

COSMOSIL SFC

Wide selection of SFC column phases

- Three categories of stationary phase for different types of compounds
- Different selectivity from HPLC



COSMOSIL SFC Column Series

Supercritical Fluid Chromatography (SFC) has become more attractive because it offers some advantages over HPLC, such as high speed, unique selectivity and environmentally friendly separations. Many conventional normal-phase stationary phases, such as diol, amino and cyano, have been used for SFC applications. However, these phases present limitations for separations. COSMOSIL SFC Columns have been developed to enhance the capability of SFC separations.

Product Information

Category I: Columns for mid- to high-polarity compounds

For these compounds, a high-polarity stationary phase is suitable. More polar compounds are retained longer.

Product	Stationary phase	Features
COSMOSIL PY	Pyridinyl	Similar selectivity to 2-ethylpyridine; strong retention in general.
COSMOSIL HP	3-Hydroxyphenyl	Different selectivity from PY; strong retention for basic compounds.
COSMOSIL Diol	Diol	Less effect from ionic interaction.

Category II: Columns for low-polarity compounds

For these compounds, a low-polarity stationary phase is suitable.

Product	Stationary phase	Features
COSMOSIL Cholester	Cholesteryl	Longer retention and better separation than C ₁₈ .

Category III: Columns for SFC-specific separations

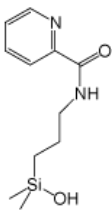
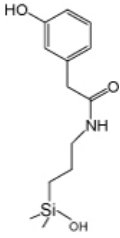
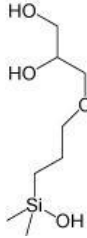
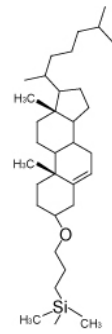
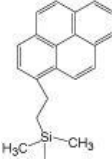
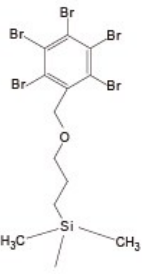
In supercritical fluid chromatography (SFC), secondary interactions such as π - π and dispersion force* are stronger compared to high-performance liquid chromatography (HPLC). As a result, these columns are capable of unique separations in SFC.

Product	Stationary phase	Features
COSMOSIL π MAX	Pyrenylethyl	Stronger π - π interactions than phenyl columns.
COSMOSIL PBr	Pentabromobenzyl	Unique separations using dispersion force.*

* Dispersion force:

London dispersion force is a weak intermolecular force that results from dipoles temporarily induced from random unsymmetrical electron positions in two adjacent atoms, also known as "instantaneous dipole-induced dipole force". It is present in all molecules, regardless of whether they are polar or non-polar. Compounds with high polarizability have stronger dispersion force.

