L-Università ta' Malta
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Determination of cannabinoids in Medium Chain Triglycerides oil

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INTRODUCTION

Cannabinoids, the major ones being cannabidiol (CBD), tetrahydrocannabinol (THC), and cannabinol (CBN) have gained attention for their therapeutic potential in managing conditions such as chronic pain, epilepsy, and anxiety. CBD based formulations are not to be considered narcotics provided the concentration of THC does not exceed levels ranging from 0.2-0.3%[1].

Oil-based cannabinoid products, particularly those using medium-chain triglycerides (MCT) oil, have become increasingly popular for their enhanced cannabinoid bioavailability.

AIMS

To develop, validate, and apply analytical methods for the quantification of cannabinoids, in various commercially available CBD preparations.

METHOD

Table 1: Chromatographic Parameters

Parameter	Value
Stationary phase	Avantor ACE C18-AR (250 x 4.6 mm; 5 µm particle size)
Column temperature	25°C
Mobile phase	ACN and 0.5% acetic acid (66:34, v/v)
Flow rate	2 mL/min
Wavelength	220 nm
Injection volume	10 µL

Standard solutions of THC (5 mg/ml), CBD (1 mg/ml), and CBN (1 mg/ml) in methanol were prepared and diluted across five concentration levels and analysed using conditions described in Table 1.

The method was validated for precision, accuracy, linearity, specificity, and robustness according to International Council on Harmonisation (ICH) guidelines[2] (Table 2).

Table 2: Summary of Validation Paramaters, Demands and Evaluation Criteria

Parameter	Demand	Evaluation
Specificity	No interference, no carryover	Blank methanol/MCT oil samples analysed in triplicate
Linearity	$R^2 > 0.99$	Calibration curves established across five concentration levels analysed in triplicates
Accuracy	Percentage bias ±15%	Recovery bias was assessed by spiking MCT oil with known analyte amounts
Precision	RSD < 15%	Intra-day and inter-day precision were measured by analysing spiked samples in triplicates
Limits of detection and quantification	< 0.2% for each	Based on a signal-to-noise ratio of 3 (LOD) and 10 (LOQ)
System suitability	RSD < 15%	Highest concentration standard analysed six times
Robustness	Theoretical plates (N) ≥ 3000 Capacity factor (k) ≥ 1	Alteration of flow rate (± 0.1 mL/min), mobile phase composition (± 5%), column temperature (± 5°C)

RESULTS

The method demonstrated optimal chromatographic separation, with retention times of 7.2 min (CBD), 12.4 min (CBN), and 14.0 min (THC) (Figure 1). Developed method was found to have acceptable precision, linearity, accuracy and system suitability (Table 3).

Table 3: Validation Results for Canabinoid Analysis Using HPLC-UV

Cannabinoids	Retention time	Interday Precision (RSD %)	Interday R^2	Intraday Regression equation	Intraday R^2	Linearity range (mg/ml)	LOD (mg/ml)	LOQ (mg/ml)	Accuracy (average)	System suitability (RSD %)
CBD	7.2	≤ 10%	0.999	≤ 10%	0.999	0.5– 0.03	0.015	0.03	101%	0.96%
CBN	12.8	≤ 12%	0.999	≤ 12%	0.999	0.5– 0.03	0.015	0.03	108%	0.69%
THC	14.5	≤ 8%	0.987	≤ 15%	0.990	1 – 0.03	0.03	0.03	104%	0.79%

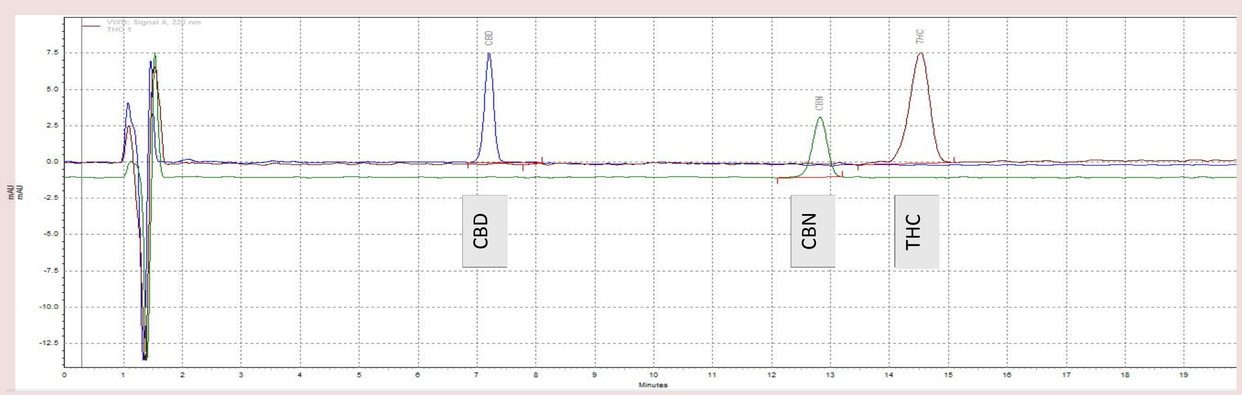

Figure 1: Chromatogram of CBD, CBN and THC

CONCLUSION

The developed method is efficient, simple, and suitable for determining THC, CBD, and CBN concentrations in cannabis preparations using MCT oil as a carrier. It can help ensure that product concentrations match label claims, enhancing consumer trust and product quality. Additionally, it supports manufacturers and laboratories in complying with THC regulations (0.2–0.3%).

REFERENCES

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