TECHNICAL REPORT
METHOD FOR PURIFICATION OF MEDICINAL CANNABIS USING CENTRIFUGAL PARTITION CHROMATOGRAPHY

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INTRODUCTION

This technical report presents the analysis of a crude ethanolic extract of **Cannabis** using a preparative liquid chromatograph system for separation coupled to centrifugal partition chromatography column (PLC + CPC).

GOAL

To present a method of separation / purification of **cannabinoids** contained in the crude ethanolic extract of **Cannabis** using the Gilson's PLC + CPC System.

MATERIALS AND METHODS

Sample and Solvents

Ultrapure water, analytical grade ethanol and heptane were used.

The ethanolic extract of **Cannabis** used has not been subjected to any previous purification. It was a crude ethanolic extract containing chlorophyll, waxes and other substances present in the plant.

Instruments

The instruments used in the experiments were: a PLC 2050 Purification System and a centrifugal partition chromatography column CPC-250, from Gilson Inc., and the HPLC system for quantification.

CPC250 and PLC 2050

Method

The chromatographic method parameters are described in Tables 1 – 3. The mobile phases used were: heptane in channel A, ethanol in channel B and water in channel C. The wavelengths used for detection were: 305 nm, 280 nm and 220 nm. The injection was done manually, using a 5 mL loop.

Table 1. Stability step

Nº	Start (min)	End (min)	Flow rate (mL/min)	%A	%B	%C	Rotor speed (rpm)
1	Ini.	0	40	2	77	21	500
2	0	10:00	40	2	77	21	500
3	10:00	20:03	12	100	0	0	1500
4	20:03	21:45	12	100	0	0	1500
5	21:45	30:00	12	100	0	0	1500
6	30:00	35:00	12	100	0	0	1500

Table 2. Elution step

Nº	Start (min)	End (min)	Flow rate (mL/min)	%A	%B	%C	Rotor speed (rpm)
1	Ini.	0	12	100	0	0	1500
2	0	1:00:00	12	100	0	0	1500
3	1:00:00	1:07:00	40	2	77	21	500

14 fractions were collected; the collection started at 8 minutes of analysis and each collection lasted 2 minutes, as shown in Table 3.

Table 3. Fractions collected

Position	Fraction	Volume	Start Time	End Time
1	001	25.1	00:08:00	00:10:05
2	002	25.1	00:10:05	00:12:10
3	003	25.1	00:12:10	00:14:16
4	004	25.1	00:14:16	00:16:21
5	005	25.1	00:16:21	00:18:26
6	006	25.1	00:18:26	00:20:32
7	007	25.1	00:20:32	00:22:37
8	008	25.1	00:22:37	00:24:43
9	009	25.1	00:24:43	00:26:48
10	010	25.1	00:26:48	00:28:53
11	011	25.1	00:28:53	00:30:59
12	012	25.1	00:30:59	00:33:04
13	013	25.1	00:33:04	00:35:10
14	014	22.0	00:35:10	00:37:00
-	-	1284.1	00:00:00	00:00:00

RESULTS AND DISCUSSION

Figure 1 presents the chromatogram obtained in the separation of the crude ethanolic extract of **Cannabis** in the PLC 2050 Purification System. Two chromatographic bands around 13 min and 26 min of analysis can be observed. Figure 1 also shows the collected fractions (sections 001 to 014).