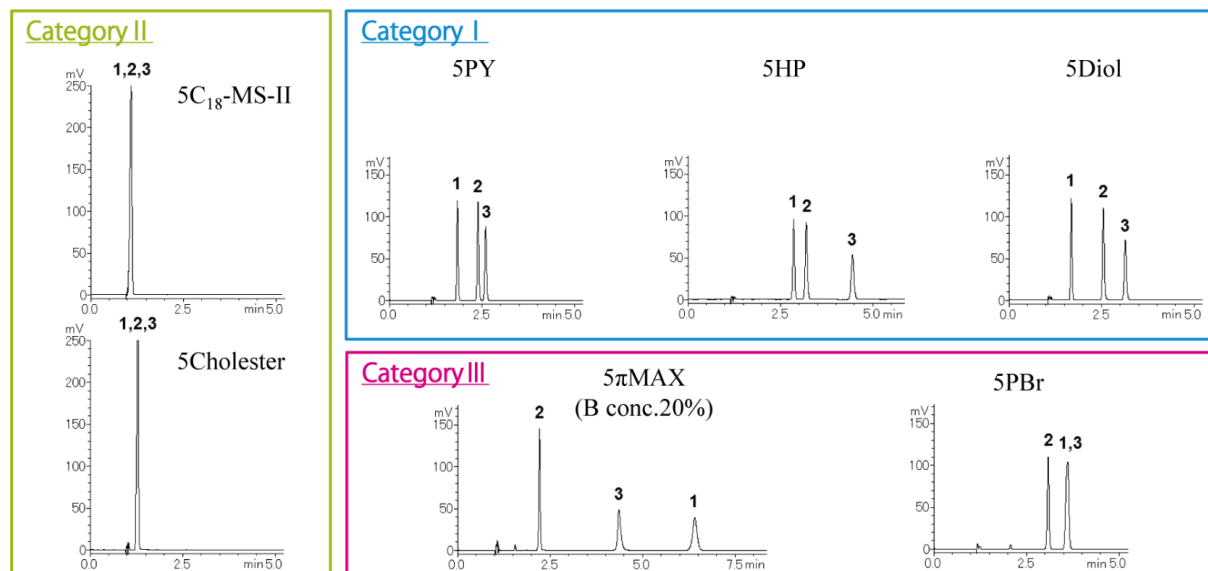
Packing Material Properties

Packing material	PY	HP	Diol	Cholester	π MAX	PBr
Silica gel	High-purity porous spherical silica					
Average particle size	3, 5 μ m		5 μ m	5 μ m	5 μ m	5 μ m
Average pore size	120Å					
Stationary phase						
	Pyridinyl	3-Hydroxyphenyl	Diol	Cholesteryl	Pyrenylethyl	Pentabromo benzyl
Endcapping	Near-Perfect Treatment					

Selection by Polarity

Derivatives of xanthine (high-polarity compounds) XLogP3: -0.8 – 0.0

Category I columns (COSMOSIL 5PY, 5HP, 5Diol) and COSMOSIL 5 π MAX separated the sample well. The elution order with COSMOSIL 5 π MAX was different than the category I columns.



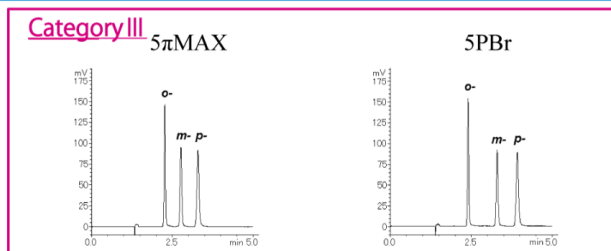
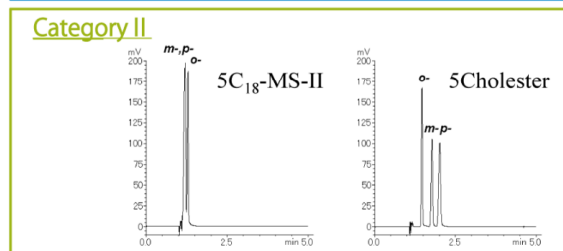
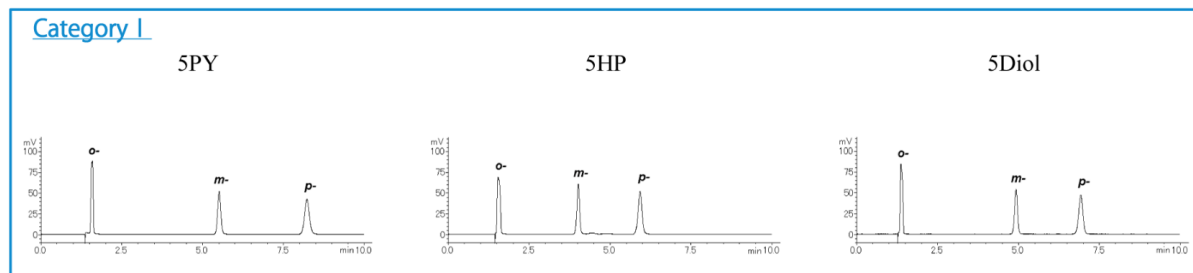
Column Size : 4.6 mm I.D. x 250 mm
 Mobile Phase : A: CO₂ B: Methanol B conc. 10% (π MAX only: 20%)
 Flow Rate : 3.0 mL/min
 BPR : 10 MPa
 Temperature : 40 °C
 Detection : UV 273 nm

Sample : 1. Caffeine (0.10 mg/mL)
 2. Theophylline (0.10 mg/mL)
 3. Theobromine (0.09 mg/mL)
 Inj. Vol. : 5.0 μ L

Selection by Polarity

Positional isomers (mid-polarity compounds) XLogP3: 1.4 – 1.9

Category I columns (COSMOSIL 5PY, 5HP, 5Diol) yielded the best separation.

