SHIMADZU
Excellence in Science

Analytical Platforms for the Hemp Lab

Hemp Testing Laboratory Solutions

We are the hemp testing instrument experts.

When purchasing analytical equipment, it is important to know that you are not just buying an instrument but investing in your lab's future.

Shimadzu not only provides the instrumentation and software, plus optional FDA 21 CFR Part 11 compliance software for required labs, but also the technical knowledge and support to help your lab be successful. We can assist with method development, instrument training, and many other areas of support like maintenance to ensure your systems are constantly operating at an exceptional level.

From seed to sale, from accurate hemp profiles to reliable, highly sensitive pesticide analysis, let us deliver scalable, turnkey solutions to meet your testing needs for today and tomorrow.

Hemp growers benefit tremendously from testing. Whether meeting state requirements or certifying a product, laboratory testing reduces your risk and ensures delivery of a quality product. Routine hemp testing services include potency, screening/ determination of terpenes, and analysis of heavy metals, pesticides and residual solvents.

Shimadzu provides you with the leading hemp testing analytical instrumentation. Our rigorously tested methods, according to USP guidelines, expansive platforms and expert team of scientists are readily available to help your hemp testing laboratory succeed. Talk to us today about your analytical testing needs.

As medicinal and recreational hemp markets continue to grow, analytical testing will ensure that consumers are receiving accurately labeled products that are free from contamination. Shimadzu is ready to assist you as you grow your laboratory. We also offer instrument research platforms and a variety of leasing programs to meet evolving requirements.

Delivering total hemp lab testing solutions for:

Information on the following pages reflects recommended platforms for each analysis/test. Some techniques, such as LC-MS/MS or GC-MS/MS, may be applicable for multiple analyses. Please contact your salesperson for more details.

Potency Testing

The Hemp Analyzer captures the spirit of an Analyzer - a comprehensive package integrating instrument hardware, software, consumables, and analytical workflow. Includes a certified reference material (CRM) mixture of target compounds. Also includes a service package to cover preventive maintenance and warranty for three years, plus free technical support for the life of the product. The solution is ready to use after one day of installation and testing, and requires no time-consuming method development on the part of the analyst.

Target Compound List	
THCV	Tetrahydrocannabivarin
Δ8-THC	Δ8-Tetrahydrocannabinol
Δ9-THC	Δ9-Tetrahydrocannabinol
THCA	Δ9-Tetrahydrocannabinolic acid
CBD	Cannabidiol
CBDA	Cannabidiolic acid
CBDV	Cannabidivarin
CBN	Cannabinol
CBG	Cannabigerol
CBGA	Cannabigerolic acid
CBC	Cannabichromene

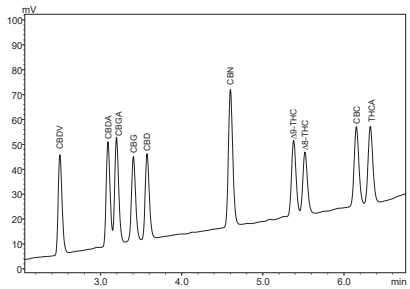
- ✦Turnkey HPLC Analyzer
- ✦Choice of 3 Proven HPLC Methods
- ✦3 Years Warranty & Preventive Maintenance

High Throughput HPLC Method Package – Designed for analysis of CBD, Δ9-THC, and 8 other commonly requested cannabinoids in under 8 minutes. This is the original method developed by Shimadzu in collaboration with industry laboratories. (Does not include THCV.)

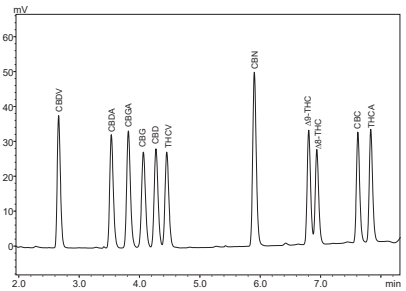
High Sensitivity HPLC Method Package – Adds THCV to the target analyte list, with an instrument cycle time of under 10 minutes. The short analysis time produces the sharpest chromatographic peaks for the best overall sensitivity.

High Resolution HPLC Method Package – Presents full baseline resolution for all 11 compounds and an analysis time under 30 minutes. This method is preferred for research purposes, or when additional compounds must be added to the analysis in response to new state regulatory requirements.

