

Ensure the Safety and Quality of Cannabis- and Hemp-Based Products

Minimize risk, maximize profitability, and grow lab productivity



Perform Comprehensive Cannabis and Hemp Testing with Agilent Instruments and Solutions

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

Agilent has developed a total package of analytical methodologies that every cannabis- or hemp-testing laboratory needs. We have a team of cannabis application experts ready to help develop, implement, and optimize methods to accelerate your laboratory success. Employing the world's most robust instruments, software, services, consumables, and sample preparation supplies, our cannabis testing workflow reduces downtime and gets you the throughput needed to keep up with sample volume.



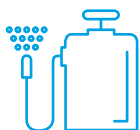
Agilent is focused on delivering products and services that maximize sample throughput, minimize instrument downtime, and future-proof laboratories against an ever-changing regulatory landscape.



Cannabis and Hemp Applications

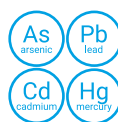
Minimize risk, maximize profitability, and grow lab productivity

From routine analysis to cutting-edge research, Agilent's portfolio works seamlessly for maximum efficiency and performance.



Pesticides and mycotoxins

Potentially harmful pesticides may be present in cannabis crops and extracts. It is therefore crucial that analytical monitoring of pesticide levels in cannabis takes place in order to assure consumer safety and comply with regulatory standards.¹



Heavy metals

Contamination with heavy metals such as arsenic, lead, cadmium, and mercury poses severe danger to human health. Cannabis products must therefore be rigorously tested to assure consumer safety.^{5,6}



Potency

Many countries around the world have legalized the use of medicinal or recreational cannabis or cannabinoid products. In these regions, quality and safety testing is required prior to retail distribution. Wherever cannabis or hemp products have been legalized, total potency and total cannabidiol quantitation is mandatory. In California, other cannabinoids like cannabidiol (CBN) and cannabigerol (CBG) are also regulated and must be quantified.²



Microbial testing

The presence of dangerous pathogens in cannabis poses a potential threat to consumers so products must be tested to assure consumer safety and comply with regulatory standards.⁷



Terpenes

Terpenes contribute to the flavor and fragrance of cannabis. Terpenes have also been used as a means of more accurately identifying and characterizing cannabis cultivars.^{3,4}



Residual solvents

Cannabis concentrates derived from the plant may contain solvents used in the extraction process. Residual solvent testing is required to ensure these volatile chemicals do not exceed levels deemed to be harmful to consumer health.⁷

1. Sullivan, Nicholas et al. Determination of Pesticide Residues in Cannabis Smoke. *Journal of Toxicology* 378168, 2013.
2. Morales, Paula et al. Molecular Targets of the Phytocannabinoids—A Complex Picture. *Progress in the Chemistry of Organic Natural Products* 2017; 103: 103-131.
3. Russo, Ethan. Taming THC: potential cannabis synergy and phytocannabinoid-terpenoid entourage effects. *British Journal of Pharmacology* 2011; 163(7): 1344-1364.
4. Fischechick, Justin. Identification of Terpenoid Chemotypes Among High (–)-trans-Δ⁹-Tetrahydrocannabinol-Producing Cannabis sativa L. Cultivars. *Cannabis and Cannabinoid Research* 2017;2(1).
5. Tangahu, Bieby et al. A Review on Heavy Metals (As, Pb, and Hg) Uptake by Plants through Phytoremediation. *International Journal of Chemical Engineering* 939161, 2011: 31.
6. McPartland, John et al. Contaminants of Concern in Cannabis: Microbes, Heavy Metals and Pesticides. *Botany and Biotechnology* 2017: 457-474.
7. Farrer, David. Technical Report: Oregon Health Authority's Process to Determine Which Types of Contaminants to Test for in Cannabis Products and Levels for Action. 2015

Confidently Perform Analysis of Flower, Extracts, and Final Products



Potency and cannabinoid content testing

In regions that have legalized medicinal or recreational cannabis, determining the total amount of tetrahydrocannabinol (THC) and other phytocannabinoids, such as cannabidiol (CBD), is required by state or country regulation. Producers, extractors, and processors need to analyze their oils, tinctures, concentrates, edibles, and beverages for total cannabinoid content to confirm label claims and for in-process optimization of their manufacturing output. In addition, forensic testing labs must also authenticate hemp products to determine whether they meet regulatory requirements for low THC—or are actually marijuana.