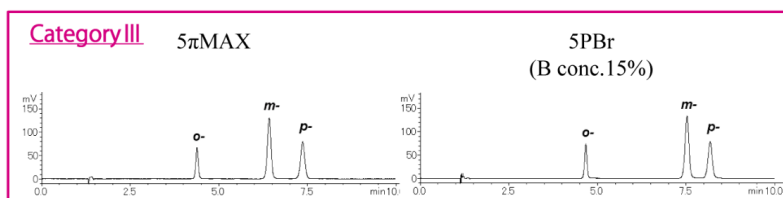
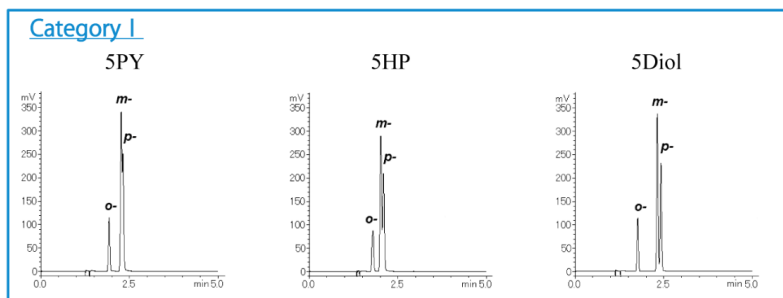
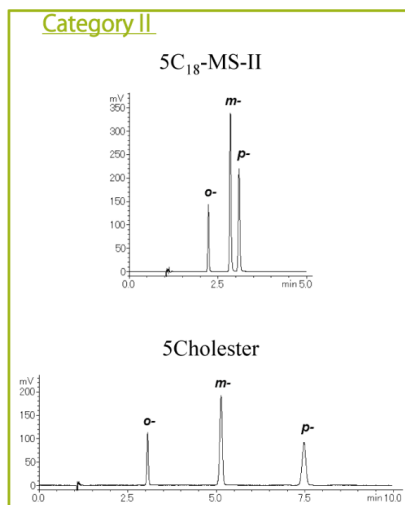


Column Size : 4.6 mm I.D. x 250 mm
 Mobile Phase : A: CO₂ B: Methanol B conc. 5%
 Flow Rate : 3.0 mL/min
 BPR : 10 MPa
 Temperature : 40 °C
 Detection : UV 254 nm

Sample : 1. *o*-Hydroxyacetophenone (0.1 mg/mL)
 2. *m*-Hydroxyacetophenone (0.1 mg/mL)
 3. *p*-Hydroxyacetophenone (0.1 mg/mL)
 Inj. Vol. : 5.0 μL

Positional isomers (low-polarity compounds) XLogP3: 5.8 – 6.0

Category III (COSMOSIL 5πMAX, 5PBr) and category II (5Cholester) columns separated most effectively.



Column Size : 4.6 mm I.D. x 250 mm
 Mobile Phase : A: CO₂ B: Methanol B conc. 5% (PBr only: 15%)
 Flow Rate : 3.0 mL/min
 BPR : 10 MPa
 Temperature : 40 °C
 Detection : UV 254 nm

Sample : 1. *o*-Terphenyl(0.1 mg/mL)
 2. *m*-Terphenyl(0.1 mg/mL)
 3. *p*-Terphenyl(0.1 mg/mL)
 Inj. Vol. : 5.0 μL