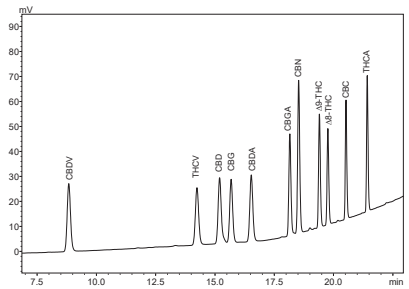
High Throughput Method



High Sensitivity Method



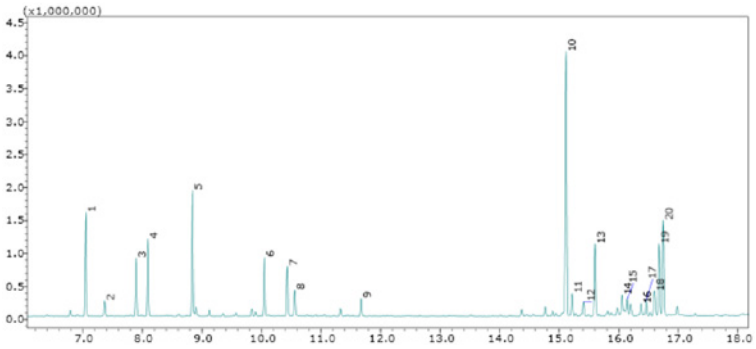
High Resolution Method



Terpene Profiling

Hemp plants produce terpenes, which give cannabis its distinctive flavor and aroma. Some of the most common terpenes are pinene, linalool, myrcene, limonene, caryophyllene, and humulene. Terpenes act as essential, medicinal hydrocarbon building blocks, influencing the overall homeopathic effect. From the pine odor of pinene to the citrus-like smell of limonene, the characterization of terpenes and their synergistic effect with cannabinoids is easily achieved using Shimadzu gas chromatography.

The Shimadzu GCMS-TQ8050 NX with HS-20 Headspace Sampler or GCMS-QP2020 NX with HS-20 Headspace Sampler and NIST Spectral Library is the ultimate platform for terpene analysis. It easily identifies more than 3,000 flavor and fragrance compounds to meet your terpene profiling needs. The same combination can also analyze residual solvents (page 7) while pesticides (page 6) can be analyzed with the addition of a liquid autosampler, such as the AOC-20i or AOC-6000.



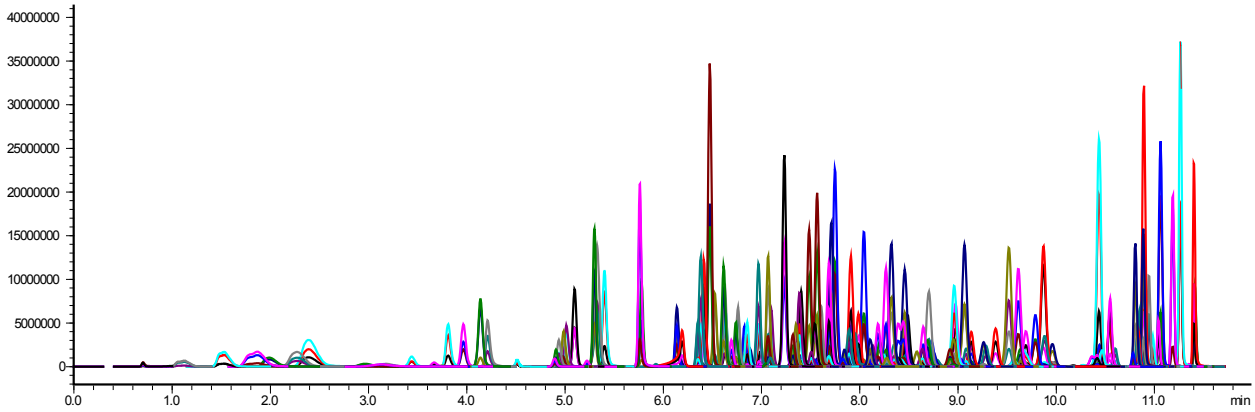
Terpenes Profile of a Hemp Plant

The Shimadzu GCMS-TQ8050 NX with HS-20 Headspace Sampler or GCMS-QP2020 NX with HS-20 Headspace Sampler

Pesticide Analysis

Pesticides are used in commercial hemp grow operations to kill insects and spiders that thrive on hemp plants. Pesticides are carcinogenic and mutagenic, causing serious harm to hemp consumers, especially immuno-compromised medicinal hemp users. Shimadzu offers the most sensitive and comprehensive pesticide analysis and confirmation available utilizing Liquid Chromatograph-Mass Spectrometry (LC-MS).

Offering excellent sensitivity and throughput, the ultra-low detection limits provided by Shimadzu LC-MS make this technique ideal for the analysis of pesticides commonly employed during hemp cultivation.



