Cannabis retailers say it's hard to sell flower with less than 20% THCa, the form of tetrahydrocannabinol that becomes psychoactive when heated.

CREDIT: AP PHOTO/MARY ALTAFFER

Shopping for cannabis testing labs

In US states struggling to regulate testing, some labs seem to offer only favorable results

BRITT E. ERICKSON, C&EN STAFF

To a passerby on the sidewalk, the retail cannabis business seems to be coming into its own. In US states with a state-regulated market, customers are welcomed into slick stores selling cannabis in carefully sealed packages. The labels on the back detail active ingredients with percentages that can go to two decimal places.

Most customers latch onto one of the first figures on the label: the percentage of tetrahydrocannabinolic acid (THCa), which turns into psychoactive Δ^9-tetrahydrocannabinol (THC) when heated. For many, the higher the THCa number the better. But leaders of several cannabis testing labs say this figure, as well as other cannabis testing results, is often fabricated.

The demand for superstrength THC products has led to a problem in the cannabis testing industry: marketers who shop around for a lab that will give them the THC results they want. And the shopping doesn't stop there. Analytical chemists in the cannabis industry say some testing labs also deliberately overlook mold and pesticides, allowing contaminated cannabis products to end up on dispensary shelves.

Testing labs that try to do the right thing say they are losing customers. Many are laying off workers or have closed down. The ones still hanging on have diversified into areas beyond

In brief

Laboratories licensed to test cannabis in markets regulated by US states claim that they're losing customers to competitors willing to provide favorable results. The "lab shopping" problem began with labs inflating levels of THCa, the acid form of the psychoactive ingredient tetrahydrocannabinol (THC), in cannabis flower. But labs say they have evidence suggesting that some competitors are also overlooking mold and pesticides, thus allowing contaminated products to reach consumers. Regulators in some states are addressing fraudulent test results better than those in others. A handful of states are opening reference labs to help with investigations, but most facilities are slow to get up and running. Labs that play by the rules are tired of waiting for regulators to address what they say is a public health issue.

cannabis, saying they can't compete with bad actors who falsify data. After years of complaining to state regulators, some labs are now taking matters into their own hands. They are collecting data and suing other labs, claiming that they are faking results.

Cannabis is illegal on the federal level, but every US state with a legal cannabis market is dealing with some degree of "lab shopping." Some states have stronger oversight of testing labs and are more willing to investigate complaints than others. But even regulators with the best intentions are finding it difficult to stamp out lab shopping.

Cannabis flower contaminated with mold is showing up on dispensary shelves across the US.

Tackling THC inflation

"I personally have been asked to find a couple more percentage points of THC," says Julie Kowalski, an analytical chemist and expert in cannabis testing. Kowalski formerly served as chief scientific officer at a cannabis testing lab in Washington State. She left the position in 2020, frustrated about the lack of scientific integrity and widespread data manipulation in the industry.

That culture persists, she says. Now a consultant, Kowalski helps new cannabis testing labs get started. Lots of people say they want to be the lab with integrity that does the best science, she says. "I always tell them, 'You better have a different business plan, because that is not going to get you customers.'" She recommends that labs diversify into areas such as environmental testing to pay the bills.

The biggest surprise at the start "was learning how the cannabis market operates," Kowalski says. Dispensaries want to sell products with the highest THC values, so they push back on growers and "the growers push back on the laboratories to produce higher numbers," she says. Labs either give clients the results they want or go out of business.

Regulators in some states are starting to crack down. On Jan. 1 of this year, California's Department of Cannabis Control (DCC) began requiring all licensed cannabis testing labs in the state to use the same standardized operating procedures and method for measuring THC and other cannabinoids. The intent was to reduce THC inflation, but some lab executives say the new policy has forced them to use an inferior method.