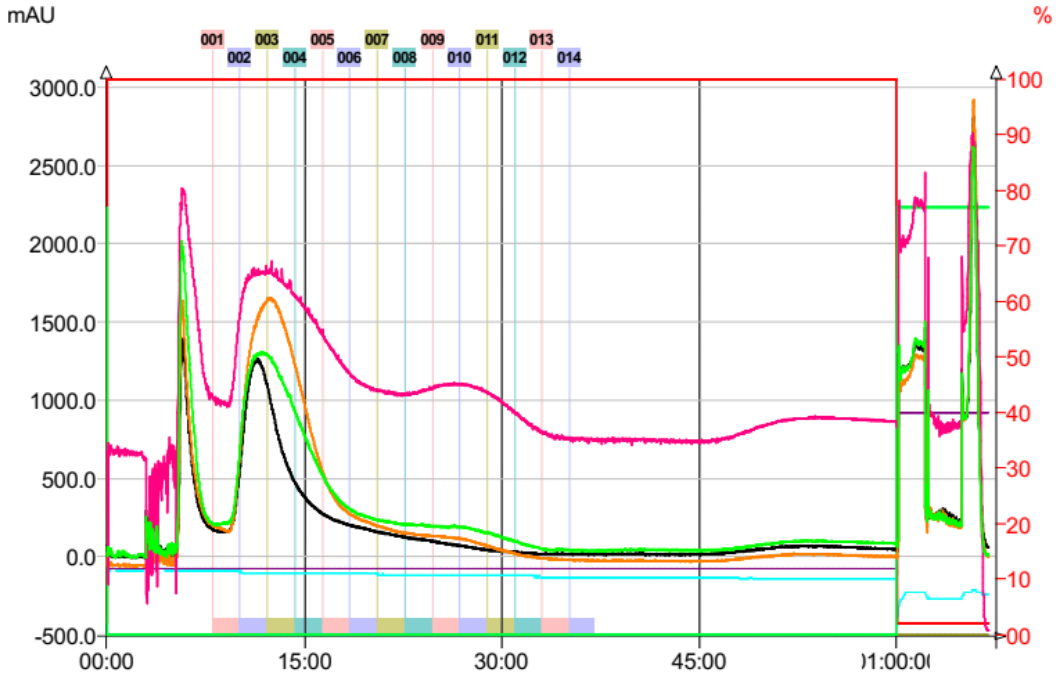

Figure 1. Chromatogram of the crude ethanolic extract of **Cannabis**.

Figure 2 shows the appearance of the crude ethanolic extract of **Cannabis** used (tube on the left) and the fractions obtained (tubes 1-14 on the right). A difference in color is observed between fractions 1, 2 and 3 rich in THC / THC-A and fractions 7 to 13 rich in CBD / CBD-A.

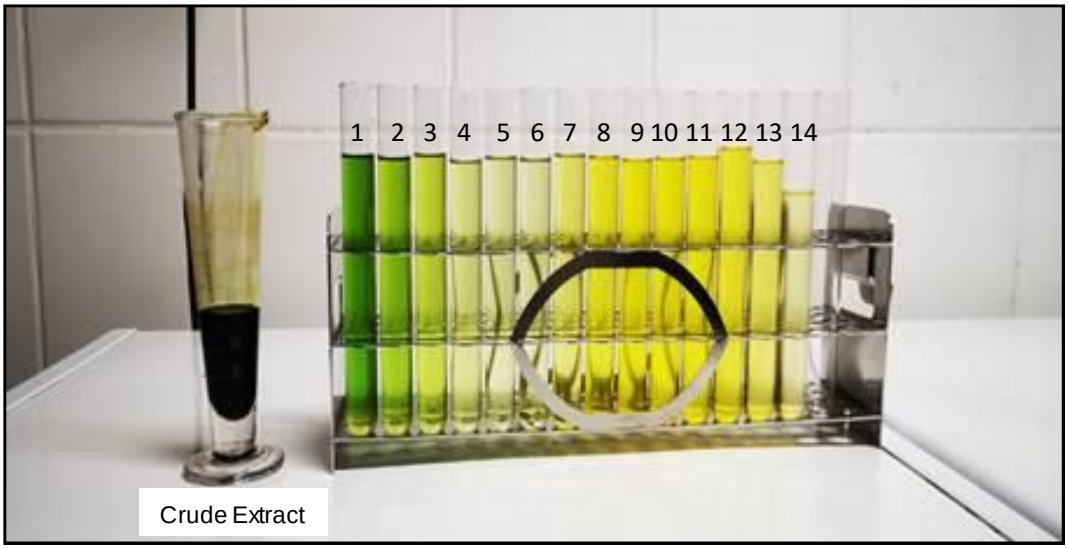

Figure 2. Appearance and color of the **Cannabis** crude ethanolic extract (tube on the left) and fractions collected (14 tubes on the right).

The fractions collected were analyzed individually by HPLC to determine the relative quantities of the **cannabinoids** of interest. The results of the most promising fractions are shown in Table **4**.

Table 4. Identification and relative quantification of **canabinoids** in the collected fractions. Analyzes were performed on the HPLC system.

Fraction	Compound
1	-
2	THC-A 79% / THC 7%
3	THC-A 26% / THC 72%
4	THC-A 8% / THC 91%
5	THC-A 9% / THC 91%
6	THC-A 13% / THC 85%
7	CBD 77% / THC-A 8% / THC 8%
8	CBD-A 44% / CBD 3% / THC 4%
9	CBD-A 81% / CBD 14%
10	CBD-A 79% / CBD 12%
11	CBD-A 76% / CBD 12%
12	CBD-A 55% / CBD 14%
13	CBD-A 21% / CBD 4%
14	CBD-A 8%

The results indicate the occurrence of the separation between the **cannabinoids** – THC-A and THC – and the **cannabinoids** – CBD-A and CBD. Even within the **cannabinoid** class there is a tendency for THC-A, mainly present in fraction 2, to separate from THC, present mainly in fraction 5.

Thus, it can be stated that a separation efficiency between THC-A/THC and CBD-A/CBD, which are the target compounds for the purification of the crude extract (THC removal), has been achieved.

CONCLUSION

In light of the data obtained, it is possible to conclude that the method using the Gilson's PLC 2050 Purification System with CPC-250 was efficient in the separation of the **cannabinoids** contained in the crude ethanolic extract of **Cannabis**. In this way, it is possible to recompose the crude extract in the desired proportions, just by grouping the fractions of interest.

ETHICS

Nova Analítica does not endorse, encourage or promote the use of its products or services for any illegal use, cultivation or commercialization of **Cannabis** or **Cannabis** products. Products commercialized by Nova Analítica are intended for use only in compliance with all applicable laws, in a manner that promotes public safety and/or linked to any approved legal scientific or medical research activity.

