Volatile Compounds Fingerprints of Black Cumin (*Nigella sativa* L.) Seed Oil Extracted by Supercritical Carbon Dioxide

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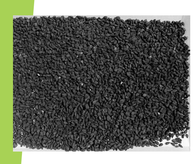
Introduction

Chemicals in Essential Oil

- Quinones (Thymoquinone 0.1-0.75%)
- Monoterpenoid phenols
- Alkaloids
- Saponins
- Phytosterols

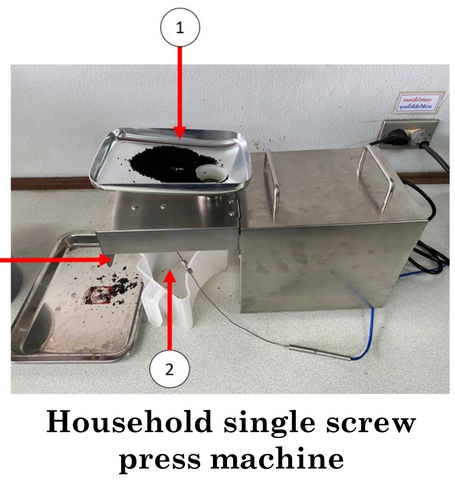
Materials & Methods



The black cumin seed was imported from Guangxi Qinzhou province, The People's Republic of China.

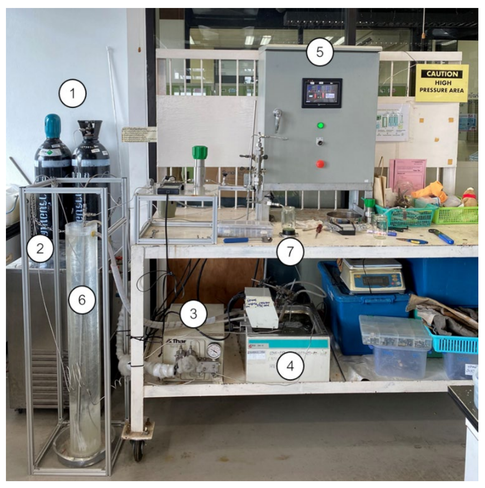
Static headspace-gas chromatography (SH-GC-FID)

Analytical column: DB-1, 0.25 mm ID × 0.25 µm × 30.0 m
Carrier gas: He (99.995%), Linear velocity of 40 cm/s.
Oven temperature: 50ºC (hold 2 min), ramp 5ºC/min to 150ºC (hold 2 min)
Sample equilibrate: 100ºC (hold 10 min)
Injection condition: 200 ºC 1.00 ml (split ratio of 1:10)
FID temperature: 280ºC



Household single screw press machine

(1) Sample hopper
(2) Compressed oil outlet
(3) Seed cake outlet



Supercritical CO_2 Extraction

(1) Liq. CO_2 cylinder
(2) Cooling bath
(3) High-pressure pump
(4) Preheater
(5) System controller
(6) Extraction tube
(7) Sample collector