High-sensitivity LC-MS/MS analysis of 211 pesticides in hemp in less than 12 minutes using a Shimadzu LCMS-8050 triple quadruple mass spectrometer

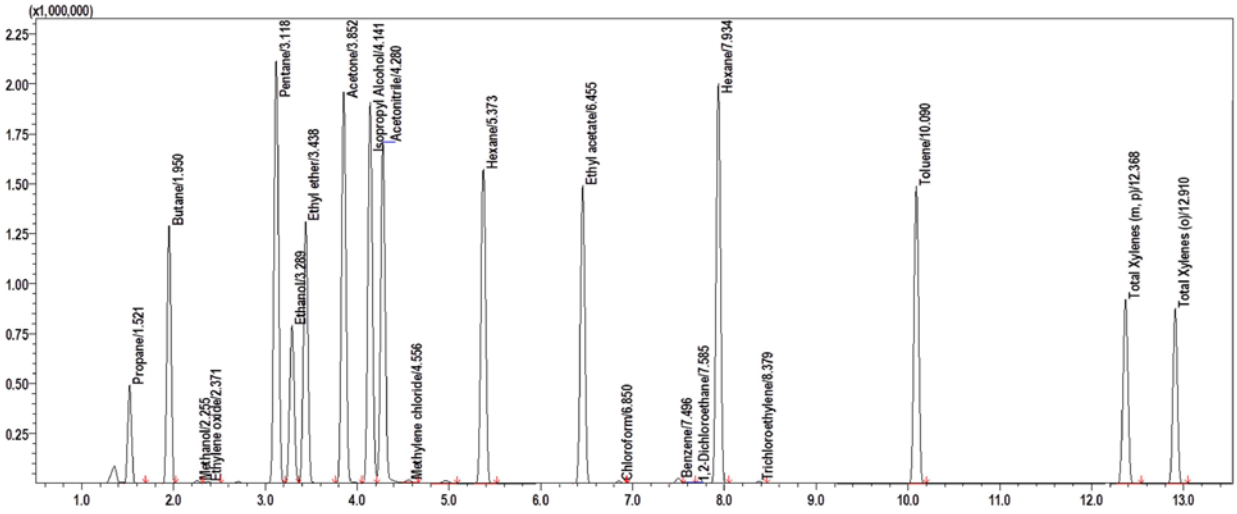
LCMS-8050 Triple Quadrupole Mass Spectrometer

The limits of detection (LOD) continue to become more difficult to measure as new regulations and methods are approved. In addition, because the pesticide list varies from state to state and country to country, and is subject to change, the addition of a GC-MS/MS may be required for complete pesticide analysis. Choose the triple quadrupole GCMS-TQ8050 with AOC-6000 autosampler for volatile pesticides, pesticides that are difficult to analyze by electrospray ionization (ESI), and other problematic pesticides, such as Captan, Chlordane, Chlorfenapyr, Cyfluthrin, Cypermethrin, Dichlorvos, Parathion Methyl, and Pentachloronitrobenzene (Quintozine), difficult to analyze by LC-MS/MS. The GCMS-TQ8050 can also be used for terpene profiling (page 5) and residual solvents analysis (page 7) with the addition of a headspace sampler.

Residual Solvents

Residual solvents are leftover chemicals from the process used to extract cannabinoids and terpenes from the plant. The solvents are evaporated to prepare high-concentration oils and waxes. Sometimes, the evaporation process does not remove all of the solvent. Since these solvents are not safe for human consumption, it is important to verify their absence so you can guarantee you are providing a safe, chemical-free product.

The Shimadzu GCMS-TQ8050 NX with HS-20 Headspace Sampler or GCMS-QP2020 NX with HS-20 Headspace Sampler enables rapid identification and quantitation of very low concentrations of residual solvents. However, if one plans to purchase the GCMS-TQ8050 NX or GCMS-QP2020 NX with headspace for terpene profiling (page 5) and pesticide analysis (page 6), then this would be sufficient for residual solvents analysis.