ACKNOWLEDGEMENTS

The authors would like to thank the non-governmental organization ABRACE for providing the material necessary for the development of this study, as well as for making the laboratory facilities available.

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SPEC SHEET | NATURAL PRODUCT PURIFICATION

PLC PURIFICATION SYSTEMS WITH CPC COLUMN

ACCELERATE THE PACE OF YOUR RESEARCH

Combining PLC Purification Systems with CPC columns streamlines your workflow while saving time and money by providing independence from shared systems.

- Perform prep HPLC, flash, and CPC runs on one system by simply switching from one column to another

IDEAL FOR YOUR NATURAL PRODUCT PURIFICATION

Natural product chemistry involves the isolation of active compounds from complex, crude, natural product extracts. CPC is a cost-effective alternative to common purification techniques, such as flash and prep HPLC, that yields a high quantity of pure compounds. CPC is your ideal solution for natural extract fractionation and natural compound purification.

THE ADVANTAGES OF CPC

- High injection capacity
- No need for pre-treatment prior to injection
- No denaturation of fragile molecules
- No risk of a blocked or contaminated column

PLC Purification System (Right) shown with Centrifugal Partition Chromatography (CPC) Column (Left)

BENEFITS OF CPC VS. FLASH AND PREP HPLC

- Purity > 99% and recovery > 95%
- No sample loss
- Cost effective - No expensive columns to replace
- Five times less solvent consumption
- High flow rate for fast run times
- Easily scalable (milligrams to kilograms)

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CPC SPECIFICATIONS

CPC 100: Part Number 21141001

Column Capacity	100 mL column capacity
Injection Range	Up to 1 g
Typical Flow Rate	Up to 15 mL/min
Maximum Pressure	100 bar (1450 psi)
Maximum Rotation Speed	100–3000 rpm (1–685 g)
Weight	60 kg (132 lbs.)

CPC 250: Part Number 21141002

Column Capacity	250 mL column capacity
Injection Range	Up to 6 g
Typical Flow Rate	Up to 15 mL/min
Maximum Pressure	100 bar (1450 psi)
Maximum Rotation Speed	100–3000 rpm (1–685 g)
Weight	70 kg (154 lbs.)

CPC 1000: Part Number 21141003

Column Capacity	1000 mL column capacity
Injection Range	up to 30 g
Typical Flow Rate	Up to 50 ml/min
Maximum Pressure	80 bar (1160 psi)
Maximum Rotation Speed	100–1500 rpm (1–254 g)
Weight	120 kg (264 lbs.)

CPC PRO SPECIFICATIONS

CPC 250 PRO: Part Number 21141004

Column Capacity	250 mL column with greater injection capacity
Injection Range	Up to 30 g
Typical Flow Rate	Up to 80 mL/min
Maximum Pressure	100 bar (1450 psi)
Maximum Rotation Speed	100–3000 rpm (1–729 g)
Weight	65 kg (143 lbs.)

CPC 1000 PRO: Part Number 21141005

Column Capacity	1000 mL column with greater injection capacity
Injection Range	Up to 100 g
Typical Flow Rate	Up to 350 mL/min
Maximum Pressure	80 bar (1160 psi)
Maximum Rotation Speed	100–2000 rpm (1–452 g)
Weight	115 kg (253 lbs.)

Combine Gilson PLC Purification Systems with Gilson CPC columns to experience the ultimate in automated, low-solvent, silica-free purifcation!

GILSON CPC BUNDLED WITH PLC PURIFICATION SYSTEM

MODEL	APPROPRIATE PLC CONFIGURATION
CPC 100 CPC 250	PLC 2050: Quaternary valve, Automatic Injection Valve, 5 or 10 mL loop, Automatic Backflush Valve, 200–600 nm UV/Vis detector
CPC 1000	PLC 2250: Quaternary valve, Automatic Injection Valve, 30 mL loop, Automatic Backflush Valve, 200–600 nm UV/Vis detector
CPC 250 PRO	PLC 2250: Quaternary valve, Injection Pump, Automatic Backflush Valve, 200–600 nm UV/Vis detector
CPC 1000 PRO	PLC 2500: Quaternary valve, Injection Pump, Automatic Backflush Valve, 200–600 nm UV/Vis detector

www.gilson.com/ContactUs

CPC 250 PRO: Purification of Cannabidiol from *Cannabis sativa*

TECHNICAL NOTE TN206

GILSON APPLICATIONS LABORATORY

INTRODUCTION

Cannabidiol (CBD, refer to Figure 1) is a major component of the *Cannabis sativa* plant. CBD is of special interest because it is non-psychotropic and studies suggest that it has therapeutic medicinal properties for the treatment of conditions including pain, inflammation, epilepsy, and cancer.[1,2] Recent changes in the legal status of Cannabis compounds for medicinal use, as well as the decriminalization of marijuana in some locations, has led to increased interest in purification, formulation, and detection of CBD. Although CBD is still classified as a Schedule I drug in the United States, the U.S. Food and Drug Administration has authorized clinical trials to evaluate the use of CBD to treat children with rare forms of epilepsy.[3]

