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Enzyme-assisted extraction of bioactive compounds from *Origanum dictamnus L.*

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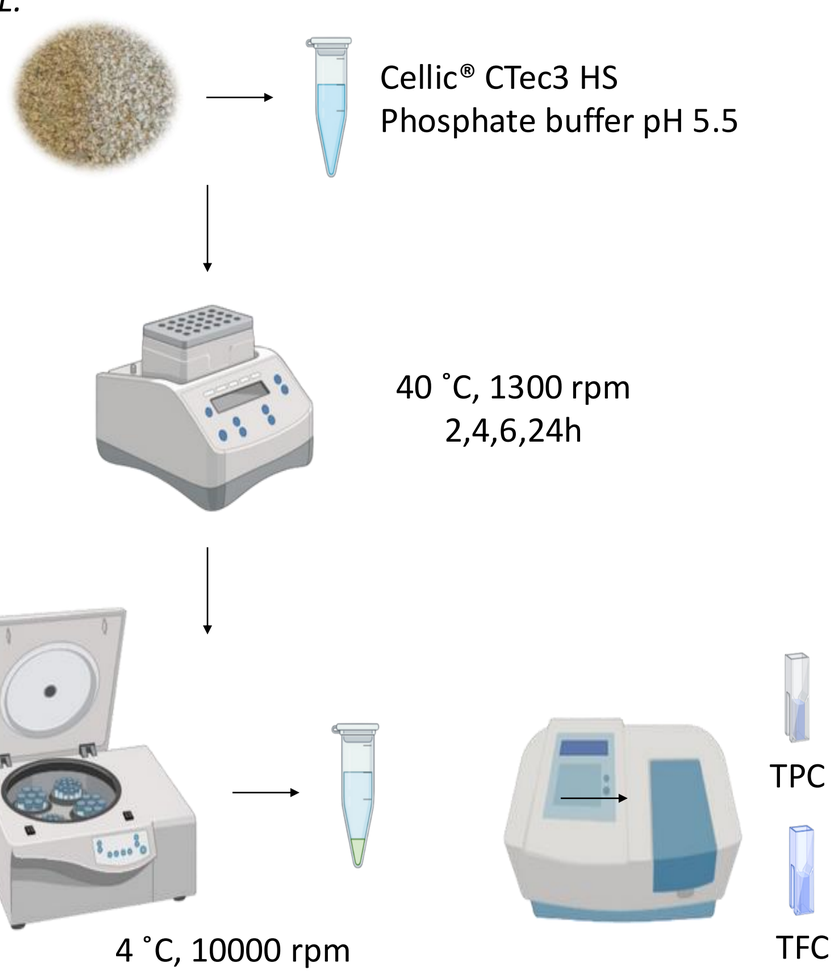
INTRODUCTION & AIM

Origanum Dictamnus L. is a medicinal plant known for its rich content in bioactive compounds. The plant cell wall consists of various structural polysaccharides such as cellulose, hemicellulose, pectin, along with lignin, proteins and bioactive compounds. These compounds are either trapped within the plant cell wall or free in the cytocol of the plant cell.[1] Conventional extraction techniques often require organic solvents and harsh conditions, which may compromise compound stability and sustainability. In this context, Enzyme-assisted extraction (EAE) has emerged as a green technology that relies on the enzymes ability to selectively degrade the plant cell wall, thereby facilitating the release of the bioactive compounds.[2]

In the present study, EAE was applied to extract bioactive compounds from the leaves of *Origanum Dictamnus L.* using the commercial enzyme preparation Cellic® CTec3 HS (Novozymes), and was compared to conventional extraction with ethanol-water mixtures of various concentrations. A Taguchi experimental design was applied to determine the optimal EAE conditions. The variables were enzyme loading (L, 50, 100, and 200 U/mg), solid-to-liquid ratio (SLR, 1, 4, and 7% w/v), and extraction time (t, 1, 3, and 6 h). The responses were total phenolic content (TPC) and total flavonoid content (TFC). Conventional extraction was performed using ethanol–water mixtures of 0-100% v/v.

METHOD

Origanum Dictamnus L.

