

Supercritical CO₂ extraction of seed oils

A. Vermoesen and J. Geuens

GOAL

During these exploratory experiments, oil was extracted from 2 different oil seeds to check if standard extraction conditions can be applied for all tested samples.

BACKGROUND

Currently vegetable oils are obtained by means of pressing and/or hexane extraction. Supercritical CO₂ extraction can be used as a green alternative for hexane.

PROCEDURE

Oil seeds were dried for 2 hours in a vacuum oven at 80°C and subsequently milled at 400rpm during 1 min in a rotating ball mill. The milling was performed. About 30 g of dried and milled seeds were put in a 100 mL extraction vessel of the SFT-150 extractor. Extractions were performed at 70°C and 6000 psi alternating between static (no flow) and dynamic phases (CO₂ flow of 25 mL/min).

Samples were collected after each dynamic phase and the oil yield was determined gravimetrically. The oil yield is expressed as % m/m compared to the mass of seeds used for the extraction.

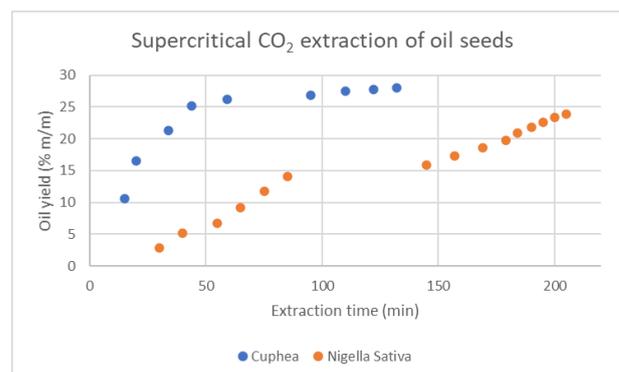
The results are compared with the results of a hexane extraction performed in an ASE150 apparatus at 105°C and 125 bar using 3 static cycles of 5 min.

RESULTS

When performing a hexane extraction on the ASE150 apparatus, *Cuphea* seeds yielded 30,25 % m/m oil while the oil yield for *Nigella Sativa* was 35,74 % m/m. The result for *Cuphea* is comparable to what is found in literature [1]. For *Nigella Sativa* literature [2] mentions up to 42 % m/m oil.

The results of the supercritical CO₂ extraction are mentioned in Graph 1. It can be seen that

extraction of *Cuphea* seeds is almost complete after 1 h and the final oil yield is similar to the oil yield obtained using hexane extraction. However, for *Nigella Sativa* the extraction seems to proceed much slower and after almost 4 h extraction has still not reached completion (no flattening of the extraction curve is observed). Moreover, the oil yield at that time is about 10% m/m lower when compared to hexane extraction.



Graph 1 Oil yield after supercritical CO₂ extraction of 2 different seed oils

DISCUSSION

It is clear that optimization of the extraction procedure is necessary for the different oil seeds. For *Cuphea* the standard conditions yielded results that were close to the reference, for Black Cumin poor results were obtained when applying standard conditions.

REFERENCES

- [1] McKeon T.A. et al., Industrial Oil Crops 2016, AOCS Press, pp. 275-341.
- [2] Ketenoglu O. et al, Cold Pressed oils 2020, Academic Press, pp. 53-64.