Cannabinoids are concentrated in a sticky resin found within the glandular trichomes, hairlike structures on the surface of the plant (Figure 2). Although most cannabinoids are nearly insoluble in water, they can typically be dissolved in oils, alcohols, and other non-polar solvents. To ensure consumer safety it is critical to develop standardized CBD products that are free of tetrahydrocannabinol (THC) and other contaminants. Gilson has developed a rapid and reproducible method for large-scale purification of CBD using centrifugal partition chromatography (CPC) (Figure 3). The method can be adapted from milligram to multi-kilogram scale, requires little solvent, and recovers close to 100% of the CBD from a complex crude extract.

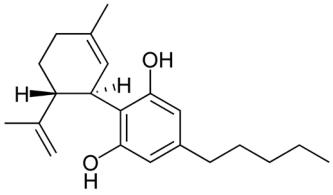

Figure 1
Chemical Structure of CBD

Figure 2
Closeup View of Glandular Trichomes on the Surface of a *Cannabis* Plant.

Figure 3
CPC 250 PRO with PLC 2250 Purifcation System

MATERIALS AND METHODS

Purification of CBD

A Gilson CPC 250 PRO column was run with an elution rate of 70 mL/min, an extrusion flow rate of 70 mL/min, and a rotation speed of 3000 rpm. The CPC column was controlled by a PLC 2250 Purification System (for preparative liquid chromatography) equipped with a 250 mL/min quaternary gradient pump, UV/VIS detector, fraction collector, and Gilson Glider control software. Analytical HPLC was performed on a Hitachi LaChrom Elite® HPLC System (VWR) equipped with a photodiode array detector (PDA) (200—800 nm). Crude extract was prepared from dried Cannabis sativa L. plant material and was filtered before being subjected to CPC. All organic solvents were analytical or high performance liquid chromatography (HPLC) reagent grade.

RESULTS AND DISCUSSION

In this study, 5 g of crude extract of *C. sativa* flowers were subjected to CPC. Using this one-step method resulted in clean separation of CBD from THC and other compounds (Figure 4). 205 mg of CBD was purified from 5 g of crude extract, and the final product had a purity of over 95% as shown by HPLC analysis. For each 5 g sample, 1 L of solvent was consumed for every 10 minutes of separation.

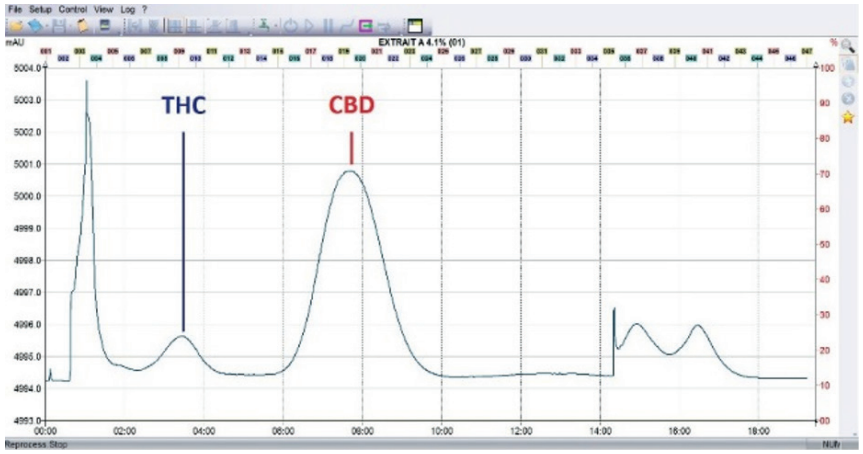

Figure 4
Chromatograph of CBD Separated from THC using CPC

CONCLUSIONS

CPC technology employs a silica-free liquid-liquid chromatography (LLC) column that can be used to purify CBD from crude extracts of cannabis in just one step. Purification parameters can be adjusted according to which cannabinoids are targeted or the desired purity level to achieve THC-free extracts, pure cannabinoids, pharmaceutical-grade products, or standard molecules for use as reference materials or for clinical evaluation. The methodology is adaptable from laboratory to industrial scale. Because the method does not use silica resin there is no irreversible adsorption of the sample to the matrix and therefore no sample loss.

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Cost-effective Approach to the Purification of Cannabinoids using CPC

INTRODUCTION

Chromatographic purification of natural compounds presents many challenges to scientists because of the complex nature of the starting matrices that are used in the process. These starting materials can damage traditional columns and cartridges, decreasing the length of their usage and increasing costs; that is, if the particular system can even accommodate the starting material. Centrifugal partition chromatography (CPC), which uses both liquid stationary and mobile phases, can handle heavily contaminated, complex starting materials, such as direct extracts from many biological sources, and has been shown useful for the isolation of piperine from *Piper nigrum*[1], gingerol from *ginger*[2] and hundreds of other natural compounds from plants. Additionally, by relying on a liquid stationary phase, CPC columns do not need to be replaced like traditional columns and cartridges used by preparative HPLC and flash chromatography methods.