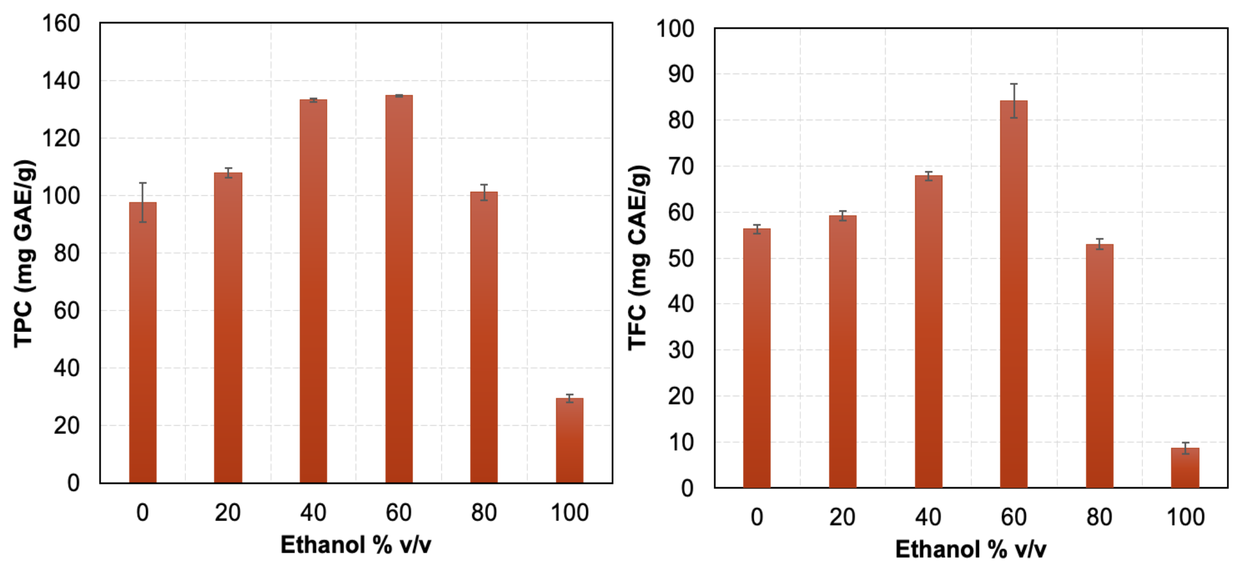


FUTURE WORK

- Combination of EAE with other green extraction methods (ultrasound or microwave-assisted extraction to improve efficiency)
- Evaluation of extracts' biological activities, namely antioxidant, antimicrobial, antiaging, antidiabetic, and anticancer
- Life cycle assessment (LCA) of the EAE process to evaluate the environmental impact and sustainability of EAE compared to conventional extraction methods

RESULTS & DISCUSSION

Conventional extraction



Enzyme-assisted extraction (EAE)

Solid-to-liquid ratio (% w/v)	Enzyme loading (Units/g)	Extraction time (h)	TPC (mg GAE/g)	TFC (mg CAE/g)
1	50	1	131.6 ± 2.8	62.5 ± 6.1
1	100	3	144.2 ± 0.6	77.5 ± 6.6
1	200	6	164.8 ± 5.2	63.2 ± 5.6
4	50	3	106.2 ± 2.8	75.4 ± 0.8
4	100	6	112.0 ± 2.4	75.2 ± 2.9
4	200	1	109.3 ± 3.6	86.4 ± 5.1
7	50	6	90.3 ± 5.2	71.7 ± 2.4
7	100	1	102.6 ± 7.4	92.5 ± 5.7
7	200	3	99.4 ± 0.7	75.0 ± 3.1

TPC (mg GAE/g) = 137.50 – 19.80 SLR + 0.36 L + 0.38 t + 1.4 SLR^2 0.17 t^2

R^2 =0,957

TFC (mg CAE/g) = 128.8 – 10,77 SLR+ 0,03 L + 1.14*t + 0.44 SLR^2 – 0.02*t^2

R^2 = 0,868

CONCLUSION

EAE

- highest TPC 164.8 ± 5.2 mg GAE/g, at 1% w/v (100 U/mg, 6h)
- highest TFC 92.5 ± 5.7 mg CAE/g, 7% w/v (100 U/mg, 1h)

Conventional Extraction

- highest TPC 133.2 ± 0.5 mg GAE/g and TFC of 67.9 ± 0.9 mg CAE/g (40% v/v)

These results support the potential of EAE as an efficient and sustainable method for the extraction bioactive compounds from *Origanum Dictamnus L.*

REFERENCES

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2. Lemoni, Z.; Kalantzi, S.; Lymperopoulou, T.; Tzani, A.; Stavropoulos, G.; Detsi, A.; Mamma, D. Optimization of Bioactive Compounds Extraction from Rosa Canina L. Pseudofruit through the Action of Two Hydrolytic Enzyme Preparations. *Journal of Chemical Technology and Biotechnology* **2025**