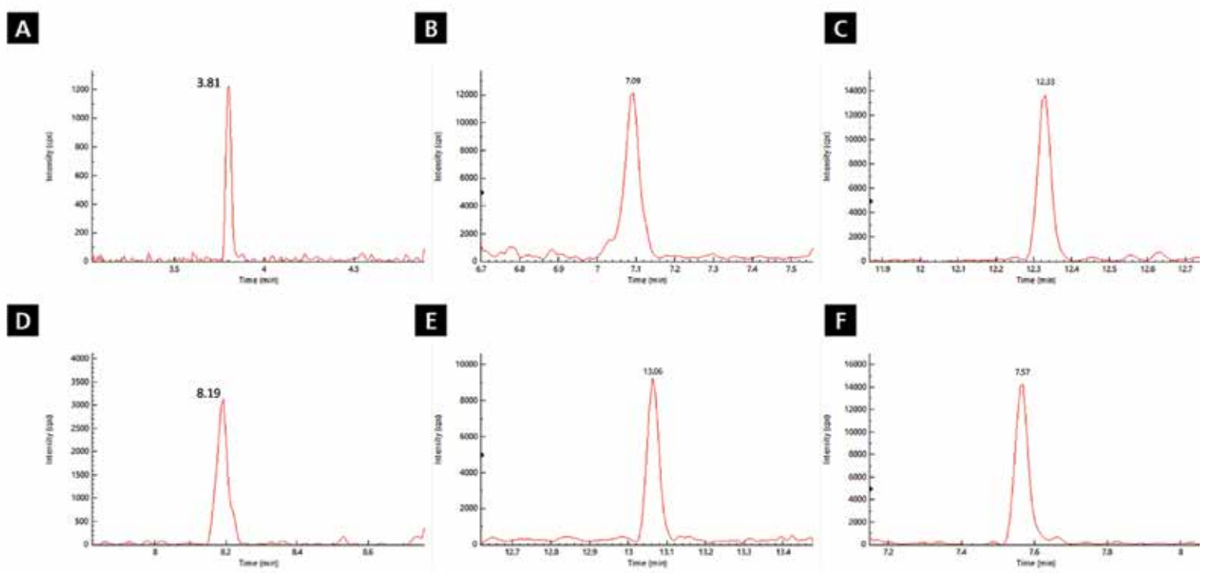

Figure Caption: MRM chromatogram from a sample cannabis matrix run on the PerkinElmer QSight ®420 with a representative set of pesticides:(a) oxamyl, (b) metalaxyl, (c) fenpyroximate, (d) myclobutanil, (e) Etofenprox and (f) Azoxystrobin.

cannabis testing. Labs utilizing standardized methods can help ensure safety, reproducibility, accuracy and compliance between products and geographies against an ever-changing backdrop of cannabis regulation.

As there is no federal oversight of cannabis in the US, however, no mandated methods or standardized proficiency tests exist today. There are, however, industry-led standards arising. Take for example, the Emerald Test™ from Emerald Scientific. This is an Inter-Laboratory Comparison and Proficiency Test (ILC/PT) program that brings well-established testing practices and standards from industries like environmental, food, pharmaceutical and water testing to the cannabis space. PerkinElmer has already started moving itself and its cannabis lab customers towards standardization by being awarded Emerald Test badges for proficiency in analytical instruments and testing methods for the detection of pesticides, heavy metals, and residual solvents as well as the determination of product potency for cannabis.

Innovative Science is at the Heart of Compliance

As noted in the 2017 report by the US National Academies of Science, Engineering and Medicine, "this is a pivotal time in cannabis policy and research" [2], with the regulatory landscape for this market constantly evolving.

In turn, we need to empower today's cannabis labs and scientists with the most advanced solutions, thinking and standards to help them protect the safety of medicinal and recreational cannabis patients and consumers.
For more information on PerkinElmer solutions around cannabis please visit: **http://www.perkinelmer.com/category/cannabis-analysis**

References

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- [2] "The Health Effects of Cannabis and Cannabinoids: The Current State of Evidence and Recommendations for Research", The National Academy of Sciences, Engineering, and Medicine, 2017. https://www.ncbi.nlm.nih.gov/books/NBK423845/