Unfiltered Black Cumin Seed oil

Black Cumin Seed cake

Before $SCCO_2$ Extraction

After $SCCO_2$ Extraction

Black Cumin Seed

Results & Discussion

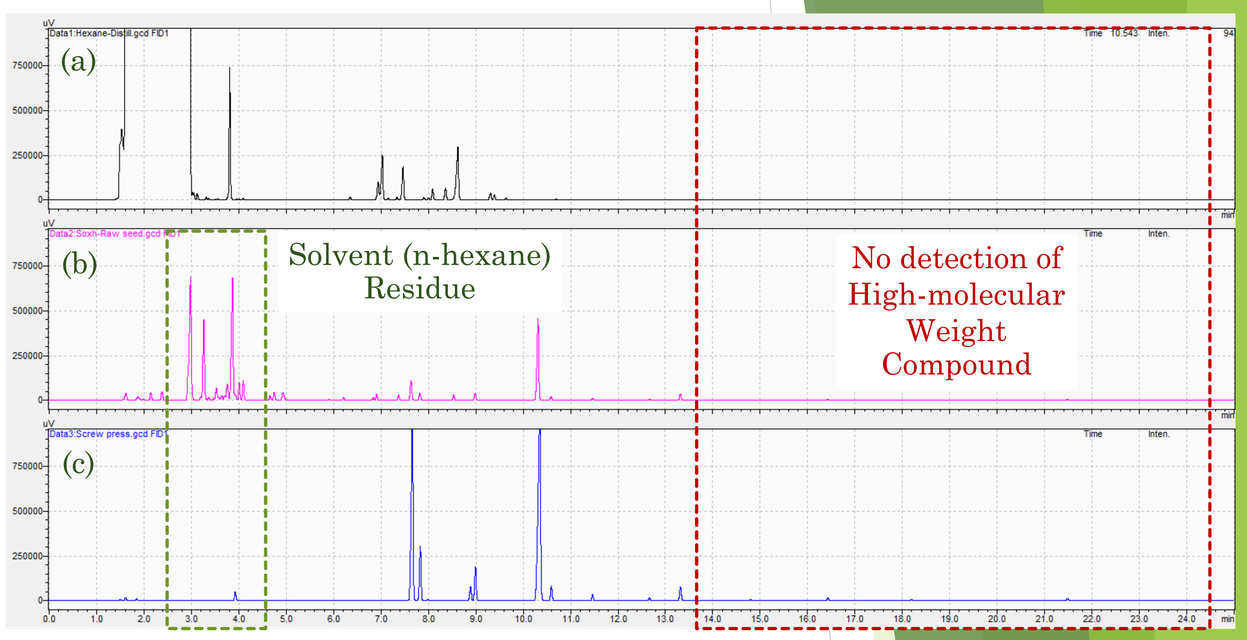


Figure 1. The GC chromatograms of (a) *n*-hexane, (b) Oil obtained from Soxhlet extraction of milled raw seed (Oil_{SE}), and (c) the extracted oil obtained from a screw-press machine (Oil_{SM})

