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Application News

Supercritical Fluid Chromatograph – Nexera™ UC

Rapid Extraction of Various Compounds from Natural Products

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User Benefits

- Manual operation can be reduced against typical extraction method.
- Automated multiple extractions for many samples can be achieved.
- Organic solvent consumption can be reduced against typical liquid extraction.

■ Introduction

Natural products include various compounds used as drug substances or aromatic oil. Generally, liquid-phase extraction is widely used to extract valuable compounds from natural products. However, it requires a lot of complex operations and time.

This article introduces the application of Supercritical Fluid Extraction (SFE) from natural products by Nexera UC SFE fraction system.

■ Features of Supercritical Fluid Extraction

Supercritical Fluid Extraction (SFE) is one of the extraction methods using supercritical fluid carbon dioxide ($SFCO_2$) as extraction liquid. $SFCO_2$ has unique features that lead to high-throughput and high recovery rate extraction. (Fig. 1) Moreover, the low cost of carbon dioxide (purity: 99.9%) can significantly reduce the total running cost of the extraction phase.

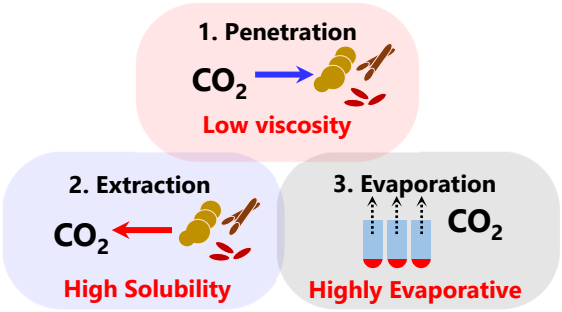


Fig. 1 Unique features of SFE (Supercritical Fluid Extraction)

■ Nexera UC SFE Fraction System

Nexera UC SFE fraction system has an extraction module and fraction collector. (Fig. 2) The extraction module, storing up to 48 extraction vessels, achieves automated multiple extractions for many samples. Fig. 3 shows the flow diagram of the system.

Fig. 2 Nexera UC SFE fraction system

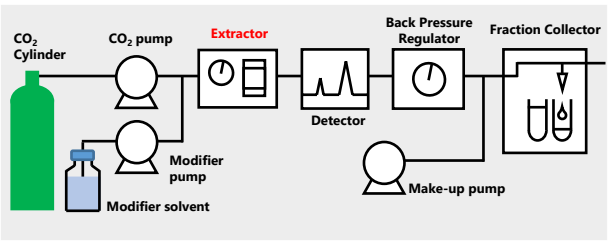


Fig. 3 Flow path diagram for Nexera UC SFE system

■ Extraction Flow

Fig. 4 shows the sample preparation protocol for SFE. The samples are homogenized and packed in a SFE vessel. Nexera UC SFE works with the combination of two types of extraction modes. (Fig. 5) After the extraction phase, $SFCO_2$ delivers the target compounds, and they are collected at fraction collector with make-up solvent.

Nexera UC SFE fraction system achieves high recovery rate collection by new Gas-Liquid Separator (GLS) "Lotus Stream". Fig. 6 shows GLS working that the liquid is separated appropriately from the CO_2.

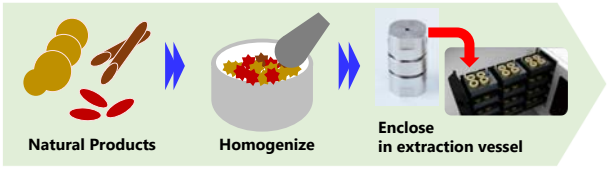


Fig. 4 Pretreatment overview of SFE

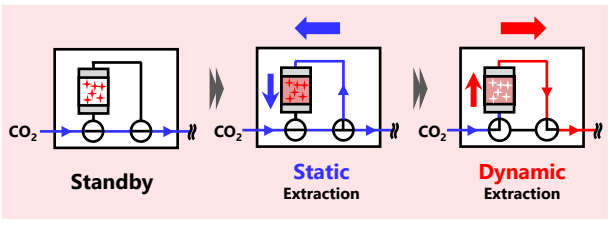
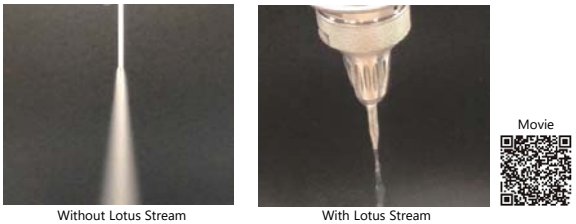


Fig. 5 SFE extraction mode



Without Lotus Stream | With Lotus Stream

Fig. 6 Gas-Liquid Separator "Lotus Stream"

■ SFE procedure against natural products

We performed SFE extraction against three types of natural products. (Tea leaves, Ginger, Nutmeg) Fig. 7 shows the sample preparation protocol for these natural products. Table 1 shows the extraction conditions, and Fig. 8 shows the extraction results. The PDA detector installed behind the extracting module can confirm the results of the extraction process.

