Supercritical fluid extracted rapeseed oil, its chemical- and sensory profile

Frandsen, Heidi Blok; Wæhrens, Sandra Stolzenbach; Petersen, Mikael Agerlin; Sørensen, Hilmer; Sørensen, Susanne; Sørensen, Jens Christian

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Supercritical fluid extracted rapeseed oil, its chemical- and sensory profile

H. B. Frandsen*, S. S. Wæhrens, M. A. Petersen, H. Sørensen, S. Sørensen, J.C. Sørensen

University of Copenhagen, Department of Food Science, Rolighedsvej 26, 1958 Frederiksberg C, Denmark
*hbf79@food.ku.dk

Introduction

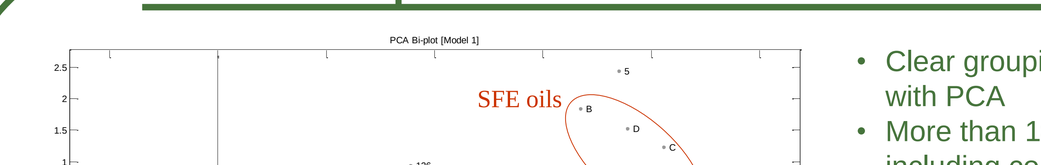
Double low rapeseed (*Brassica napus* L) is among the world most produced oilseeds used for human oil consumption. This seed oil has a high level of triacylglycerols (TAGs) primarily consisting of the essential fatty acids (FAs) oleic acid (C18:1 ω9); linoleic acid (C18:2, ω6) and linolenic acid (C18:3, ω3), with a ω3: ω6 ratio close to 1:2 [1]. This specific FA profile, as well as the content of antioxidants and phytosterols, are the major reasons why rapeseed is considered as health promoting when present in food and feed [1,2].
The industrial extraction of rapeseed oil is commonly performed with cold-pressing, warm-pressing and/or ether solvent extraction. Supercritical fluid extraction (SFE) is, however, among the relatively newer alternatives for extraction of oil and other lipids [3,4]. High quality oil can be extracted using SFE and the method allows for a potential fractionation of different lipids.
Selected rapeseed cultivars have been extracted to yield oil using different processing parameters and the oils have been evaluated with respect to aroma, taste and chemical profiles.

Processing conditions

Rapeseed		SFE conditions	
Cultivar	**Flower color**	**400 bar, 55 ºC**	**300 bar, 55 ºC**
Excalibur	Yellow	[A]	
Silvershadow	White	[B]	
Lyside	White	[C]	[D]

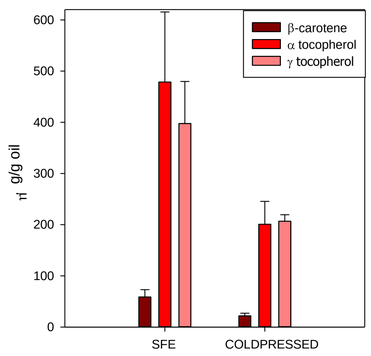
Cold-pressed oils	Flower color	
Pilot plant	yellow	[E]
Bandholm no 4*	Yellow	[F]
Lehnsgaard*	Yellow	[G]
Bandholm no3*	yellow	[H]

*=commercial oil



Antioxidants

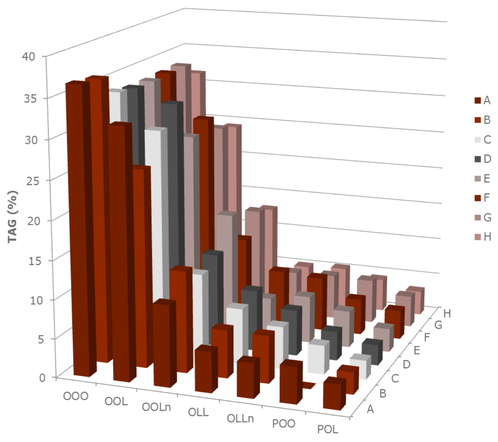
The extractability of antioxidants from rapeseed is higher with SFE than with cold-pressing of rapeseed. The average levels of β-carotenoid are 2.7 times higher in SFE oils than in cold pressed oils. Similar relations are observed for the tocopherols with about 2-2.5 higher level in SFE oil
In the SFE oils, a difference is observed between [C] and [D], as an effect of applied pressure (results not shown)



The carotenoids were analysed measuring UV absorbance at 480 nm and using 1% solution extinction coefficient of 2280
The tocopherols were analysed directly using normal phase HPLC.
SFE: average of [A-D], coldpressed : average of [E-H]