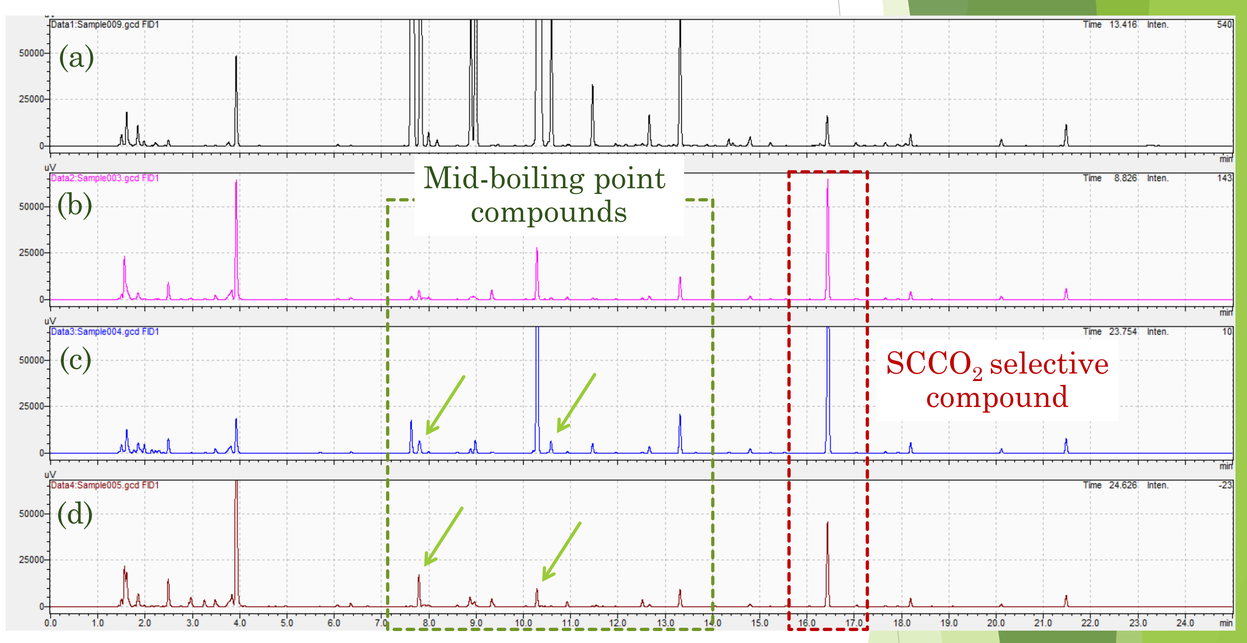


Figure 2. The GC chromatograms of black cumin seed oils obtained from (a) screw press machine and $SCCO_2$ extractions at 20.0 MPa (b) 40 °C, (c) 50 °C, and (d) 60 °C.

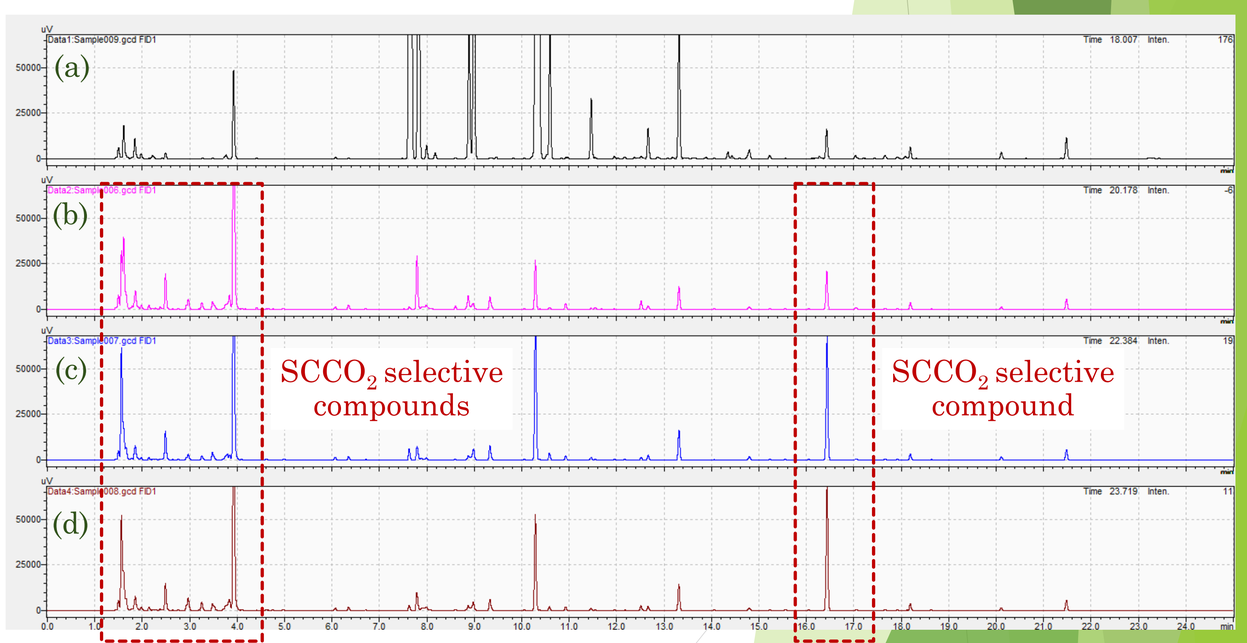


Figure 3. The GC chromatograms of black cumin seed oils obtained from (a) screw press machine and $SCCO_2$ extractions at $SCCO_2$ extractions at 30.0 MPa (b) 40 °C, (c) 50 °C, and (d) 60 °C.

Conclusion

The screw press method was suitable to extract the mid-molecular weight compounds, while the $SCCO_2$ extraction was capable to extract the low- and high-molecular weight compounds. The solvent residue was detected in sample obtained from Soxhlet extraction. The $SCCO_2$ extraction revealed its selectivity on specific compound based on the extraction temperature and pressure. The unknown compounds will be identified by gas chromatograph-mass spectrometer equipped with the static-headspace autosampler (SH-GC-MS) in the further study.

References

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Acknowledgements

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