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# Hemp Purification: Delta-9-THC Remediation of Crude CBD Extract Using the CombiFlashTorrent® AQ with 8.6 kg C18 RediSep Gold® Column

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Chromatography Application Note  
AN120

## Introduction:

Marijuana is a federally controlled substance in the United States, while hemp is not, the 2018 Farm Bill<sup>1</sup> provides a very clear definition of hemp, distinguishing it from marijuana based on the concentration of  $\Delta$ -9 tetrahydrocannabinol (THC), thereby removing hemp from the heavy restrictions of the Controlled Substances Act of 1970.<sup>2</sup>

From the 2018 Farm Bill, Section 297A, Definitions:

“In this subtitle:

*“(1) HEMP.—The term ‘hemp’ means the plant *Cannabis sativa* L. and any part of that plant, including the seeds thereof and all derivatives, extracts, cannabinoids, isomers, acids, salts, and salts of isomers, whether growing or not, with a delta-9 tetrahydrocannabinol concentration of not more than 0.3 percent on a dry weight basis.”*

Therefore, in the production of hemp-derived products, it is crucial to keep  $\Delta$ -9 THC levels below 0.3%. The process of extracting cannabinoids from hemp plant material, however, can produce extracts with  $\Delta$ -9-THC concentrations over that limit. In such cases the extract cannot be used and must either be discarded, sometimes at great expense, or remediated. Luckily, flash

chromatography offers a reliable, selective, scalable, and economically viable method for separating  $\Delta$ -9-THC from other cannabinoids. High throughput methods are available with the capacity to remediate up to 1 kg of CBD extract per run when using with an 8.6 kg RediSep Gold® C18 column on a CombiFlash® Torrent AQ system

The smaller spherical particle size of the RediSep Gold C18 column offers superior loading capacity as compared to other columns with larger, irregularly shaped particles. Column loadings up to 10% have been used in  $\Delta$ -9-THC remediation from CBD extract.<sup>3</sup> The Torrent AQ system allows flow rates up to 1 L/min., well within the method parameters for THC remediation. Additionally, the solvent selection valve in the Torrent AQ allows an automated sequence of injections for unattended sample loading, equilibration, and gradient delivery, enabling purification of up to 6 kg of crude CBD extract over an 8-hour day.<sup>3</sup> When the system is run unattended over a 24-hour period, remediation of up to 18 kg of crude CBD extract per day can be realized.

The method shown below illustrates expected throughput when coupling the Torrent AQ and an 8.6 kg RediSep Gold C18 column to remove THC from crude CBD extract. Using the Torrent AQ's Solvent Select Valve for automated, unattended operation, the throughput is upwards of 5 kg per 8-hour day, and, if run continuously, can remediate more than 15 kg of crude CBD extract over a 24-hour period.

## Experimental and Results:

**Sample Loading:** 10% (860 grams of crude CBD sample dissolved in 1.6 L of MeOH)

**Flow Rate:** 800 mL/min

**Equilibration:** 2 CV @ 65% MeOH/H<sub>2</sub>O (only before 1st run in Manual Control)

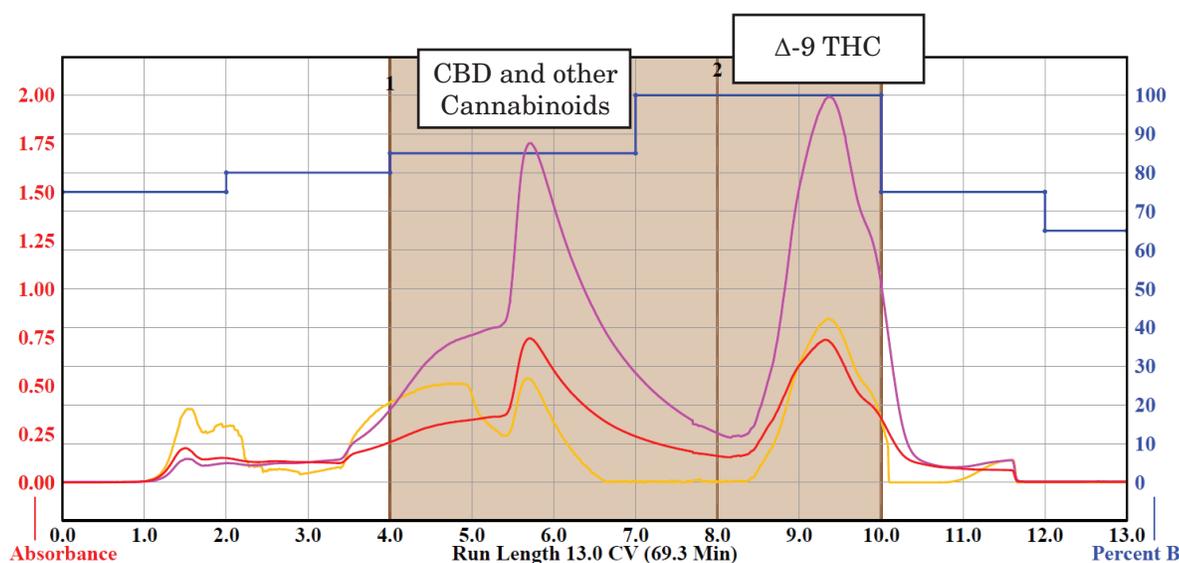
**Solvent A:** Water

**Solvent B:** Methanol

**Time for run:** 78 minutes + 2 minutes for Loading Sample (at 800 mL/min) = 80 minutes cycle time = 1.33 hours

6 runs in 8 hour day = 5160 grams of crude material purified per day

Duration (CV)	%B
0.0	75.0
2.0	75.0
0.0	80.0
2.0	80.0
0.0	85.0
3.0	85.0
0.0	100.0
3.0	100.0
0.0	75.0
2.0	75.0
0.0	65.0
1.0	65.0



## Conclusion:

Flash chromatography provides a repeatable, large-scale, viable method with sufficient resolution for the removal of  $\Delta$ -9-THC from CBD sample. The spherical RediSep Gold C18 material allows for increased resolution and greater loading capacity compared to other C18 flash media. RediSep Gold C18 columns also show strong reproducibility in processing CBD extract across numerous back-to-back runs.

<sup>1</sup> 2018 United States Farm Bill, Part of the Agricultural Act of 2018, Pub. L. 115-334

<sup>2</sup> Controlled Substances Act, 21 U.S.C. § 802(16).

<sup>3</sup> Depending upon initial purity of the sample source and target CBD purity with other non  $\Delta$ -9-THC cannabinoids.

## Teledyne ISCO

P.O. Box 82531, Lincoln, Nebraska, 68501 USA

Toll-free: (800) 228-4373 • Phone: (402) 464-0231 • Fax: (402) 465-3091

