Agilent

Trusted Answers

Establish Your Cannabis Lab Fast

Ready-to-run eMethods and applications for cannabis testing: an application compendium

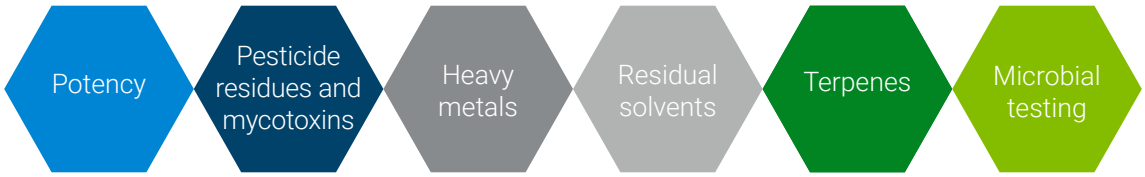
Introduction

Setting up a cannabis testing lab is a major undertaking. Expertise is required in many areas, including business, process and data management, chemical and biological testing, and a rapidly changing regulatory and statutory environment. Testing requires a suite of analytical tools that includes chromatography, mass spectrometry, and quantitative polymerase chain reaction (qPCR).

Agilent has a complete product and support offering for cannabis and hemp testing and has developed a complete suite of analytical methodologies to meet the most demanding cannabis-related regulatory requirements. Employing robust instrumentation, and sample preparation techniques along with expertly selected consumables and supplies, our cannabis testing workflows allow rapid start up, reduce downtime, and increase throughput to keep up with sample volume. In addition, we have built a suite of eMethods. eMethods feature ready-to-run acquisition and data analysis methods and reporting templates along with a user guide to accelerate successful laboratory implementation - all supported by an expert team of scientist and engineers.

Applications

This compendium presents eMethods and applications using Agilent instruments and solutions in the following areas of cannabis analysis:



Agilent eMethods

eMethods, a new Agilent product, provide a comprehensive and efficient delivery of end-to-end cannabis testing workflows. eMethods include information about sample preparation, chemicals, and consumables and deliver complete analytical instrumentation methodologies for automation, sample introduction, separation (chromatography), and detection (LC, GC/MS, LC/MS, ICP-MS), along with data processing and reporting tools.