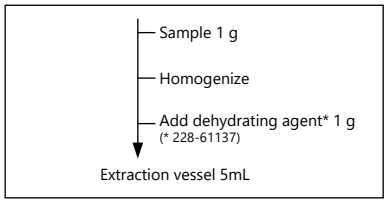


Fig. 7 Sample preparation protocol

Table 1 Extraction conditions

Extraction solvent	: CO_2 /Methanol = 7:3
Flow rate	: 5 mL/min
Time program	: Static mode (0-2 min)→Dynamic mode (2.01-7 min) → Wash(7,01-10 min)
Vessel temp.	: 50℃
Back pressure	: 15 MPa
Fraction time	: 2-7 min
Make-up	: 2 mL/min Tetrahydrofuran
Detection	: PDA (250 nm, 280nm, 300 nm), Prep-Cell

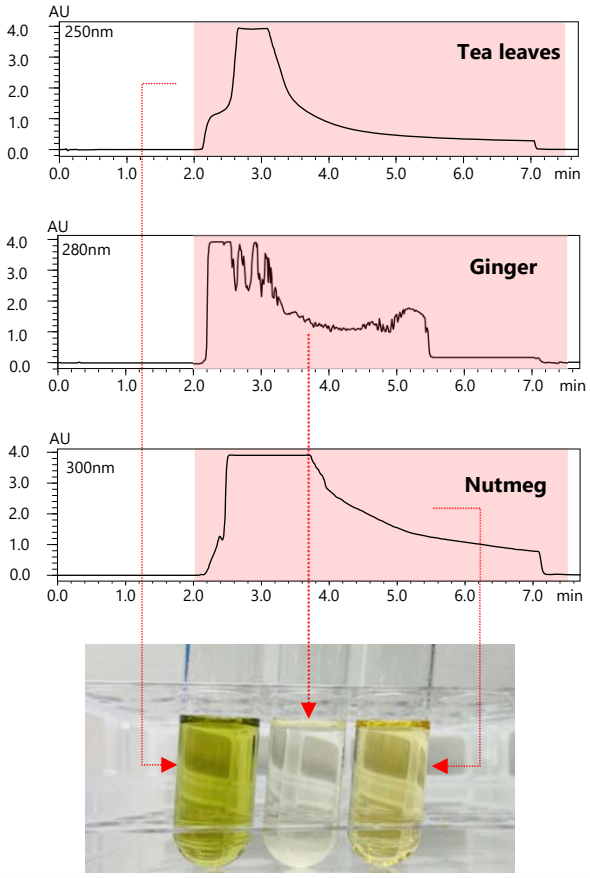


Fig. 8 Extraction chromatograms from natural products

■ Confirmation of extract fractions by analytical HPLC

These obtained fractions were analyzed by analytical HPLC. Table 2 shows the analytical conditions, and Fig. 9 shows obtained chromatograms. As a result, it was possible to find various compounds contained in the SFE fractions from each natural product.

Table 2 Analytical conditions

Column	: Shim-pack™ XR-ODS II*1 (100 mm× 2 mm I.D., 2.2 µm)
Mobile phase	: A: Water B: Acetonitrile
Flow rate	: 0.5 mL/min
Time program	: B conc. 2% (0 min) → 98% (7-8 min) → 2% (8.01-10 min)
Column temp.	: 40℃
Injection vol.	: 1 µL
Vial	: SHIMADZU LabTotal™ for LC 1.5 mL, Glass*2
Detection	: PDA (250 nm, 280 nm, 300 nm)

*1 P/N: 228-41623-92 *2 P/N: 227-34001-01

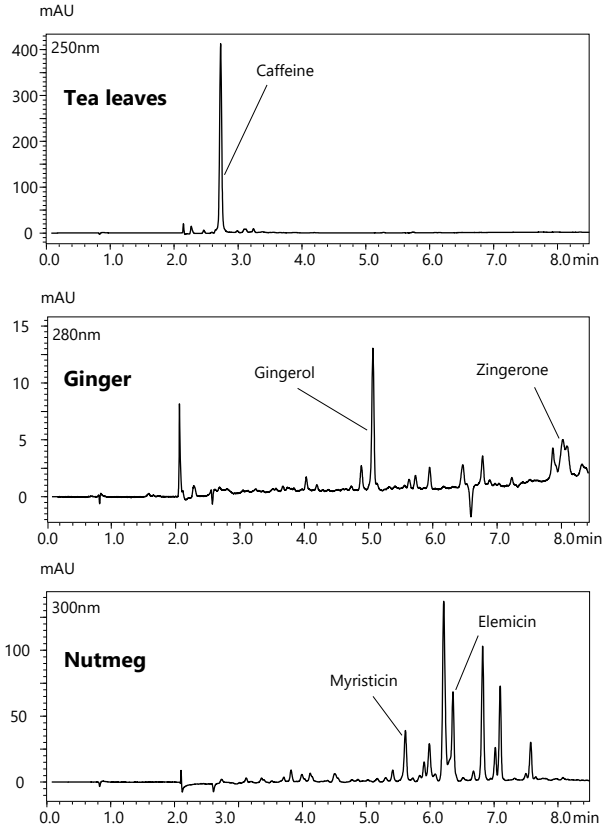


Fig. 9 Analytical chromatograms of extracts from natural products

■ Conclusion

This article introduced the extraction process from natural products by Nexera UC SFE Fraction system. SFE can be expected to provide superior advantages compared to typical liquid extraction in terms of process time length and running cost.

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