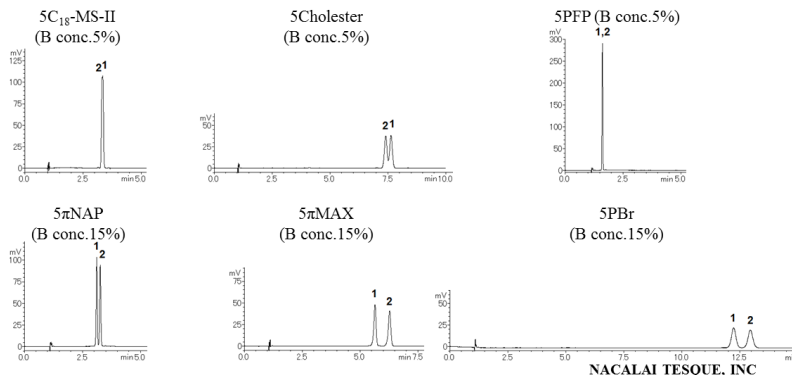
Applications

Vitamin D

COSMOSIL 5πMAX and 5PBr were able to separate the vitamins. The PFP (pentafluorophenyl) column, which also uses a halogenated stationary phase, could not separate them. The dispersion force used by PBr interacts more strongly with larger molecules. PFP, which is a smaller molecule, does not exhibit this selectivity..

Column: COSMOSIL **
 Column size: 4.6mmI.D.-250mm
 Mobile phase: A: CO₂
 B: Methanol
 B conc. **%
 Flow rate: 3.0 ml/min
 BPR: 10 MPa
 Temperature: 40 °C
 Detection: UV265nm

Sample: 1; Vitamin D₃ (0.6 mg/ml)
 2; Vitamin D₂ [Calciferol] (0.6 mg/ml)
 Inj.Vol.: 3.0μl



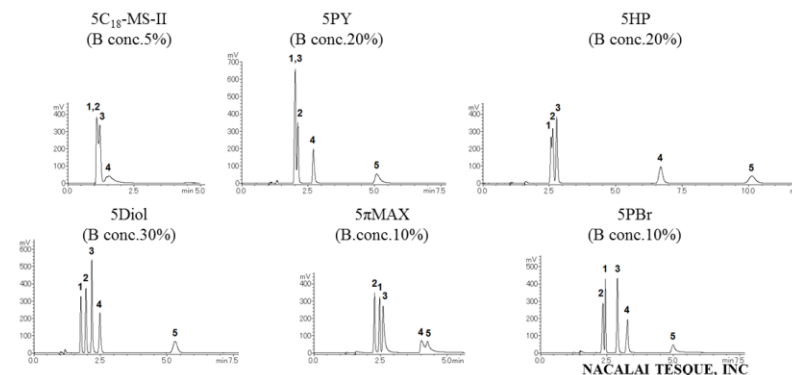
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 AP-1610

Nucleobases

COSMOSIL 5Diol separated 5 nucleic acid bases.

Column: COSMOSIL **
 Column size: 4.6mmI.D.-250mm
 Mobile phase: A: CO₂
 B: 100mmol/l Ammonium Acetate - Methanol
 B conc. **%
 Flow rate: 3.0 ml/min
 BPR: 10 MPa
 Temperature: 40 °C
 Detection: UV260nm

Sample: 1; Thymine (0.2 mg/ml)
 2; Uracil (0.2 mg/ml)
 3; Adenine (0.2 mg/ml)
 4; Cytosine (0.2 mg/ml)
 5; Guanine (0.2 mg/ml)
 Inj.Vol.: 5.0μl



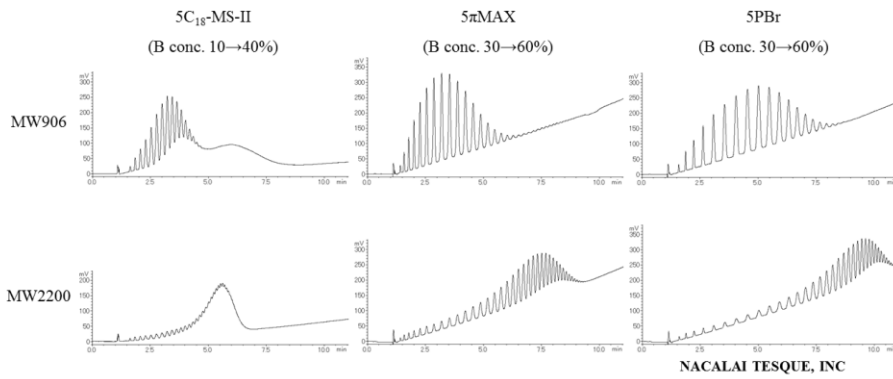
NACALAI TESQUE, INC
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Polystyrene