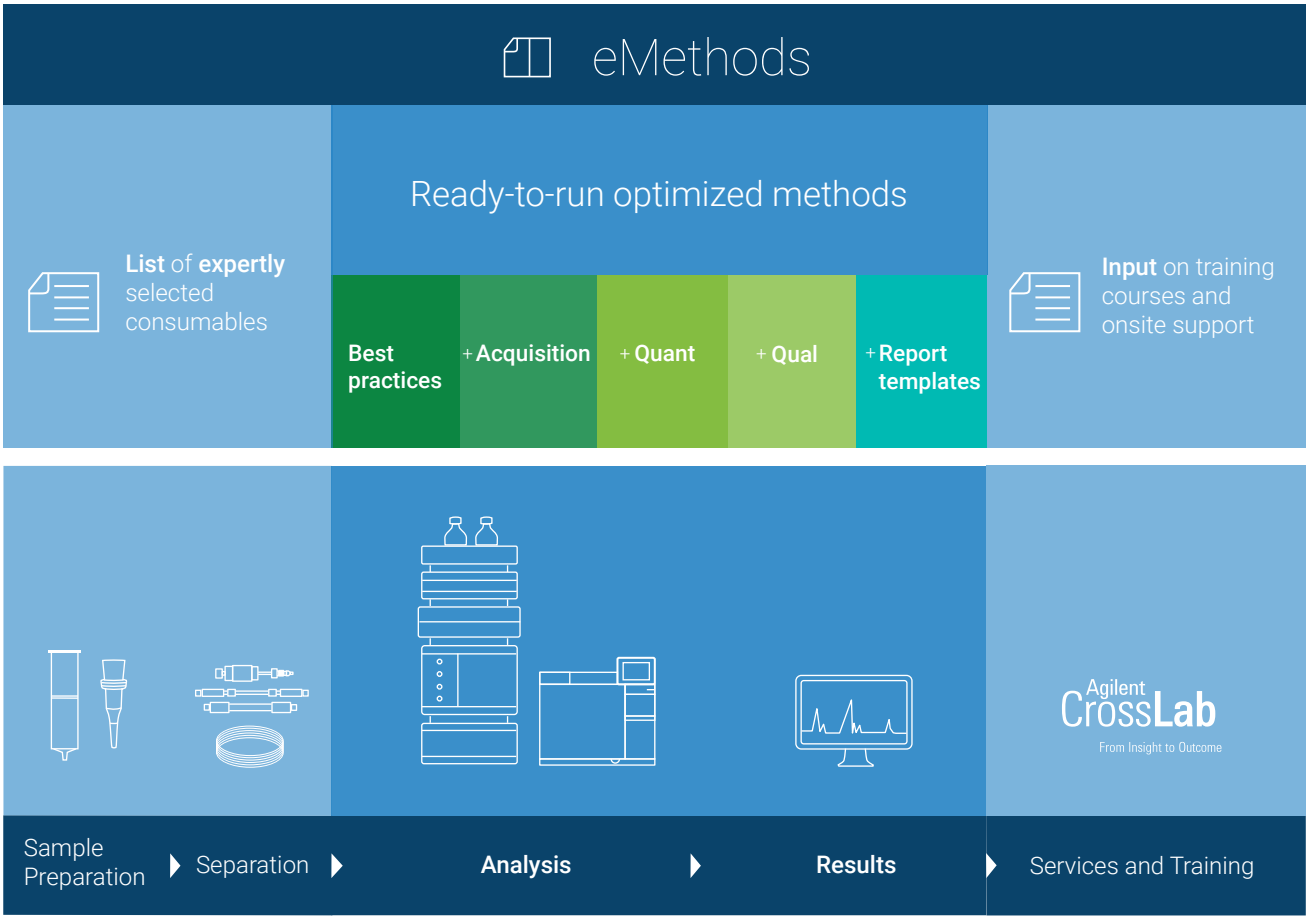
Agilent eMethods are designed to accelerate your startup time by condensing large amounts of technical information and optimized analytical methods into a ready-to-run, downloadable, digital information package. You reduce the time and effort involved in researching the analysis, eliminate delays associated with missing or incompatible components, and maximize profitability and lab productivity with quick start up.

Each eMethod provides you with all the information you need to quickly establish your cannabis testing workflow, including:

- The most suitable platform, instrument, and configuration
- Optimized analytical methods for sample introduction, separation, detection, and more
- The optimized sample preparation protocols and needed supply information
- Collection of best practices to assure streamlined operation

Agilent eMethods provide comprehensive workflows

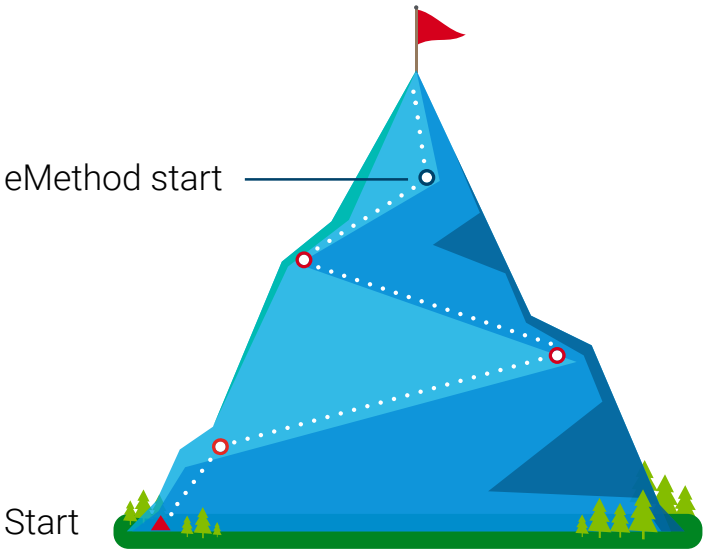
An eMethod covers the full scope of a cannabis testing setup, from the consumables needed for sample preparation to templates for result reporting. What's more, your Agilent representative can provide you with information on training and onsite support relevant to your analysis.



