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*Updating the Technical,
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**Impact of CBD and THC Variants
on Workplace Drug Testing**

Impact of CBD and THC Variants on Workplace Drug Testing

With the emergence of CBD products and chemists creating new marijuana variants, laboratory testing methods require updating

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The laboratory confirmation methods for marijuana have been a straightforward analytical procedure for decades. Following a presumptive immunochemical positive for marijuana use, the resultant metabolite Δ^9 -THCA is reliably found and reported by GC/MS. The mass spectrometry method remained unchanged unless there was an instrument change, such as GC-MS conversion to LC-MS/MS technology. The overall testing process worked amazingly well, with few technical challenges to the testing process. But now, that has all changed. With the emergence of CBD products and chemists creating new marijuana variants, laboratory testing methods require updating.

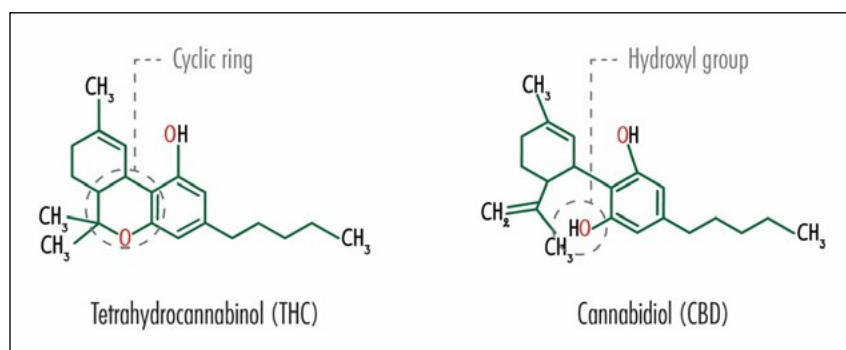
Cannabidiol (CBD) became the first “legal” commercial marijuana product following the Hemp Farm Bill of 2018. The “Farm Bill” opened the door for marketing and interstate trade of CBD products, and a CBD industry quickly emerged with edibles, tinctures, creams, vapes, etc. The only caveat for CBD was that CBD must be extracted from hemp, which is by definition $< 0.3\%$ tetrahydrocannabinol (THC).

CBD products are “health and dietary supplements”, which places them into the never-never land outside of FDA and federal oversight.^{1,2} In addition, there are no current requirements for any product testing of CBD products or accountability for accuracy of medical claims and product composition. This resulting lack of regulations, standards, and product testing left the door open for opportunists to supply harmful and noncompliant CBD products.



The chemical composition of CBD and THC are very similar. (See Figure 1). The chemical structure between CBD and THC is based on the closure of a chemical ring to convert CBD to THC. This ring closure happens in a very acidic environment. This simple conversion raised a concern as to whether this chemical conversion could occur *in-vivo*. The early science was inconclusive, but additional studies quickly proved that the body's stomach acid or liver metabolism did not convert CBD into THC.³

Figure 1 THC v CBD Structure



Although the *in vivo* conversion theory was disproven, individuals with positive marijuana results claimed only CBD ingestion for their proposed medical benefits. However, the THC present is not the result of the conversion of CBD to THC but rather the THC that exists in impure products available on the OTC market. (Naturally, another explanation is that the THC is simply there following the use of cannabis). Products with too much or too little CBD are often contaminated with other drugs, such as synthetic cannabinoids (K2) or THC, which led to positive urine drug tests.

Laboratory investigations also found that CBD alone has minimal impact on screening tests and did not convert to THC with extractions and derivatization for GC/MS or LC-MS/MS. In addition, special studies conducted by the National Laboratory Certification Program with the federally certified laboratories demonstrated CBD's stability.⁴ Thus, the good news is that all the unexpected laboratory results tests with CBD seen are due to the variable formulation of

the purchased CBD product and not laboratory testing deficiencies or errors.

The federal drug-testing program quickly prohibited the CBD as an alternative explanation or ingestion theory for a positive THC urine. This eliminated many technical challenges to marijuana testing and CBD became a "Buyer Beware" product. However, some employers within the non-regulated industry did not exclude CBD for their employees and work through occasional CBD vs. THC challenges. To assist in evaluating the

CBD challenges, MedTox Laboratory developed a CBD:THC ratio from several hundred donors to determine the likelihood of a positive marijuana test from CBD ingestion.⁵ This ratio calculation does, however, require

additional testing as the laboratory must now test for THC parent, Carboxy-THC, CBD, and Carboxy-CBD.

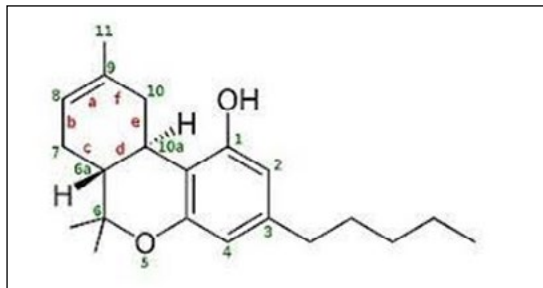
The total amounts of CBD parent and metabolite are compared to the total of THC plus metabolite. Based on their evaluation, a ratio of 10:1 (CBD:THC) would indicate that CBD was likely ingested and not from marijuana. Values of less than 10:1 to 1:1 are "indeterminate" and samples with a ratio of < 1 as only marijuana use. CRL's use of the MedTox ratio appears to have merit and assist in evaluating donor claims. Most frequently, it refutes the donor claim as CBD and CBD metabolites are absent in the urine.

