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

<table>
<thead>
<tr>
<th>Rapeseed</th>
<th>SFE conditions</th>
<th>Cold-pressed oils</th>
<th>Flower color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultivar</td>
<td>400 bar, 25 °C</td>
<td>Yellow</td>
<td>B</td>
</tr>
<tr>
<td>Escalibur</td>
<td>500 bar, 55 °C</td>
<td>Yellow</td>
<td>E</td>
</tr>
<tr>
<td>Silvercabbage</td>
<td>White</td>
<td>Yellow</td>
<td>H</td>
</tr>
<tr>
<td>Lyside</td>
<td>White</td>
<td>Yellow</td>
<td>D</td>
</tr>
</tbody>
</table>

The profile of native triacylglycerols (TAGs) were analyzed with enhanced 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.

Antioxidants

The extractability of antioxidants from rapeseed is higher with SFE than with cold-pressing of rapeseed. The average levels of β-carotene are 2.7 times higher in SFE oils than in cold pressed oils. Similar relations are observed for the tocopherols with about 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).

Triacylglycerols

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 1.2-2.7 for SFE oils.

Fatty acids

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

Volatile compounds detected with SPE headspace GC-MS

- 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 (e.g. 1-hexanol (90))
- Glucosinolate transformation compounds detected:
  - 1-Cyanoethyl-3-ene (76)
  - But-3-enylthioisocyanate (104)
  - Methylythiocyanate (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 plotted
- The sensory panel also detected significant differences in:
  - Taste
  - Mouthfeel
  - Odor (COD)
  - Aftertaste

Conclusions

- SFE oils may contain a higher level of antioxidants than cold-pressed oils.
- Fingerprinting of aroma compounds from SFE 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

References


Acknowledgements

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