We have done the hard work for you

eMethods save you valuable start-up time and reduce or even eliminate the extensive work involved in:

1. Researching the analysis
2. Understanding the requirements
3. Choosing the right instruments and consumables
4. Verifying sample preparations
5. Optimizing the analytical methods
6. Streamling data analysis and reporting



Compared to starting from the ground up, an eMethod gives your lab a head start because we have already done most of the initial work for you.

Potency Testing

In all regions where medicinal or recreational cannabis programs have been legalized, it is mandatory to determine the total amount of the psychoactive content as the sum of tetrahydrocannabinol (THC) and tetrahydrocannabinolic acid (THC-A) and also report other phytocannabinoids such as cannabidiol (CBD). Potency testing can also provide accurate information to distinguish between hemp (THC<0.3%) or cannabis.

LC and LC/MS

Potency testing is typically performed by HPLC with UV detection. However, MS analysis, such as with the Agilent LC/MSD iQ, is becoming increasingly common. LC/MS measurements not only precisely determine total THC and total CBD content, but also commonly profile and quantify other cannabinoids that may be present but not regulated in cannabis or hemp products.

The Agilent 1220 Infinity II LC with UV detector provides rapid and robust test for 11 common cannabinoids found in cannabis flower, hemp, and oils.

Potency testing also can be performed on the Agilent 1260 Infinity II LC with UV or MSD iQ detectors with Agilent OpenLab CDS software.

In addition, Agilent Cannabis and Hemp Potency Kits are designed to go hand in hand with our instrumentation and eMethods. The consumables kits include sample preparation, analytical columns, and associated supplies needed to analyze 400 cannabis flower samples for potency.

FTIR

The Agilent Cary 630 FTIR (Fourier transform infrared spectrometer) provides a fast, easy, accurate, and economical system to measure laboratory-grade potency measurements of cannabis products. Some of the products that have been tested using the Cary 630 FTIR for potency consist of concentrates (shatter, butter, waxes) and distillates with THC potency values as high as 93%.

Relevant literature

LC and LC/MS application notes and eMethods

Dedicated Cannabinoid Potency Testing in Cannabis or Hemp Products Using the Agilent 1220 Infinity II LC System

eMethod: G5277AA Option 010

Quantification of Cannabinoids in Industrial Hemp Using the Agilent 1220 Infinity II LC System

eMethod: G5277AA Option 020

Quantitation of Phytocannabinoid Oils Using the Agilent Infinity II 1260 Prime/InfinityLab LC/MSD iQ LC/MS System

FTIR application note

Quick and Real-Time Potency Determination of Cannabinoids Using FTIR Spectroscopy

Pesticide and Mycotoxin Testing

Determining the residual amount of pesticides and mycotoxins is essential to ensure that safe products are delivered to the consumers. The selectivity and sensitivity required for the determination of residual pesticides and mycotoxins in this complex matrix can only be consistently achieved through triple quadrupole mass spectrometry coupled to both liquid and gas chromatography (LC/MS/MS and GC/MS/MS). The GC/MS/MS and LC/MS/MS dual-platform approach allows the detection of each analyte with the most suitable detection technique, ensuring reliability and delivering the highest throughput, unlike an LC/MS/MS-only approach.

Agilent has developed a superior analytical workflow for this analysis that includes an efficient single-stream sample preparation, which cleans up the complex matrix associated with cannabis and is amenable to both LC/MS/MS and GC/MS/MS analysis. Using both platforms assures that data quality is not sacrificed, and maximum productivity is reached. A data analysis and reporting package, using Quant-My-Way tools specifically designed for cannabis laboratories, provides effortless data review and report presentation.

LC/MS/MS

The Agilent 1260 Infinity II Binary Pump with the 1260 Infinity II Multisampler coupled to the Agilent 6470A or Ultivo triple quadrupole LC/MS is the ideal platform for this testing. This hardware configuration, which uses the Agilent MassHunter software, has been demonstrated to meet the most demanding limits of quantitation on large target lists like those of California and Canada.