The $\Delta 8$ -THCA Problem

Since the inception of the federal drug-testing program, the reportable metabolite for the ingestion of marijuana has been only $\Delta 9$ -THCA. Illicit cannabinoid chemists realized this, and with some time and creativity, developed

$\Delta 8$ -THC.⁶ As the name implies, the double bond has moved to the 8th position. (See Figure 2 & 3). This shifting of the double bond happens when $\Delta 9$ -THC is in strong acid. This process is done in a laboratory and not in the stomach.

Figure 2 Counting Carbons in THC



And Voila! We now have the creation of $\Delta 8$ -THC metabolites, which is also not included in employer drug policies or federal regulations.

$\Delta 8$ -THCA, unlike CBD, has apparent psychotropic cannabis-like effects and yet is not reported by laboratories. Thus, this $\Delta 8$ -THCA produced by clandestine chemists making cannabinoid variants of the normal $\Delta 9$ -THC from marijuana introduces a significant technical challenge to the laboratories and drug-testing programs.

Plant marijuana has always had a tiny amount $\Delta 8$ -THC and can appear in some urine samples as a minimal peak. It would range from non-detectable to < 1% of the $\Delta 9$ -THCA amount. This percentage started to change changing a couple of years ago. The $\Delta 8$ -THCA amount began to rise substantially, while the same time, the $\Delta 9$ -THCA metabolite amount was decreasing.

Earlier this year, CRL conducted a retrospective analysis of data for our cannabinoid positive samples for the preceding 12 months. In March 2020, the number of samples containing substantial amounts of $\Delta 8$ -THCA was 4%; by September 2020, it rose to 8%, in March of 2021, it rose to 18% and has continued to rise 19.9% in July 2021. In many of these samples,

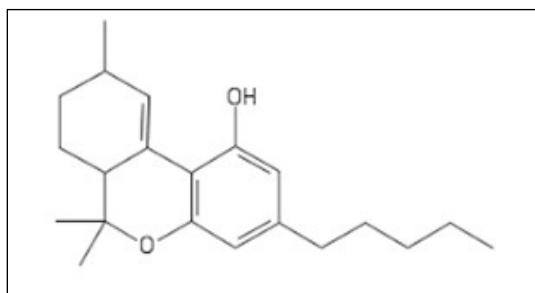
the $\Delta 8$ -THCA peak would dwarf the $\Delta 9$ -THCA metabolite.

We now see $\Delta 8$ -THCA levels of several thousands of ng/mL with $\Delta 9$ -THCA in some cases below the cutoff! $\Delta 8$ -THC is now the new “legal” high, claiming that it is merely a hemp extract. The evaluation of these claims is still under legal review. Although some literature claims that the “psychological high” is more appealing for the users, these statements have not been evaluated or peer reviewed.

Introducing: $\Delta 10$ -THC

It turns out that another new marijuana variant was also accidentally created during the California forest fires of a year ago. In controlling the forest fires, fire retardant was sprayed over the forest, and some of these retardants were accidentally or intentionally sprayed over the marijuana fields. For the crop to be safe, the retardant needed to be removed. In cleaning up the marijuana, a new chemical substance was chemically created, which is now identified as $\Delta 10$ -THC.⁷ Again, this involves switching a double bond. $\Delta 10$ -THC is 100% made in the laboratory and not found in the marijuana plant. (See Figure 3)

Figure 3 Delta 10-THC



Safety Concerns, Risks and Technical Challenges

The sale of the $\Delta 8$ -THC, $\Delta 10$ -THC, and other products are for sale in convenience stores, gas stations and CBD shops. These products have created a new and separate industry and currently taking shelf space away from CBD products.

The drug testing industry has survived the CBD product assault with donor acceptance that the CBD product purchased and endorsed by a CBD store employee is likely neither pure nor labeled accurately, and a marijuana positive is possible. However, the emergence of $\Delta 8$ -THC and $\Delta 10$ -THC variants are deliberate attempts to circumvent the drug testing rules and pose a much more significant challenge. Individuals are purposely using these products as a marijuana substitute with no other purpose than to avoid drug detection using current reporting standards.

The threat of these variants is that individuals in safety-sensitive positions that involve driving 18-wheelers, flying planes and operating locomotives are using them. With further purification of the marijuana variants, the use of a marijuana product will no longer be detectable with existing reporting standards. Therefore, it is time to review and update the reporting of marijuana variants.

¹ Cerino P, et al. A Review of Hemp As Food and Nutritional Supplement. [Cannabis and Cannabinoid Research](#). Vol 6, Number 1, 2021. Pages 19-27.

² Britch SC, et al. Cannabidiol: pharmacology and therapeutic targets. [Psychopharmacology](#). 238, 2021, pages 9-28.

³ Crippa, JAS, et al. Oral Cannabidiol Does Not Convert to $\Delta 8$ -THC or $\Delta 9$ -THC in Humans: A pharmacokinetic Study in Healthy Subjects. [Cannabis and Cannabinoid Research](#). Vol 5.

⁴ Hart D. Cannabinoid Metabolites Pose Analytical Challenges in Urine Drug Testing Laboratories. [Drug Testing Matters](#). 2019, pages 1-6.

⁵ Janis GC, et al. [Unrolling the Challenges of CBD in the Drug Testing Laboratory](#), SOFT Annual Meeting Abstract 2019.

⁶ Weinberg B. [The Delta-9-THC Controversy. What's Really at Stake?](#) Project CBD. April 2021.

⁷ Lupoi JS. The Bizarre Crystallization of $\Delta 10$ -THC. [The Bizarre Crystallization of Delta10-THC](#). March 2020.

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