This article will discuss the basic principles behind CPC and explore the use and benefits of CPC in the purification of cannabinoids from crude cannabis oil.

WHAT IS CPC?

Centrifugal partition chromatography can be performed on pilot, preparative and industrial scales. Whereas both preparative and flash chromatography rely on a solid silica stationary phase, CPC is silica-free, using two immiscible liquids as stationary and mobile phases. Similar to both preparative HPLC and flash chromatography methods, the separation of the target molecule is based on its respective affinity to the liquid phases as expressed by the partition coefficient,

K_D, much as if you used a glass separatory funnel. With CPC, one phase is made stationary by centrifugal force while the other phase is pumped through the column. Molecules with greater affinity for the mobile phase will pass through faster and elute first, while molecules with greater affinity for the stationary phase will pass through slower and elute later. The CPC systems can work in both ascending and descending modes, which determines whether the lighter or heavier phase acts as the stationary phase on the column, respectively. These operational modes are comparable to normal phase typically used for flash chromatography and reversed phase commonly used for preparative HPLC. Traditional chromatography requires a column change to perform normal or reversed phase separations, whereas, with CPC, switching between ascending and descending modes performs this switch automatically on the column.

Using the separatory funnel further as an example, CPC purifications are like performing a liquid-liquid separation using hundreds of connected separatory funnels. This allows the separation to repeat many hundreds of times, increasing the efficiency of the purification (**Figure 1**). In addition, by changing the solvents used, it is possible to purify different compounds based on their individual partition coefficients, allowing one to achieve highly selective and efficient separations

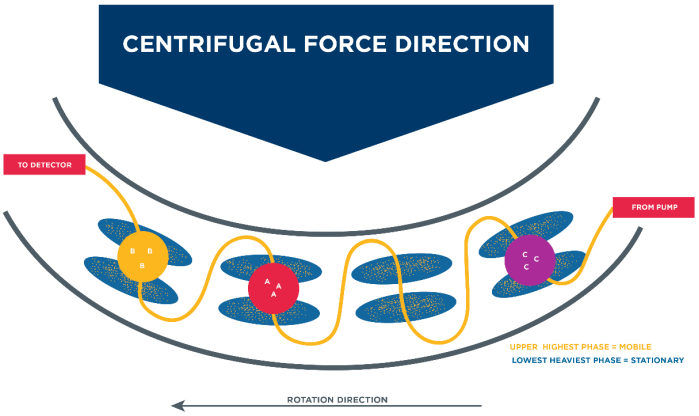

Figure 1. Principle behind CPC

The CPC column design is much like having a series of hundreds of separatory funnels connected end to end. In this case, three molecules with differing affinities to the two phases are introduced with the lighter mobile phase into the first funnel and shaken. After the phases settle, the heavier, lower phase is moved to the next funnel. This process is repeated until the last funnel. A CPC column mimics these hundreds of liquid-liquid separations with the two phases in this manner when operating in descending mode

The actual CPC column or rotor is composed of a stacked series of stainless steel discs that rotates on an axis, providing the centrifugal force to hold the stationary phase on the column (**Figure 2**). Each disc is engraved with hundreds of twin cells. These twin cells act similarly to the separatory funnel example, where the heavier mobile phase passes out one set of cells and is pumped into the next when operating in descending mode, repeating the separation hundreds of times. Molecules with greater affinity for the heavier mobile phase will move faster through the CPC column and elute earlier. This design provides better retention of the stationary phase, while allowing the use of higher flow rates for faster separations and increased productivity

Figure 2. CPC column design

The CPC column rotates on an axis and is designed to be resistant to high pressures. The column is composed of numerous stacked discs, each of which are engraved with hundreds of twin cells. This design provides better retention of the stationary phase, allowing for higher flow rates for faster separations..

A variety of CPC columns exist, offering different options in flow rates and injection volumes. **Table 1** provides an example of various Gilson CPC columns and their characteristics. In addition to the column, the CPC system requires a preparative-scale pump, injector, and optional detector and collector to perform the purification just like the setup for preparative HPLC or flash chromatography. A CPC column can be attached to many existing preparative HPLC systems, replacing the traditional column. Software such as the Gilson Glider CPC software allows researchers to program automatic injections to stack runs, decreasing hands-on time and increasing productivity.

One of the key advantages with CPC is the ability to use increased flow rates, which can lead to faster run times. In addition, CPC offers numerous benefits over preparative HPLC and flash chromatography (**Table 2**). Unlike preparative HPLC, CPC can be used on complex mixtures. CPC also uses significantly less solvent and does not require replacing columns or cartridges as does preparative HPLC and flash chromatography systems, resulting in lower consumable costs. With CPC, the same solvent system can be used from run to run, replacing the stationary and mobile phases as necessary.