GC/MS/MS

The Agilent 8890 or Intuvo 9000 GC system equipped with the 7693 Automatic Liquid Sampler (ALS) and the Agilent 7010 triple quadrupole mass spectrometer, can not only test for many of the target analytes in the various regional pesticide lists but specifically targets those compounds that are not amenable to electrospray ionization (ESI). Using a LC/MS/MS approach, analytes that are not detected by ESI require a second analysis using atmospheric pressure chemical ionization (APCI). A multi-platform approach better fits the needs of this complex testing in high-throughput laboratories.

Consumables for LC/MS/MS and GC/MS/MS

Agilent Cannabis Pesticide and Mycotoxin Kits are designed to go hand in hand with our instrumentation and eMethods. The consumables kits include sample preparation, analytical columns, and associated supplies needed to analyze 400 cannabis flower samples for pesticide residues and mycotoxins. The kits can accommodate different instrument configurations used for the analysis and provides step-by-step instructions on how to perform our single-stream sample preparation procedure.

Relevant literature

LC/MS/MS application notes and eMethods

Determination of Pesticides and Mycotoxins in Cannabis Flower as Defined by Legalized U.S. State Recreational Cannabis Regulations

eMethod: G5279AA Option 010 (Ultivo based and G7259AA Option 020 (6470 based)

A Sensitive and Robust Workflow to Measure Residual Pesticides and Mycotoxins from the Canadian Target List in Dry Marijuana Flower

eMethod: G5279AA Option 030

Why LC/MS/MS and GC/MS/MS Are Required for the Analysis of Certain Pesticides

GC/MS/MS application notes and eMethods

Analysis of 27 GC-Amenable Pesticides Regulated in the Cannabis Industry in North America with the Agilent 8890/7010B Triple Quadrupole GC/MS System

eMethod: G5278AA Option 010

Analysis of Challenging Pesticides Regulated in the Cannabis and Hemp Industry with the Agilent Intuvo 9000/7010 GC/MS/MS System: The Fast-5

eMethod: G5278AA Option 020

A Sensitive and Robust Workflow to Measure Residual Pesticides and Mycotoxins from the Canadian Target List in Dry Marijuana Flower

eMethod: G5278AA Option 030

Heavy Metals

Heavy metals can accumulate in hemp and cannabis during cultivation and processing. Exposure to metals such as lead, cadmium, arsenic, and mercury poses serious safety concerns. Many regions demand metals testing to ensure the safety of cannabis and hemp products prior to reaching the commercial market.

The Agilent ICP-MS Cannabis Analyzer dramatically shortens the time it takes to develop and optimize a new method, verify its performance, and obtain regulatory approval. The Cannabis Analyzer combines the powerful Agilent 7800 ICP-MS system with its standard High Matrix Introduction (HMI) technology, plus an optional Agilent SPS 4 autosampler. It comes complete with an optimized analytical method, ICP Go software interface, ICP-MS MassHunter software, and a consumables starter kit. The analyzer package includes expert assistance to help with setup, method transfer, and operator training.

Relevant literature

Multi-Element Analysis of Cannabis and Hemp Using the Agilent 7800 ICP-MS

Agilent ICP-MS Cannabis Analyzer

Residual Solvents

Residual solvents are extraction by-products found in processed cannabis and hemp products. Manufacturers need to incorporate stringent testing protocols to ensure that their cannabis concentrates, distillates, and extracts meet regulatory requirements. Agilent has developed efficient, high-throughput testing protocols to satisfy this need.

Residual solvents are volatile organic compounds (VOCs) used in manufacturing processes and must be removed or reduced to acceptable amounts in consumer products. Residual solvents testing requires headspace sampling, GC separation, and detection with a mass spectrometer. Agilent has developed a headspace GC/MS analysis system, built around the California residual solvent Category I and Category II target lists and limits of quantitation, that rapidly and efficiently meets regulatory requirements. The system is comprised of the 7697 Headspace Sampler, 9000 GC, 5977MS and driven by the MassHunter SW.