Josh Wurzer is cofounder and chief compliance officer of SC Laboratories, a cannabis testing firm operating in multiple states, including California, where it launched. The state's new rule has "tied our hands behind our back," he says, adding that SC Labs has developed its own method and would like the chance to demonstrate to regulators that it is more accurate.

For the first few months after California required the standard method, THC percentages fell for cannabis flower sold there. But they seem to be creeping up again, industry watchers say.

Before the regulation, it was common to see 30–45% THC values on cannabis flower in California—a level that is biologically improbable. "It's just impossible for the plant to make 45% THC," says Amber Wise, scientific director at Medicine Creek Analytics, a cannabis testing lab near Seattle.

THC inflation differs from state to state, Wise says. She typically sees flower in Washington with 20–25% THC, which is within the scientifically reasonable realm.

THC inflation was a big problem in Oregon early on, but levels seem to have gone down there, according to Wurzer. "It got so bad where flowers were listed as 50% THC." He credits Oregon retailers, not regulators, for getting the situation under control. "Certain dispensaries just started seeking accurate results," he says. When a dispensary offers products with bogus test results like 50% THC, Wurzer adds, "it devalues everything else on their shelves."

In addition to Oregon and California, SC Labs has testing labs in Michigan, Colorado, and Arizona. "We see THC inflation to an extent in all of the markets we're operating in," Wurzer says. Though the problem isn't as bad in some states as it is in California, "it's certainly an issue everywhere," he says.

THC inflation is "probably one of the largest consumer fraud issues in US history," says Chris Hudalla, founder and chief scientific officer of ProVerde Laboratories, an analytical testing firm in Massachusetts. "The level of fraud and the level of lab shopping varies by state. In every state, I would say it's a significant problem," he says. "The state where we operate is probably one of the worst."

Hudalla compares THC inflation with chicken plumping, in which meat producers inject water into poultry to increase the weight. "When you buy chicken at the grocery store, 10% of what you're paying for is probably just water," he says. When a lab is pumping potency values, "you're paying for THC that's not there." Hudalla estimates that Massachusetts consumers paid for $90 million worth of THC that they did not get in 2022, the most recent year for which data are available.

Wurzer doesn't see THC inflation as a health issue. "But people who are willing to fudge their THC results are the first ones who are going to be willing to cheat or fudge a result that is more dangerous or that is more important for health and safety."

One of those areas is mold.

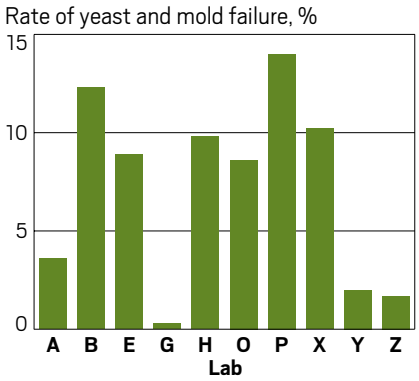
Passing contaminated weed

Microbes such as yeast and mold are a huge problem for the cannabis industry and the biggest reason cannabis fails testing. The economic pressure to manipulate results so cannabis products don't flunk microbial testing is intense, Kowalski says. "I've had clients tell me, 'We totally think that you know what you're talking about, but I will not be able to test with you

CREDIT: SHUTTERSTOCK

Outliers

Some cannabis labs in Massachusetts reported unusually low rates of failure for yeast and mold contamination in 2022.



Source: Data provided by Chris Hudalla of ProVerde Laboratories, who obtained them from the Massachusetts Cannabis Control Commission through a Freedom of Information Act request.

because you just gave us a failed micro. And that lab down the street—I know that I will not get a failing result.'"

States address yeast and mold contamination in different ways. Many states require classic microbial plating and culture methods. Some have adopted a limit of 10,000 colony-forming units (cfu) per gram of cannabis flower. In Maryland, the limit is 10 times higher because nearly all products would fail the 10,000 cfu/g limit.