Potency testing is typically performed by LC with UV detectors. However, analysis with mass is becoming more common and quantification by Fourier-transform infrared spectroscopy (FTIR) spectroscopy is routine practice. These tests can determine total THC and CBD content, as well as profile and quantify other cannabinoids that may be present.

Dedicated cannabinoid testing: Agilent Infinity II LC systems

The Agilent 1220 Infinity II LC system is factory configured to test for 11 common cannabinoids. It includes all required consumables and training, so you can be up and running in just a few days. We can also deliver this same methodology on the Agilent 1260 Infinity II LC system or, for high-throughput labs, the Agilent 1290 Infinity II LC system. Add mass confirmation to your LC analysis with the LC/MSD.

Real-time potency determination: Agilent Cary 630 FTIR

This system takes laboratory-grade potency measurements of cannabis products—including concentrates and distillates. Measurement results can be acquired within minutes with basically no sample preparation and minimal user training.

MassHunter software

MassHunter software has unique features that transform data into insights. With qualitative and quantitative analysis tools, MassHunter allows you to use the same software across GC/MS, ICP-MS, LC/MS/MS and GC/MS/MS instruments.

OpenLab software

Agilent OpenLab secures laboratory data as part of the overall quality management system, as specified in ISO 17025. To ensure consistent, accurate, and reliable results, OpenLab ECM enables a lab to secure all electronic content and make it quickly available during an audit. The solution also enables labs to centralize data, preventing loss or tampering at a single workstation.



Agilent 1220
Infinity II LC



Agilent 1260
Infinity II LC



Agilent Cary 630
FTIR

Pesticide and mycotoxin testing

Determining the residual amounts of potentially dangerous pesticides and mycotoxins in cannabis products is critical, and challenging. You must identify parts per billion (ppb) levels of these chemicals against a background of phytocannabinoids, terpenes, and other endogenous chemicals. The selectivity and sensitivity required for determining residual pesticides and mycotoxins in these complex matrices can only be achieved through a dual platform approach utilizing both LC/MS/MS and GC/MS/MS.

Reliable quantitation: LC/MS/MS

The Agilent 1260 Infinity II binary LC with multisampler, coupled to the Agilent 6470 triple quadrupole mass spectrometer or Ultivo triple quadrupole LC/MS system, is ideal for pesticides screening. It harnesses Agilent MassHunter software to meet demanding quantitation limits (for example, the large target lists like those in California and Canada) which will only get more stringent over time.

Heavy metals and nutrients testing

Hemp and cannabis are known to readily concentrate and accumulate heavy metals, some of which may be harmful when ingested, inhaled, or absorbed. Exposure to metals such as lead, cadmium, arsenic, and mercury poses serious safety concerns. Therefore, where permitted, metals testing to ensure the safety of cannabis and hemp products before they reach the market is required. This system can also be used for soil, irrigation water, and plant nutrient testing.

Robust, high-throughput monitoring: Agilent ICP-MS Cannabis Analyzer

Our Cannabis Analyzer combines the powerful Agilent 7800 ICP-MS system with its standard High Matrix Introduction (HMI) system, 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.

Sensitive target analysis: GC/MS/MS

The Agilent 8890 GC system or the Agilent Intuvo 9000 GC system, coupled to the Agilent 7010 triple quadrupole GC/MS system, can test for many targets in regional pesticide lists. They are suited for compounds that are not amenable to electrospray ionization sources (ESI) used in LC/MS/MS. Contrary to popular claims in the testing industry, all pesticides cannot be analyzed by LC/MS/MS alone.

Optimized for laboratory productivity

The approach of using both LC/MS/MS and GC/MS/MS allows laboratories to optimize their workflows to attain the highest level of productivity possible. By using the correct tools for the job, Agilent provides:

- Maximized sample throughput
- Minimized instrument downtime
- Future-proofed laboratories
- Cross-validated positive results
- The ability to run more samples and generate higher revenue, all in the smallest amount of lab space possible



Agilent 1260 Infinity II
Prime LC with Ultivo
LC/TQ



Agilent 7010B
triple quadrupole with
Intuvo 9000 GC/MS



Agilent 7800
ICP-MS system



Residual solvents and terpenes profiling

Agilent protocols for testing residual solvents and terpenes meet regulatory requirements, and are designed for high-throughput laboratories. These methods combine the Agilent 7697A headspace sampler, the 8890 GC system or the Intuvo 9000 GC system, and the Agilent 5977B GC/MSD system.

