Comparative extraction of cannabinoids

M. Sarrazin [a]*, A.C. Martel,[a] Y. Boumghar[a]

[a]*CEPROCQ Collège de Maisonneuve, Montreal, H1N 1C1, Canada*

**Corresponding author: msarrazin@cmaisonneuve.qc.ca*

1. Introduction

The legalization of cannabis in Canada since October 2018 opened an entirely new and interesting market for both recreational and medicinal purposes. Public information on industrial cannabis-based food products, usually called «edibles», and on natural health product are rare and inconsistent. Nowadays, these products are usually produced in a primitive and empirical way. The development and introduction of such a product into the market must meet the Health Canada guidelines by considering the public safety. Therefore, a research plan is proposed to overcome the existing gaps in the cannabis-based product development.

The main cannabinoid components in cannabis are tetrahydrocannabinol (THC) and cannabidiol (CBD). THC has more recreational applications due to its psychoactive effects, whereas the CBD is used to treat inflammations and pain.

In this work, we have compared two different extraction methods on a mix of cannabis *Sativa* and *Indica*: supercritical carbon dioxide (SC-CO_2) extraction and ethanol Soxhlet extraction. We have purified these extracts by centrifugal partition chromatography to obtain rich THC extract.

2. Materials and Methods

Cannabis (brand name: Mix3) was purchased from QcGoldtech. It was decarboxylated at 120°C during 90 minutes.

Supercritical extraction had been done on the CEPROCQ laboratory scale supercritical unit with a 500 ml reactor.

All the cannabinoid analysis had been done on an Agilent 1,260 Infinity system where sample were injected onto a Phenomenex Kinetex 2,6 µm C18 (50 x 2.1 mm, 100A). Mobile phase was solvent A (water, 5% v/v methanol, 0.1% v/v formic acid) and solvent B (methanol, 0.1% formic acid) with a flow rate of 0.4 mL/min and a 23 minutes elution gradient: 52% v/v B hold for 0 min, then a linear increase to 88% v/v B over 18 min, an increase at 100%B at 18.1 minutes and 100% v/v B hold for 4.9 min. Cannabinoids were detected at 220 nm.

Centrifugal partition chromatography had been done with a FCPC system from Kromaton.

3. Results and discussion

With a central composite design, it has been showed that the most influent parameter on the supercritical CO_2 extraction is the time.

With the best extraction conditions, 55°C, 300 bars, 10 g/min flow and 6 hours extraction time, 92% of THC had been extracted and a 55% THC extract had been produced.

The comparison between Ethanol Soxhlet extraction and Supercritical CO_2 extraction is shown in table 1.

Table 1. Comparison between Ethanol Soxhlet extraction and Supercritical CO_2 extraction

Extraction	Yield (%)	THC (g/100g extract)	THCA (g/100 g extract)	CBN (g/100 g extract)	CBG (g/100 g extract)
Soxhlet in ethanol	44.5	29.9	0.8	1.7	0.7
Supercritical CO2	20.6	54.8	1.4	3.3	1.5

Table 1 shows that supercritical CO_2 extraction is more selective than ethanol Soxhlet extraction. THC will be easier to concentrate with Supercritical CO_2 extract.

To concentrate the THC extract, a Centrifugal Partition Chromatograph (CPC) had been used. To purify THC, the 3 solvents system of Hazekamp and Al [1] had been used: hexane/acetone/acetonitrile 5:2:3 (v/v/v).

In order to produce extracts with high THC concentration, the extracts need to be diluted at a high concentration in the CPC mobile phase. SFE extract is easily soluble at high concentration in mobile phase to inject into the CPC but Soxhlet extract is not easily soluble in mobile phase because a part of the extract precipitates. It was not possible to inject Soxhlet extract into the CPC without further treatment because the extract contained polar compound which precipitate in the mobile phase (figure 1).

The SFE extract separation on CPC gives a THC fraction (figure 2). After evaporation, an extract with an 80% THC concentration had been produced.

Figure 1. picture of the 100g/l SFE extract (left) and 100 g/l Soxhlet extract (right)

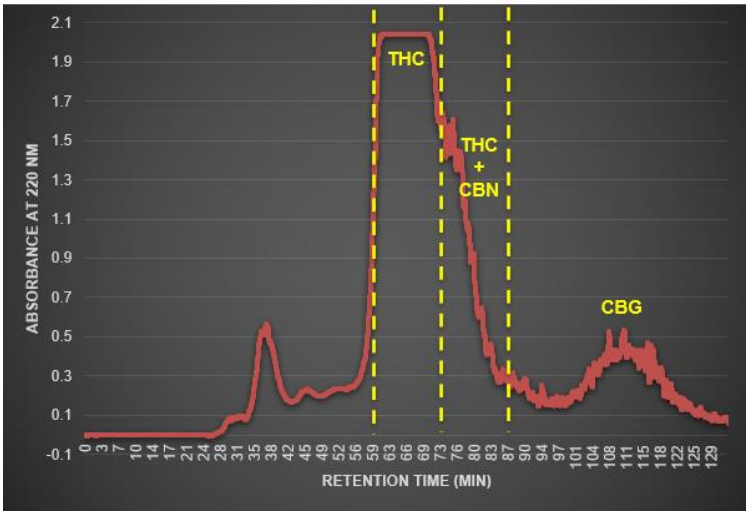

Figure 2. CPC chromatogram of the SFE extract

4. Conclusions

To extract THC in cannabis, Supercritical CO_2 extraction is more selective than ethanol Soxhlet extraction (Soxhlet ethanol extract: 30% THC, SFE extract: 55% THC). At the end of the Supercritical CO_2 extraction, cannabis polyphenols (Cannflavins, quercetin [2]) could be extracted by increasing the solvent polarity with a co-solvent like ethanol to obtain a second product. This is not possible with Soxhlet ethanol extract because polyphenols are extracted with THC.

In order to produce high THC extract (80%), CPC could be used with SFE extract because it's easily soluble into the mobile phase but it's more complicated with ethanol Soxhlet extract because polar compounds are not soluble into the mobile phase.

References

1. A. Hazekamp, R Simons, A. Peltenburg-Looman, M. Sengers, R. Van Zweden, R. Verpoorte, J. of liquid chrom. & Rel. Tech., **2004**, 27(15), 2421-2439
2. J.L. Bautista, S. Yu, L. Tian, ACS Omega, 2021, 6, 8, 5119–5123