Triacylglycerols

The profile of native triacylglycerols (TAGs) were analyzed with enhanced fluid liquid chromatography (EFLC) and detected with evaporative light scattering detection (ELSD) [3]. A similar profile was found in all oils, with minor variations between the amount of the individual TAGs in the different oils

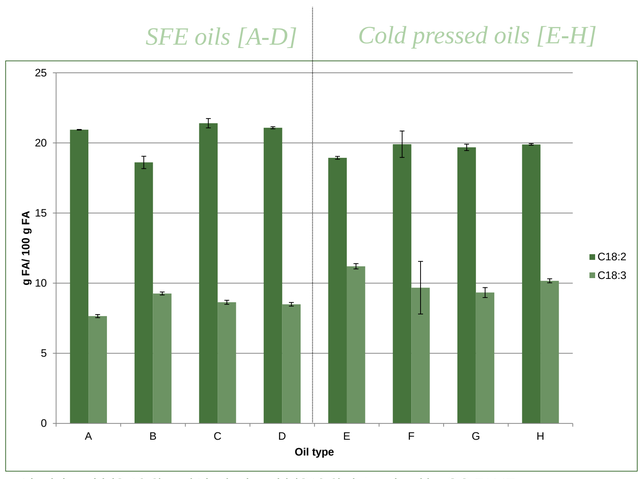


Profile of the quantittive domination triglycerides in rapeseed oil analysed with enhanced fluid liquid chromatography (EFLC).
O: oleic acid; P:palmitic acid, L: linoleic acid; Ln: lionelenic acid,

Fatty acids

The ratio between the essential (FAs) linoleic acid (ω6) and linolenic acid (ω3) ranged between 1:1.7-2.7 (ω3 :ω6) for cold-pressed oils, and between 1:2.0-2.7 for SFE oils.

No effects on the ω3/ω6 ratio is seen when processing is performed with different pressures ([C] and [D]).



Linoleic acid (C:18:2) and Linolenic acid (C18:3) determined by GC-FAME

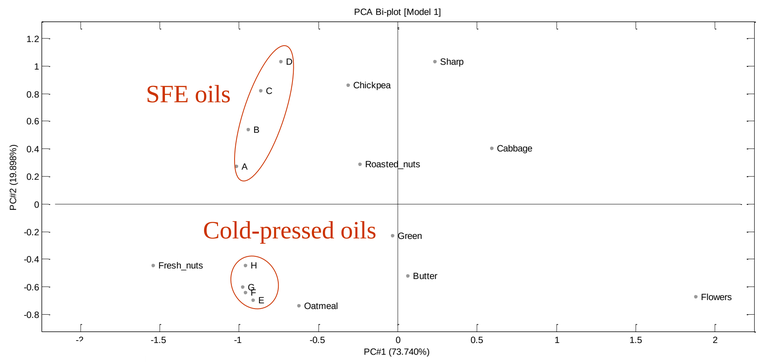
Volatile compounds detected with SPE headspace GC-MS

PCA plot. Fingerprinting analysis of volatile compounds (no.1-147) detected with SPE headspace GC-MS and relation with differently processed rapeseed oils in double determination.

- Clear grouping between SFE and Cold-pressed oils with PCA
- More than 100 volatile compounds are detected including compounds in the chemical groups:
  - Aldehydes (e.g. heptanal (66), hexanal (45))
  - Ketones (e.g. 2-heptanone (65))
  - Alcohols (eg. 1-hexanol (90))
- Glucosinolate transformation compounds detected:
  - 1-Cyanobut-3-ene (76)
  - But-3-enylisothiocyanate (104)
  - Methylthiocyanate (75)

Sensory panel

- Different appearance was observed:
  - Cold-pressed oils: more transparent
  - SFE oils: more yellow and green(only [C])
- Clear grouping between SFE- and cold-pressed oils with PCA when flavor descriptions are plottec
- The sensory panel also discovered significant differences in
  - Taste
  - Mouthfeel
  - Odor
  - Aftertaste



PCA plot. Flavor descriptions in the different oil analyzed by 11 different judges

Conclusions

- **SFE oils may contain a higher level of antioxidants than cold-pressed oils.**
- **Fingerprinting of aroma compounds from SPE headspace GC-MS is a tool that allows for distinguishing between SFE and coldpressed oils.**
- **SFE of rapeseed results in other types of flavors and tastes in the oil than found in coldpressed oils**

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Acknowledgements

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