In California, regulators no longer require total yeast and mold counts. Instead, labs test for pathogenic molds, such as *Aspergillus*, as well as harmful bacteria like *Salmonella* and *Escherichia coli*, using polymerase chain reaction methods.

Despite the testing requirements, moldy weed still ends up on store shelves across the US.

In Massachusetts, wholesale cannabis purchased by multiple producers "is horribly contaminated with mold," Hudalla says. Because of problems with moldy weed, he says, "about a year and a half ago, we started offering free yeast and mold testing for anyone in the state—a home grower, somebody who bought product at a retail operation, any producer, any retailer."

ProVerde analyzed the data gathered so far from the free service and found that over 50% of the cannabis sourced from Massachusetts retailers failed the limit for mold. "This is product that was certified to be tested as mold-free," Hudalla says. The dataset is not huge, he adds, "but there are enough points that it raises concerns that there's something not right."

Hudalla says that he turned over all the data to state authorities but that the Massachusetts Cannabis Control Commission refused to even acknowledge them. In addition to evidence of moldy weed, he has given the state data on inflated THC values and unlawful pesticides, he says. "I provided to our Cannabis Control Commission on the order of thousands of data points that would indicate fraud, malfeasance, or incompetence."

Hudalla says ProVerde's insistence on accurate results has cost it business. "We have some of the fastest turnaround times. We have the lowest price point in Massachusetts. We have the largest facility. And we still have one of the lowest market shares," he says. Labs compete by providing customers with the results they want, according to Hudalla. "If they don't like your results, they may ask you to alter them."

He recalls being asked to remove pesticide findings from a certificate of analysis (CoA).

"One of the largest producers said, 'If you don't take this pesticide off my CoA, I will never do business with you again, and I will make sure that nobody else does.'" ProVerde lost a significant client that day "because we refused to take that pesticide off," Hudalla says.

Testing labs in California describe a similar situation. "I've been reporting fraudulent lab results to the DCC since about 2017," says Josh Swider, cofounder and CEO of San Diego–based Infinite Chemical Analysis Labs, which also operates in Colorado and Michigan.

Swider estimates that he has given regulators in California about 100 CoAs from contaminated products that he says passed testing by other labs and got into stores in the state. He purchased the products himself and tested them. In some cases, pesticides were more than 200 times the state limit. "I'm telling them of health problems on the shelf, and they're acting like all I'm trying to do is get a competitive advantage," he says.

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>
> —**Chris Hudalla**, founder and chief scientific officer, ProVerde Laboratories

After getting nowhere with regulators, Infinite Chemical Analysis and San Francisco–based Anresco Laboratories filed a lawsuit in late June against 13 other California-based cannabis testing labs, claiming that they had inflated THC percentages or failed to detect contaminants like mold and pesticides. These fraudulent results have created an unfair environment in which honest labs are at a disadvantage, the lawsuit claims.

"It's not for financial gains," Swider stresses. "It is so this gets brought to light."

An accurate sample weight is needed to determine the concentrations of cannabinoids in cannabis flower.

CREDIT: PROVERDE LABORATORIES

Labs that are testing cannabis correctly and protecting the public are not thriving because "there are enough labs out there that'll just turn a blind eye to things, or do things wrong, or have back-end deals," he says.

According to Swider, California regulators stopped talking to him after years of his haranguing. So he emailed Gov. Gavin Newsom in December listing 150,000 cannabis products that were being sold to consumers despite having failed testing and detailing how long regulators had known about them. Only then did the state start taking action, he says.

Regulators play catch-up

In late July, California regulators shut down California Cannabis Testing Labs (CCTL), alleging that it "engaged in activity that poses a threat to public health, safety, or welfare." The lab had been operating under a provisional license, which was renewed annually, since 2019. In a letter to the lab's owners dated July 24, the DCC canceled the provisional license and denied CCTL's application for an annual license.