These polystyrene samples with different degrees of polymerization are likely separated by number of monomer units. COSMOSIL 5πMAX and 5PBr were able to separate the high-MW polystyrene.

Column: COSMOSIL **
 Column size: 4.6mmI.D.-250mm
 Mobile phase: A: CO₂
 B: Tetrahydrofuran
 B conc. *→*% 10min Linear gradient
 Flow rate: 3.0 ml/min
 BPR: 10 MPa
 Temperature: 40 °C
 Detection: UV220nm

Sample: Polystyrene, MW906 (5.0 mg/ml)
 Polystyrene, MW2200 (5.0 mg/ml)
 Inj.Vol.: 5.0μl



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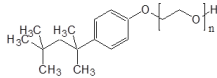
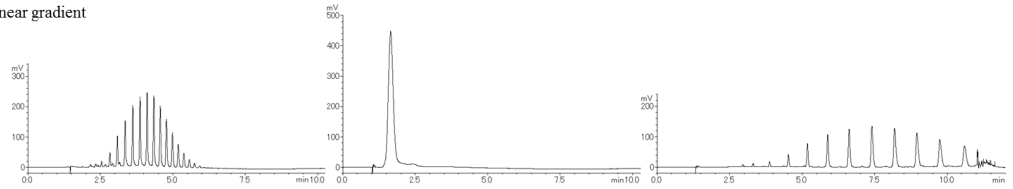
Surfactants

Column: COSMOSIL **
 Column size: 4.6mm I.D.-250mm
 Mobile phase: A: CO₂
 B: Methanol
 B conc. 5→60% 10min Linear gradient
 Flow rate: 3.0 ml/min
 BPR: 10 MPa
 Temperature: 40 °C
 Detection: UV220nm
 Sample: Triton X-100 (5.0 mg/ml)
 Inj.Vol.: 5.0µl