Table 1. Gilson CPC Column Parameters

Model	Maximum injection Capacity (g)	Maxiumum Elution Flow Rate (mL/min)	Maximum Pressure (bar)
CPC 100	1	15	100
CPC 250	6	15	100
CPC 1000	30	50	80
CPC 250 PRO	30	80	100
CPC 1000 PRO	100	350	80

Table 2. Comparison CPC, Flash Chromatography and Preparative HPLC Methods

Column Features	CPC	Preparative HPLC	Flash Chromatography
Silica	No	Yes	Yes
Sample	Simple to complex	Simple	Simple to complex
Solvent Consumption	5 times less	Significant	Significant
Efficiency	Medium	High	Low
Cost	No column consumables	Prep HPLC column	Cartridge
Flexibility	No column change necessary	Column change necessary	Column change necessary
Scale-up	Easy	Non-linear	Non-linear

Rather than purchasing a new column or cartridge for a new application, the CPC can be loaded with different solvents to create the column needed. CPC is also very easy to scale up for processing milligrams to kilograms of product efficiently, whereas preparative HPLC and flash chromatography may require substantial changes to optimize the purification methodology as it moves to a larger scale.

USE OF CPC IN CANNABINOID PURIFICATION

Cannabidiol (CBD), a non-psychotropic cannabinoid from Cannabis sativa, has been identified as a possible treatment for a variety of conditions including pain, inflammation, epilepsy and cancer[3,4]. The cannabinoids are found in the sticky resin of trichomes found on the plant's surface. However, for the safe use of CBD in possible treatments, it must be purified from other contaminants in a cannabis extract such as tetrahydrocannabinol (THC).

In general, the CBD purification begins with the production of a crude extract that is made by extracting dried marijuana with a solvent, such as ethanol, hexane or supercritical CO_2. This crude extract is then diluted and injected into the CPC system. The appropriate fractions are collected and solvent is removed, resulting in purified target cannabinoids.

Using this procedure with the Gilson CPC 250 PRO and PLC 2250 Purification System, 5 g of crude cannabis oil was injected and 600 mg of CBD with greater than 90% purity and 120 mg of THC with greater than 90% purity were isolated (**Figure 3**). The entire separation took approximately 20 minutes and used only 600 mL of solvent.

The use of CPC in the purification of cannabinoids from marijuana provides additional opportunities to improve productivity and cost effectiveness. Consider the purification results described above. If one were to automate injections using the Gilson Glider CPC software for continuous 20-minute runs, more runs could be performed within a given time period, increasing the amount of starting material processed. **Table 3** presents the potential amounts of starting material that could be purified using the Gilson CPC system described in the purification.

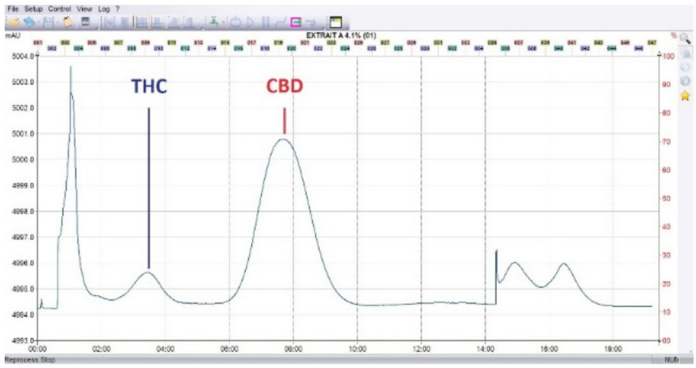

Figure 3. CPC purification of CBD and THC from cannabis oil using a Gilson CPC 250 PRO and PLC 2250 Purification System

Starting with 5 g of crude oil, 600 mg of CBD and 120 mg of THC were purified in 20 minutes. Purity determined by HPLC was over 90% for both compounds.

The CBD application demonstrates some of the main cost-effective benefits of using CPC for the purification of natural products. First, because CPC uses two immiscible liquid phases, there is no column to replace or silica to recycle, eliminating these costs. Also, the CPC purification method uses significantly less solvent than flash or preparative HPLC methods, saving money on disposal and solvent costs. Lastly, CPC accommodates high injection capacities, from milligrams to kilograms of sample, and faster run times, both of which can increase the amount of final purified cannabinoid components in a specified period of time over more traditional chromatography solutions.

SUMMARY

In summary, the use of CPC in the purification of natural products can provide a cost-effective solution to some of the problems facing scientists developing these methods. Because CPC employs both a liquid stationary and mobile phase, expensive preparative HPLC column or flash cartridge replacement and silica recycling are no longer necessary, eliminating those costs. In addition, the design of the CPC system uses less solvent than with preparative HPLC or flash chromatography, decreasing the costs associated with solvent use. Most importantly, CPC can accommodate complex samples and use faster flow rates, improving the productivity of the separation particularly in scenarios where multiple runs are automated to occur.