The letter lists 20 violations, dating back to February 2022, including failure to detect the presence of pesticides. In one case, state officials detected 59.2 μg/g of the insecticide chlorfenapyr in a cannabis vape cartridge. CCTL's CoA says chlorfenapyr was not detected. California prohibits the use of chlorfenapyr on cannabis. State officials initiated a recall of the product on July 17.

In another case, the lab allegedly failed to detect *Aspergillus* in cannabis flower; that led state officials to initiate recalls of products tested by CCTL in March, May, and June. The DCC's letter also cites evidence of "a repeated pattern of reporting inaccurate and inflated cannabinoid results."

CCTL has requested a hearing to appeal the denied application. The lab also asked the Alameda County Superior Court for a temporary restraining order and a preliminary injunction against the DCC. Regulators granted the lab's request for a hearing, but the court denied its request for a temporary restraining order and preliminary injunction.

California currently has 27 licensed commercial cannabis testing labs, according to the DCC website. It took the agency more than 2 years to build a case against CCTL, and it's unclear how many other labs it is investigating.

Enforcement has been slow in California in part because of delays in getting the state's cannabis reference laboratory up and running. In 2021, California agreed to invest more than $11 million over 5 years to establish a third-party reference lab at the University of California San Diego that could validate results from the state's internal reference lab. The internal lab analyzes samples in response to complaints about contaminated or mislabeled products.

A handful of other states also have internal reference labs or are in the process of opening them to standardize methods, audit independent testing labs, and investigate complaints. But many of them can't start compliance work because they are not yet accredited to international standards such as ISO/IEC 17025.

Regulators in Maryland opened a reference lab in March in an industrial park on the outskirts of Baltimore. The lab has five full-time employees and plans to hire a sampling technician. With an annual budget of about $1 million, the lab plans to standardize cannabis testing methods and develop parameters for each test, says Michelle Sallin, chief of laboratory services and laboratory director at the Maryland Cannabis Administration.

Maryland has only four licensed independent cannabis testing labs, so it has not had to deal with lab shopping as much as other states, Sallin says. Nonetheless, she adds, the state is developing strategies to curb THC inflation "by providing more frequent audits of the data packets from independent testing labs and eventually using the reference laboratory to test samples of products with high THC values."

The reference lab is equipped with millions of dollars worth of analytical instruments, but for now they mostly sit idle. Scientists there are developing and validating methods in order to achieve ISO/IEC 17025 accreditation, without which they can't test products found on retail shelves, Sallin says. The lab expects to be fully accredited by March 2025.

Michigan plans to open a cannabis reference lab by the end of this year to serve as a third-party testing lab. But, as in Maryland, it will be early 2025 before the lab is fully accredited and able to test cannabis samples.

Even without the reference lab, Michigan has been one of the more responsive states when it comes to complaints about cannabis products, says SC Labs' Wurzer. When a sample is questionable, officials ask a few labs to test it.

With the new reference lab, "we hope to ease the burden on our licensed labs by bringing that kind of testing in-house," says Claire Patterson, the Michigan reference lab's director. "We think it's obviously going to be a lot quicker, and it'll reduce any sort of financial burden on those labs," she says.

Michelle Sallin, the Maryland Cannabis Administration's chief of laboratory services and laboratory director, optimizes a liquid chromatography method for measuring cannabinoids.

CREDIT: BRITT E. ERICKSON/C&EN

"Right now, we send those labs out, they get the samples, they do all the testing, but then they end up eating those costs."

Like other state cannabis reference labs, Michigan's lab plans to work on method development for THC, other cannabinoids, and pesticides. "I think it's a little bit early right now for us as the state to say, 'You have to use this one method,'" Patterson says. "I don't think that we know enough about all of the methods that are out there and how they're performing."

Patterson says the new lab will conduct random audits of Michigan's 25 independent cannabis testing labs. "Everyone needs to be following the rules," she says. Public health and safety "should be everyone's top focus. I'm broadly hoping that we can assist in that process."

