

Brian Blevins

Mentor: Tim McPherson, Marcelo Nieto

Title: *Analysis of cannabidiol (CBD) and delta-9-tetrahydrocannabinol (THC) content of full spectrum and THC free CBD oils*

Abstract

Purpose

Within the last few years, cannabidiol (CBD) oil has become increasingly popular. It is now available in pharmacies, grocery stores, and convenience stores. Many claim to be "delta-9-tetrahydrocannabinol (THC) free" or contain less than 0.3% THC by weight. Anecdotal evidence exists discussing patients using CBD oils and failing a drug test. Since CBD oils are nutritional supplements, the FDA does not regulate them. Without scientific analysis of the products, one cannot know the contents inside, whether it is THC free, contains less than 0.3% THC, or if the concentration on the label is accurate.

Methods

Twelve 500 mg CBD oils were purchased for evaluation of CBD and THC content. Six claimed to have 0% THC and six were to have less than 0.3% THC. A CBD calibration curve was prepared with analytical standard diluted to 3.125, 6.25, 12.5, 25, and 50 mcg/mL. The THC calibration curve was prepared with analytical standard diluted to 0.391, 0.781, 1.5625, 3.125, 6.25, 12.5, and 25 mcg/mL. A series of dilutions were completed at room temperature using methanol in one series and acetonitrile in another. Products were diluted to a 20 times dilution to detect THC, and 667, 1,333, or 6,670 times dilution to detect CBD. Using high performance liquid chromatography (HPLC), 50 microliters were injected into the column using a mobile phase of 80% methanol and 20% water running at 1 mL/min for 15 minutes per sample. Each sample was analyzed in triplicate. Using the equation $C = (AUC \cdot m + b) \cdot 667 / 1,000$, where C is the concentration of the sample, AUC is the area under the curve of the sample, m is the slope of the CBD calibration curve, and b is the intercept of the CBD calibration curve, we calculated the total CBD per mg/mL in each product and compared it to the label. The same calculation was done for THC, with the equation $C = (AUC \cdot m + b) \cdot 20 / 10,000$, to yield the percentage of THC in each product.

Results

Regarding CBD content, samples 1 and 3-9 had an expected concentration of 16.67 mg/mL. Sample 2 had an expected concentration of 125 mg/mL. Samples 10 and 12 had an expected concentration of 33.33 mg/mL. Sample 11 had an expected concentration of 16.66 mg/mL. Sample 4 was the only sample to have a CBD content between 95% - 105% of the labeled amount. Four samples had significantly lower amounts of CBD than what their labels stated. Sample 3 had a CBD content of 57.43% of the labeled amount. Samples 8 and 9 had CBD content of ~20% of the labeled amount. Sample 12 had a CBD content of 17.81% of the labeled amount. Regarding THC content, samples 1-3, 9, 11 and 12 had an expected THC concentration of less than 0.3%. Samples 4-8 and 10 had an expected THC concentration of 0. Samples 1-3, 9, 11 and 12 all were below the 0.3% threshold for THC content. Samples 4-8 and 10 all had trace amounts of THC within them, ranging from 0.004% up to 0.02%.

Conclusion

Some of the CBD oils were close to what the label stated, however, 92% were mislabeled with regards to the CBD content and the 5% buffer. All of the "THC free" CBD oils had some trace amount of THC in them. Urine drug screens can detect THC metabolite levels as low as 5 ng/mL, therefore, it is possible that any one of these CBD oils can result in a failed drug screen if taken within 72 hours after consumption. Further studies are warranted. IRB approval not required.