HARRICK SCIENTIFIC PRODUCTS

No. 21155

A DIAMOND ATR-FTIR STUDY OF VARIOUS MEDICINAL CANNABINOID FORMULATIONS

Figure 1. The DiaMaxATR.

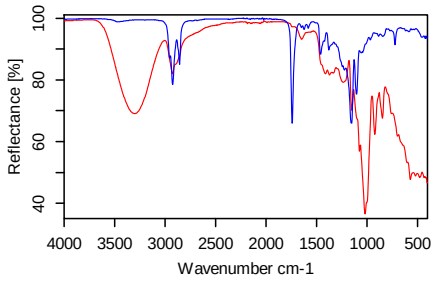

Figure 2. ATR spectra of the exterior of the two softgels examined: Plus+CBD Oil™ in red and A1 in blue.

ABSTRACT

Cannabinoids and opiates have been used for medicinal purposes for thousands of years for relief of pain and seizures. The past few years have seen an increase in opioid overdoses and tightened regulation to prevent abuse, addiction, and deaths. There are few therapeutic alternatives to the opioids with the notable exception of cannabinoids.

At least a hundred cannabinoids have been found to have medicinal properties. The most commonly known are CBD (cannabidiol) and THC (tetrahydrocannabinol). These are extracted from hemp and marijuana plants, which are botanically distinct cannabis species. CBD extracted from hemp is available as a supplement and contains no THC. Cannibinoids extracted from marijuana include CBD as well as some THC component, and hence are highly regulated because of the psychoactive properties of THC. CBD does not appear to have any intoxicating effects such as those caused by THC.

Here, several cannabinoid capsules and softgels are examined using mid-infrared diamond ATR spectroscopy.

EXPERIMENTAL

Infrared spectra were collected on an FT-IR spectrometer equipped with the Harrick DiaMaxATR™ single-reflection high-throughput diamond ATR accessory. The system was purged to remove water vapor and CO_2. Spectra were collected at 8 cm^{-1} resolution and signal averaged over 32 scans. The spectra were referenced to the clean ATR crystal.

Five formulations were investigated. Both the exterior of the capsules and softgels and the interiors were examined. The exteriors were measured as is. Then the capsules and softgels were cut open to examine the contents. Two of the samples were from hemp: Plus+CBD Oil™ softgels (5 mg CBDA/CBD in extra virgin olive oil) and Plus+CBD Oil™ capsules (10 mg CBA in modified food starch, cellulose, silicon dioxide and magnesium stearate). The other three were medicinal marijuana from two different suppliers, designated here as A1 (8.5 mg THC, 8.5 mg CBD in coconut oil in a softgel), A2 (9.0 mg THC, <0.1 mg CBD in coconut oil in a capsule) and B (0.7 mg THC, 4.3 mg CBD in coconut oil in a capsule). Small aliquots of the contents of the capsules and softgels were placed on the ATR crystal. Pressure was applied to

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compress the solid samples against the diamond.

RESULTS AND DISCUSSION

Figures 2 and 3 show the exterior of the softgels and capsules respectively. In figure 2, the Plus+CBD Oil has the characteristic bands expected from cellulose, including the OH stretch at 3310 cm^{-1}, the CH stretch near 2939 cm^{-1}, the CO stretch at 1030 cm^{-1} and the 1647 cm^{-1} HOH bend from adsorbed water. These bands are much less apparent in A1. Instead, A1 shows the characteristic cannabinoid bands around 1624, 1581, 1510, 1462 and 1374 cm^{-1}, indicating either migration of the cannabinoids through the gelatin shell or contamination of the outside of shell during production. Figure 3 shows the normalized spectra of the capsules examined. The spectra were normalized because the band intensities in the spectrum of A2 were considerably stronger than those of the other two samples. The outside of the capsules from the Plus+CBD Oil and B are largely cellulose, as expected. The spectrum of the exterior of A2 is similar to that of A1, indicating either migration of the cannabinoids through the capsule or contamination of the outside during manufacturing.

Figure 4 shows the spectra from the contents of the five formulations. The two from hemp and B have a band at 3010 cm^{-1} which is not present in the marijuana samples A1 and A2, perhaps indicating differences in the extraction process. All the samples except the Plus+CBD Oil™ capsules show a weak band at 3477 cm^{-1} due to a phenol OH stretch. The Plus+CBD Oil™ capsules are the only formulation that contains cellulose and the broader OH stretch from cellulose may be masking the phenol OH band. The Plus+CBD Oil™ capsules also have a strong band at 1047 cm^{-1} from cellulose. All four samples show the characteristic bands of cannabinoids around 1624, 1581, 1510, 1462 and 1374 cm^{-1}.

CONCLUSION

The Harrick DiaMaxATR, high throughput diamond ATR is effective at revealing spectral differences among some of the extracted medicinally beneficial canna-binoids.

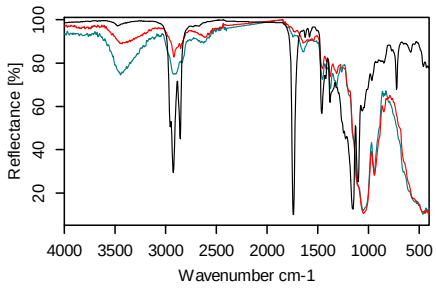

Figure 3. Normalized ATR spectra of three capsules: Plus+CBD Oil™ in red, A2 in black and B in green.

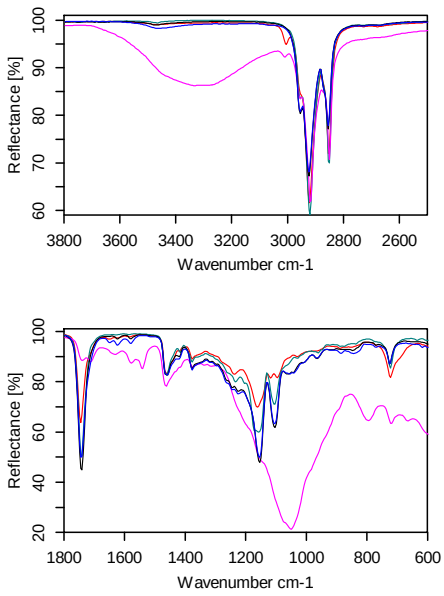

Figure 4. ATR spectra of the contents of both the softgels and capsules: Plus+CBD Oil softgel in red; Plus+CBD Oil capsule in pink, A1 in blue, A2 in black and B in green.

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141 Tompkins Ave., 2nd floor • PO Box 277 • Pleasantville, NY 10570
www.harricksci.com • E-mail: info@harricksci.com
Phone (international): 914-747-7202 • Phone (in USA): 800-248-3847 • Fax: 914-747-7209