Residual solvents

Potentially harmful volatile organic compounds (VOCs)—like acetonitrile, methanol, and butane—used during extraction and manufacturing must be removed or reduced to a residual amount. Testing for residual solvents is commonly required for pharmaceuticals, and defined in the USP-467 monograph.

Residual solvents testing requires headspace GC systems with either FID detection, mass spectrometry, or both. Agilent GC/MSD headspace analysis is built around the California residual solvent target list and limits of quantitation, so you can meet regulatory mandates with confidence.

Terpenes

Cannabis plants synthesize terpenoids such as limonene, linalool, and pinene. Although these compounds are not psychoactive, they do define the plant's aroma and character. Terpene profiling and quantitation are required by many regions regulations. However, unless there is a specific labeling claim, a lab cannot fail a batch of product based on terpene identity or concentration. The analysis of terpenes, therefore, serves as a quality test.

Agilent headspace GC/FID/MSD identifies and quantifies 22 common cannabinoid terpenes in less than six minutes, with an injection cycle time of 10 minutes.

Looking for great instrument value with no compromises?

Our certified pre-owned instruments deliver like-new performance, reliability, and speed at an affordable price. Agilent-trained technicians refurbish each instrument using genuine Agilent factory parts, so you can be sure that each module meets our rigorous specifications. And every instrument comes with the Agilent 12-month warranty for ultimate peace of mind.



Agilent 8890/5977B GC/MSD with 7697A headspace sampler
Headspace sampling ensures an inert sample pathway for superior GC/MSD performance without analyte degradation or loss.

Microbial screening

The presence of dangerous pathogens, such as *Aspergillus spp.* and *E. coli*, in cannabis products can pose a threat to consumers. Early detection of these species is critical to prevent crops from reaching fatal levels of contamination. A common technique for detecting these pathogens is culturing in growth media plates. However, plating techniques are highly organoleptic, and are susceptible to false positives and negatives.

qPCR microbial testing: fast, accurate, and scalable

Agilent has partnered with Medicinal Genomics to provide selective, sensitive quantitative PCR (qPCR) assays for identifying and quantitating microbes, yeasts, and mold per regulatory standards.



The Agilent AriaMx Real-time PCR system and the Medicinal Genomics Microbial Testing Platform create

a validated workflow that includes decontamination, an internal control, and multiplexed reactions. In multiple states in the U.S. and in Canada, this workflow was used to test up to 46 samples at a time for *Salmonella*, *Shiga toxin-producing E. coli*, mold, and four *Aspergillus* species in one 96-well plate.



Agilent AriaMx Real-time PCR system

Let Agilent be your single source for your cannabis testing workflow

Consumables you'll need to analyze your cannabis samples

Cannabis is a unique plant that requires unique sample preparation and analytical techniques to achieve parts per billion (ppb) and parts per trillion (ppt) detection limits. Agilent can help your lab with columns, supplies, and sample preparation solutions using methods that have been optimized and verified by our scientists. Our application compendium and user guide, combined with our custom chemical standards service, make it easy for you to get started quickly. Save time and simplify decision-making with preconfigured kits, such as the **Agilent Cannabis Pesticide and Mycotoxin Kits**. These kits include all of the sample preparation products, columns, and supplies you need, along with step-by-step guidance to analyze 400 cannabis samples using an LC/MS or LC/MS and GC/MS workflows.

For more information, visit: www.agilent.com/chem/CannabisKit



Get more from your instruments with expert service and support

Agilent CrossLab offers service options to meet the needs of your entire laboratory—especially in regulated industries. We provide comprehensive repair, maintenance, and qualification for your analytical instruments, regardless of manufacturer. With the largest network of trained technicians, only Agilent can provide the best-in-class support and remote diagnostics to maximize uptime, ensure compliance, and simplify lab management processes.

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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.
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