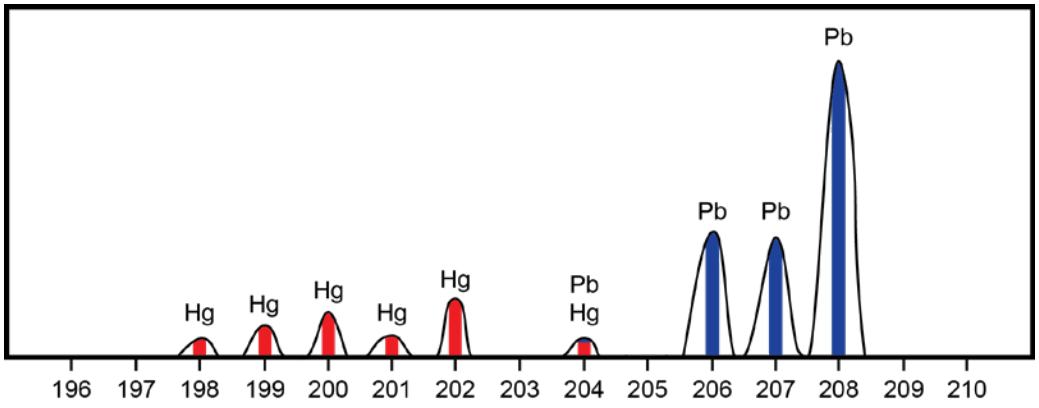
TIC chromatogram of 20 Residual Solvent standards (required in CA)

The Shimadzu GCMS-TQ8050 NX with HS-20 Headspace Sampler or GCMS-QP2020 NX with HS-20 Headspace Sampler

Heavy Metals Testing

Metals can be found in soil and fertilizer. As hemp plants grow, they take up metals from the soil. 'Heavy metals' are a group of metals considered to be toxic and include lead, cadmium, arsenic and mercury. Laboratory testing helps to ensure that your products are free from toxic concentrations of these hazardous metals. Additional toxic and nutritional elements are easily added to the analysis list as needed.

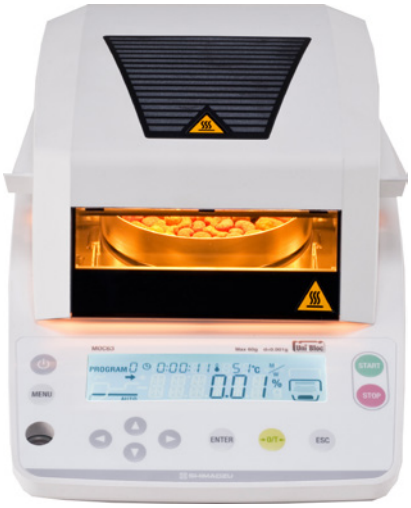
There are several ways to determine trace metals in plant material, all requiring an acid digestion. However, the Inductively Coupled Plasma Mass Spectrometry (ICP-MS) method provides the sensitivity to measure low levels of these toxic metals without the need for additional sample preparation or purchase of additional expensive sample introduction accessories.



Portion of ICP-MS mass spectrum showing presence of mercury and lead in a contaminated sample

ICPMS-2030 Inductively Coupled Plasma Mass Spectrometer

Moisture Content & Precision Weighing

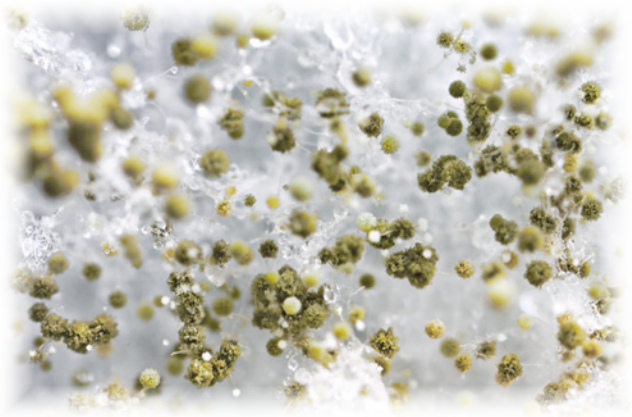


Moisture can be extremely detrimental to the quality of stored hemp products. Dried hemp typically has a moisture content of 10-12%. A moisture content above 12% is prone to mold growth.

The moisture content of a variety of hemp samples can be measured using Shimadzu MOC63u (and MOC-120H) balances. The MOC63u is applicable to a variety of hemp products and its long-life and high-power halogen heater provides quick and accurate measurement.

We offer a complete line of balances, from top-loading to analytical.

Mycotoxins Analysis



Since hemp has a high moisture content, long term storage of the material can allow for fungal growth known as mold. Mycotoxins are a toxic secondary metabolite of mold. Aflatoxins are a subset of mycotoxins which are found in soils and decaying vegetation. Regulatory bodies have placed restrictions on the allowable limits present in food.

An LCMS-8050 offers the hemp lab the ability to rapidly test for mycotoxins achieving the ultralow levels of detection needed.