Table 3. Faster run times provide opportunity to increase the amount of starting material processed in a specified period of time*

Model	Run time (mins)	Amount injected/run (g)	Amount injected/hr (g)	Amount injected/8 hrs (g)
CPC 250 PRO	< 20	5	15	120
CPC 1000 PRO	< 20	30	90	720

***NOTE:** Injection mass and run time can vary depending on the crude oil used and the final goal (e.g., CBD content, THC content, etc). The productivity is based on the amount of crude oil treated.

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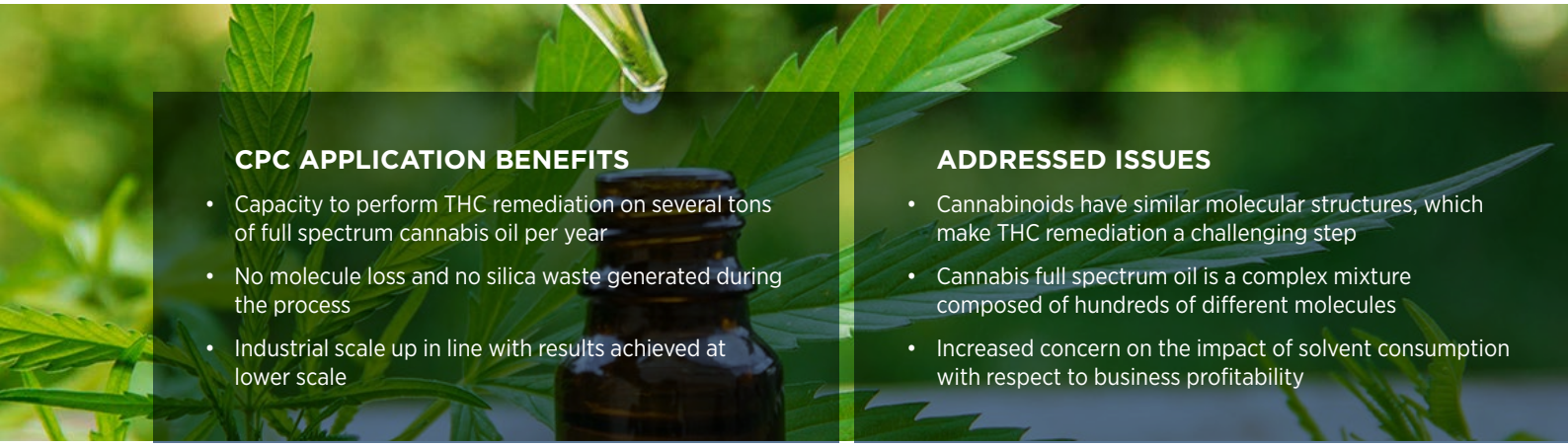
MULTI-TON PROCESSING OF FULL SPECTRUM CANNABIS OIL FOR THC REMEDIATION

BY CENTRIFUGAL PARTITION CHROMATOGRAPHY (CPC)

APPLICATION NOTE AN1040



CPC APPLICATION BENEFITS

- Capacity to perform THC remediation on several tons of full spectrum cannabis oil per year
- No molecule loss and no silica waste generated during the process
- Industrial scale up in line with results achieved at lower scale

ADDRESSED ISSUES

- Cannabinoids have similar molecular structures, which make THC remediation a challenging step
- Cannabis full spectrum oil is a complex mixture composed of hundreds of different molecules
- Increased concern on the impact of solvent consumption with respect to business profitability

R. BOULHO, G.AUDO | GILSON PURIFICATION, SAINT AVÉ, FRANCE

INTRODUCTION

Δ-9-tetrahydrocannabinol (THC) content in cannabis products, such as food supplements, vapes, or medicinal matrices, is strictly regulated in most countries worldwide.

This has fueled demand for **broad spectrum** THC-free oil, and spurred interest in THC remediation technologies applicable at industrial scale level.

CPC is a preferred technology with natural product purification due to its ability to extract, remove or purify a target compound without denaturing or losing other compounds present with it in the sample.

This application note demonstrates the added value of CPC for THC remediation of multiple tons of full spectrum oil.

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MATERIALS AND METHODS

Systems: A Gilson VERITY® CPC Process with a 5 L column connected to a VERITY® SKID LC system (Production LC system) (Figure 1) equipped with a 3 L/min elution pump, 1 L/min injection pump, UV/VIS detector, fraction collector, process control software, and an Ascending/Descending automated valve was used for the purification step. Waters *UPC²* system were used for the CPC purity fraction control.

Solvents : All organic solvents were technical or high-performance liquid chromatography (HPLC) reagent grade, stored in 208 L containers.

Sample: A decarboxylated, dewaxed and filtered, supercritical CO_2 extract from *Cannabis sativa* (Full spectrum oil) was processed. Composition of the full spectrum oil in terms of cannabinoid content is detailed in Table 1.

CPC Method: Multiple automated injections of 250 g of full spectrum oil, diluted in elution solvent, were performed by CPC Ascending mode. Extrusion started after 17 mins of elution for a total run time of 20 mins. Rotation speed was fixed at 1050 rpm.

Figure 1

Gilson VERITY® CPC Process connected to a VERITY® SKID LC system

Table 1

Cannabinoids composition of the processed Full Spectrum Oil Measured by *UPC²*.