She acknowledge that it won't be easy. "This industry is so creative and so fast paced—it's hard for us to keep up," Patterson says.

Oklahoma, once viewed as a kind of Wild West for cannabis because of its lax testing regulations, also plans to open a reference lab by year-end. It should be fully operational by the middle of 2025, says Cortney Cnossen, medical quality assurance lab director for the new lab.

The state, which allows cannabis to be used only for medical purposes, enacted stricter standards in July for its 25 testing labs. "Our biggest goal is patient safety," Cnossen says. "It's ensuring that what is labeled and being sold at dispensaries is

"You see it in the data that the honest mostly go out of business."

—Yasha Kahn, vice president of marketing and data science, MCR Labs

what patients are actually getting, as well as making sure our laboratories are operating correctly."

The new lab plans to administer a proficiency testing program to ensure that all cannabis testing labs in the state produce accurate results. "Ideally we would like to generate samples in our laboratory and send them out to labs," Cnossen says. The labs would test the samples and send their results back to the reference lab, which would analyze the data for outliers. The agency also has a team of data analysts looking at all the laboratory reports for data anomalies and anything suspicious, she says.

"State reference labs can be a huge support to regulators in understanding testing inconsistencies and for use in investigations that might lead to recalls or enforcement action," says Gillian Schauer, executive director of the Cannabis Regulators Association (Cannra), an umbrella organization of state cannabis regulators.

Cannra facilitates discussions so state regulators "can learn from each other and work together to develop best practices, including those related to sampling, product surveillance, testing, and recall," Schauer says. Through the association, state governments are discussing systems for adverse event reporting and monitoring, "which can be costly and resource-intensive to set up, but can help regulators identify situations that warrant immediate action to protect public health," she adds.

It might not seem like it, but regulators are taking a number of approaches to address compliance among cannabis labs, Schauer says. "Just because people aren't reading about enforcement actions in the press does not mean they are not in process."

Regulators have to be cautious in their investigations "to ensure that enforcement actions are based on due process and sufficient evidence," Schauer says. They typically cannot share information with the public about the investigations, which often take several months to complete.

Chris Hudalla, founder and chief scientific officer of ProVerde Laboratories, analyzes microbial contamination in cannabis.

CREDIT: PROVERDE LABORATORIES

Exposing data outliers

Many cannabis testing labs that are trying to run an honest business say they are tired of waiting for regulators to act. They are also frustrated that states won't make cannabis testing data readily available to the public.

Yasha Kahn, vice president of marketing and data science at MCR Labs, which offers cannabis testing services in Massachusetts, Maine, and New York, has had some success getting state testing data through Freedom of Information Act requests. Kahn says he has sent requests to 37 states and so far received data from 17. The names of the labs that generated the data are not provided, he notes.

The data show that in every state, labs reporting the highest THC concentrations increase their market share year after year, Kahn says. Labs that have a total yeast and mold failure rate that's three to eight times below the national average also increase market share, he says. Those with a failure rate similar to the national average lose market share.

In most states, data on THC concentrations have an abnormal statistical distribution, with a cliff right at 20%. That's because cannabis flower with reported THC levels under 20% doesn't sell, according to Kahn.

The data also show that when cultivators switch to particular labs, their THC concentrations go up. "It's systematic," Kahn says. "We see this in almost every state, that a lab or two offer this incredible service." Similarly, he says, the data show that when cultivators switch to particular labs, their failure rate for mold drops way below the national average of 9–12%. Kahn plans to partner with other scientists to publish analyses of the data in peer-reviewed journals.

Based on the data he has seen so far, Kahn estimates that 30% of cannabis testing labs in the US are reporting false results. And those labs test 50–60% of the products because they are rapidly gaining market share, he says. "Some states don't have a single honest lab left," he warns. "You see it in the data that the honest mostly go out of business." ■