LCMS-8050 Triple Quadrupole Mass Spectrometer

Software Compliance

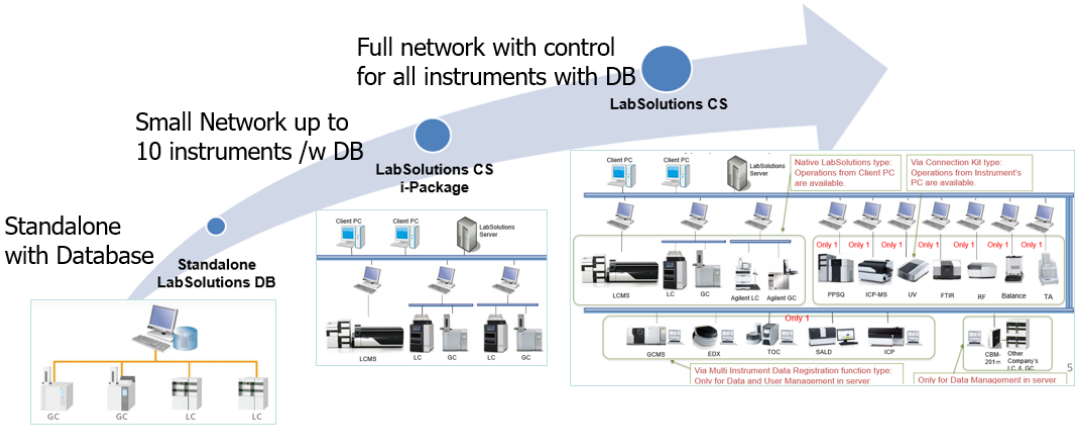
LabSolutions DB/CS provides comprehensive features, controls and functionality that assure data integrity in your cannabis laboratory. The broad nature of these controls allows a compliant data management environment to be quickly and easily established whether working with a small number of instruments within a single laboratory or with multiple instruments across a large number of laboratories.

This also includes the ability to:

- Manage additional, non-analytical instruments in a compliant manner (e.g. balances / weigh scales)
- Capture additional laboratory data in a compliant and integrated manner
- Integrate common third-party instruments from multiple vendors into a single compliant data management environment
- Step up from folder/file management to database management for FDA 21 CFR Part 11 Compliance

LabSolutions DB/CS provides multiple features and functions which support data integrity and electronic records/electronic signatures compliance.

These features can be mapped against the FDA's 21 CFR Part 11 (Electronic Records, Electronic Signatures), EU Eudralex 4, Annex 11, PIC/S and Computerized Systems and data integrity ALCOA+ requirements.



Research Platforms

Does your facility need capabilities beyond the standard quality control lab? Shimadzu offers a wide variety of research instrumentation that allows you to be at the forefront of cannabis research. Having these advanced tools at your fingertips gives you access to the most advanced technology available.

Instrumentation includes:

- Online SFE-SFC-LC-MS/MS – reduces sample preparation and detects isomeric and chiral compounds
- MALDI-TOF MS – detection of microorganisms and cultivar typing
- High-resolution Q-TOF LCMS – accurate mass measurements

Cannabinoid Standards

Shimadzu manufactures two cannabinoid mixtures to reduce the time of your sample preparation. Each standard has a concentration of 250ug/mL housed in a flame-sealed ampule. All Shimadzu standards are manufactured to ISO-17025 Guide 34 requirements.

- 10-part mix contains: THC-A, Δ8-THC, Δ 9-THC, CBD, CBD-A, CBD-V, CBN, CBG, CBG-A, CBC
- 11-part mix contains: THC-A, THC-V, Δ8-THC, Δ 9-THC, CBD, CBD-A, CBD-V, CBN, CBG, CBG-A, CBC

Part Number	Description
220-91239-20	Certified Cannabinoids Standards Mixture - 10 Components 1mL x 250ug/mL
220-91239-21	Certified Cannabinoids Standards Mixture - 11 Components 1mL x 250ug/mL

Columns and Vials

Shimadzu specifically engineered a superficially porous liquid chromatography analytical and guard column for the analysis of cannabinoids. Ensure the ultimate in resolution and sensitivity for hemp analysis by using the NexLeaf™ brand.

Part Number	Description
220-91525-70	NexLeaf™ CBX™ for Potency, LC Column 2.7 µm 150 mm, 4.6 mm ID
220-91525-72	NexLeaf™ CBX™ Guard Column 2.7um, pack of 3
220-91525-73	NexLeaf™ Guard Column Holder
227-34001-01	LabTotal Vial Kit, 100/pk
220-90631-01	Vial, 40mL, EPA Clear, 72/pk

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