Δ9-THC	CBD	CBG	CBC	CBN	Total Cannabinoids
2.42 %	56.12 %	0.63 %	1.77 %	0.30 %	61.24 %

RESULTS AND DISCUSSION

The initial full spectrum decarboxylated oil contained 2.42 % of Δ9-THC with a goal of decreasing the Δ9-THC content to less than 0.3 %.

The quantity injected per run was optimized to the system's limit of capacity in order to achieve the highest productivity for this extract. The limiting factor here was the loss of CBD in the final broad spectrum oil.

Figure 2 shows the content (Weight/Weight) of both CBD and THC in the different fractions obtained after a single CPC run. Three main groups are shown: Group 1 with THC and no CBD, Group 2 as an overlap of CBD and THC, and Group 3 as the CBD-rich broad spectrum oil without, or with a very limited amount, of THC.

Figures 3 and 4 show the UPC² analysis of Groups 2 and 3. Group 2 is a mix of THC (Rt 4.036 min) and CBD (Rt 3.694 min). The final composition of Group 3 (THC-free fraction) as a broad spectrum oil has less than 0.1 % of THC and more than 90 % of CBD.

The goal here was to focus on Group 3, but as a perspective Group 1 and 2 could also be used commercially for other purposes.

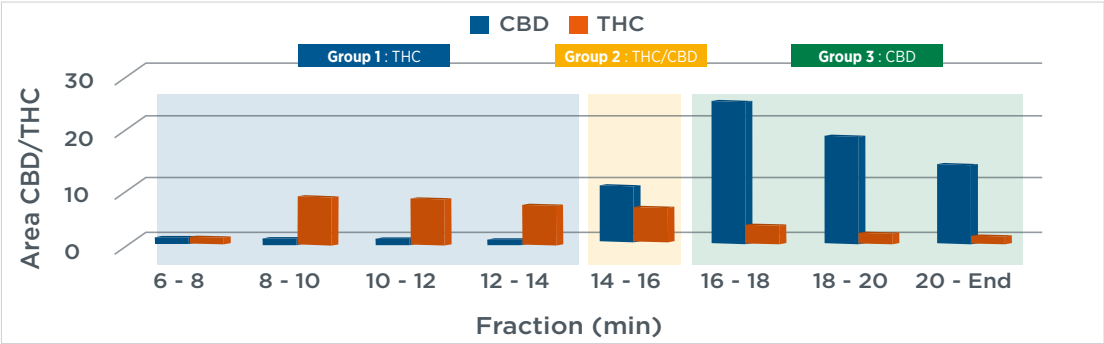

Figure 2

CBD and THC Content in CPC Fractions from the VERITY® SKID LC system

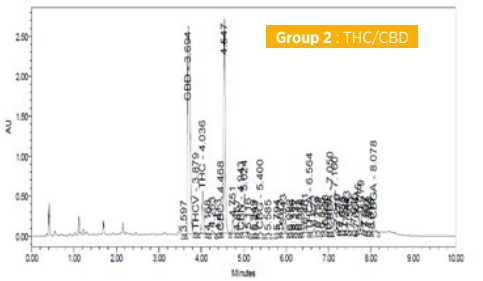

Figure 3

UPC² analysis group 2

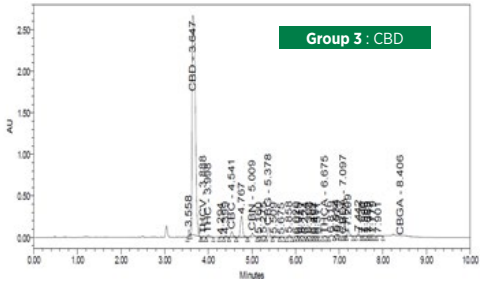

Figure 4

UPC² analysis group 3

The total run time is 20 min for each 250 g injected, which equates to 18 kg of full spectrum oil processed per day and 6.6 tons processed per year considering the system is fully automatic. Productivity and solvent consumption for THC remediation from full spectrum oil is detailed in Table 2.

Table 2

Productivity and Solvent Consumption for THC Remediation from Full Spectrum Oil

Injected Extract (g/run)	Injected Extract (kg/8hrs)	Productivity (t/year)	Solvent Consumed (L/run)	Solvent Consumed (L/kg injected)
250	6	6.6	11	44

Note: Result assuming the VERITY® CPC Process 24/7, fully automatic operating mode and solvent recycling >95 %.

CONCLUSIONS AND BENEFITS

Contrary to silica based chromatography, CPC implies no irreversible adsorption, loss, or denaturation of the injected extract. These features allow for recovery of all compounds processed by CPC. In this study, three goals were achieved:

- THC remediation to obtain a broad spectrum THC free oil containing less than 0.1 % THC.
- Scale up and optimization of the method for processing multi-tons of cannabis extract per year on a GMP compatible system.
- Containment of opex costs to perform at less than 10 € (44 L) in solvents consumed per kg of injected extract.

REFERENCES

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