Relevant literature

Novel Residual Solvents Analysis of Cannabinoid Products with the Agilent Headspace-GC/MS system

Terpenes

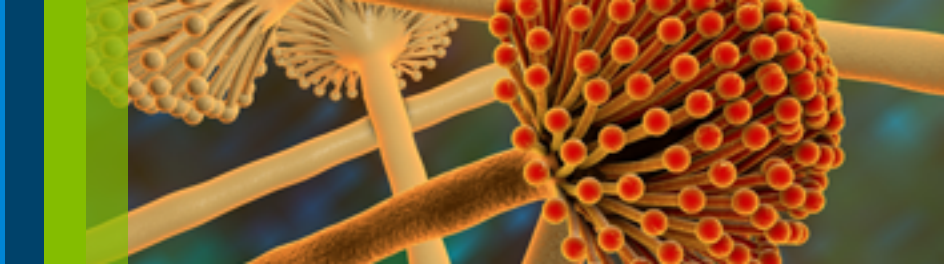
Terpenes are volatile and semi-volatile chemicals that engender flavor and aroma to cannabis and cannabinoid products. Although these compounds are not psychoactive, they do define the sensory character of the plant. The unique terpene composition gives the signature taste, smell, and experience of a particular strain so regularly reproducing the same terpene profile is key to product consistency.

Terpene profiling and quantitation are required by many regions, but no specific target list or detection levels are required. However, if there is a specific labeling claim on a product, such as 10 mg linalool/355 mL in a beverage, a laboratory must verify that the listed components and their quantity are accurate. In this latter case, terpenes analysis is therefore a quality control test. The Agilent terpenes analysis is performed by direct injection of the extracts of the cannabis, hemp, and cannabinoid products using the Intuvo 9000 GC and the 5977B MSD and controlled by the MassHunter SW. The method identifies and quantifies 40 common cannabinoid terpenes.

Relevant literature

Terpenes Analysis in Cannabinoid Products by Liquid Injection Using the Agilent Intuvo 9000/5977B GC/MS System

Microbial Testing



Under moist conditions, microbes such as *Aspergillus spp.* and *E. coli* can grow and thrive. Cannabis plant material must be monitored to ensure that these microbes are not present in consumer products. A common technique used for monitoring these dangerous pathogens in cannabis flower, extracts, and a variety of infused products is culturing in growth media plates, which is susceptible to false positive and false negative errors. Other shortcomings of culture-based microbial testing include the fact that *Aspergillus spp.* don't culture well, show nonspecific growth, and fail to grow pathogens.

Agilent has partnered with Medicinal Genomics to provide a complete workflow with highly selective and sensitive qPCR assays for the unequivocal identification and quantitation of microbes, yeasts, and mold mandated by various regulatory agencies. This workflow shortens the time to achieve results and reduces false positives and negatives compared to culture-based plating methods by using qPCR to detect the unique DNA sequence of *Aspergillus*, *Salmonella*, *E. coli*, and all other state-required microbial targets.

The Agilent AriaMx real-time qPCR system, the Bravo automated liquid handling platform, and the Medicinal Genomics PathoSeek Microbial Safety Testing Platform are part of a validated (by Medicinal Genomics) and efficient workflow that is comprised of an internal cannabis control and the ability to detect single or multiple targets per sample. The workflow can be processed manually or automated with the Bravo platform. In California, 46 samples can be tested for Salmonella, STEC (Shiga toxin-producing E. coli), and 4 Aspergillus species in one 96-well plate. In contrast, the same measurements following AOAC plating guidelines would require 1104 plates, a more than 10-fold increase compared to the Agilent AriaMx solution.

Relevant literature

Optimized Cannabis Microbial Testing: Combined Use of Medicinal Genomics Extraction Methods with the AriaMx qPCR Instrument

Agilent products and solutions are intended to be used for cannabis quality control and safety testing in laboratories where such use is permitted under state/country law.

Learn more:
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