COSMOSIL
5SL-II

COSMOSIL
5C₁₈-MS-II

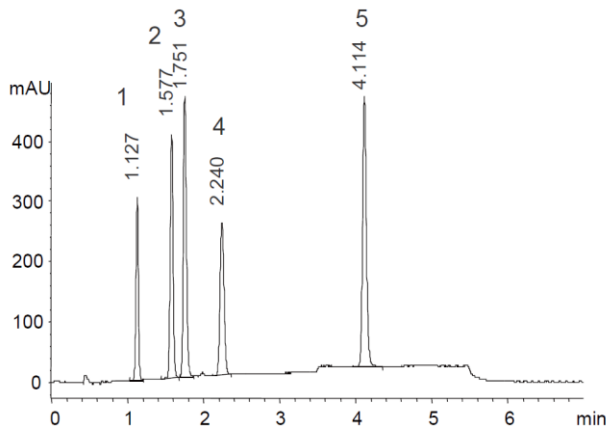
COSMOSIL
5PBr



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AP-1603

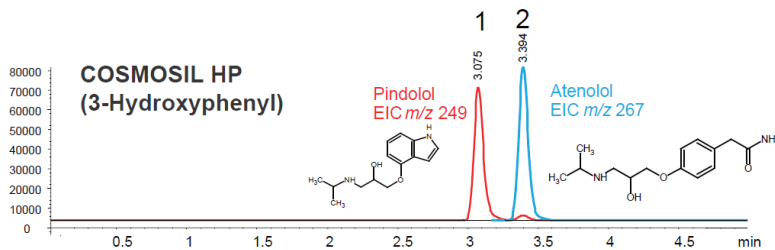
Non-steroidal anti-inflammatory drugs



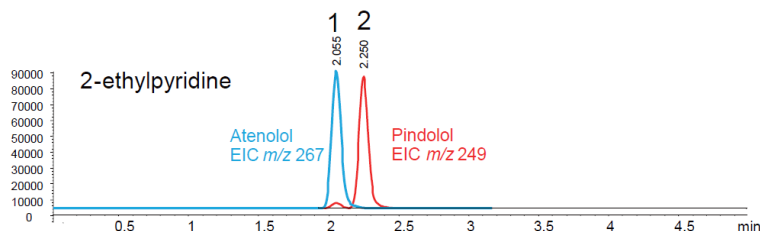
Column size: 4.6 mm I.D. x 150 mm
 Mobile phase: Carbon Dioxide : Methanol
 Gradient: 95:5 to 65:35 over 6 minutes
 Flow rate: 5.0 ml/min
 Temperature: 30°C
 Detection: UV 230 nm
 Sample:
 1. Ibuprofen
 2. Fenoprofen
 3. Flurbiprofen
 4. Ketoprofen
 5. Indoprofen

Beta Blockers

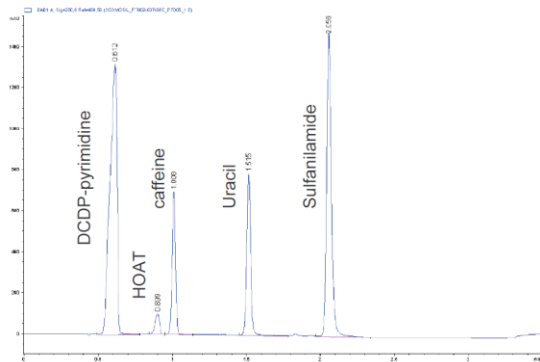
Peak elution order reversed under identical conditions.



Column size: 4.6 mm I.D. x 150 mm
 Mobile phase : Carbon Dioxide : Methanol
 w/20mM ammonium formate
 Gradient: 95:5 to 50:50 over 4 minutes
 Flow rate: 5.0 ml/min
 Temperature: 30°C
 Detection: APCI(+)
 Sample:
 1. Pindolol
 2. Atenolol



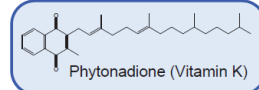
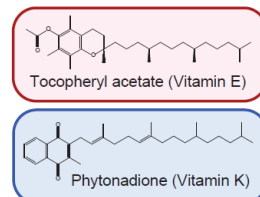
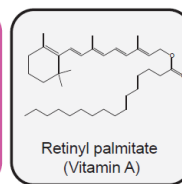
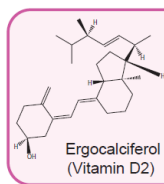
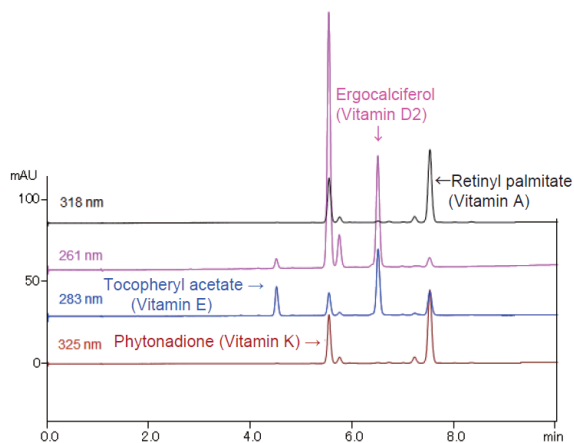
Hydrophilic organics



Phase: Pyridinyl
 Column size: 4.6 mm I.D. x 150 mm
 Flow rate: 5.6 mL/min
 Pressure: 140 bar
 Temperature: Ambient
 Mobile phase: Methanol gradient 5-50%
 @18%/minute;
 hold @ 50% 0.1 min;
 return to 5% @99%/min

Fat-Soluble Vitamin Analysis with COSMOSIL Cholester

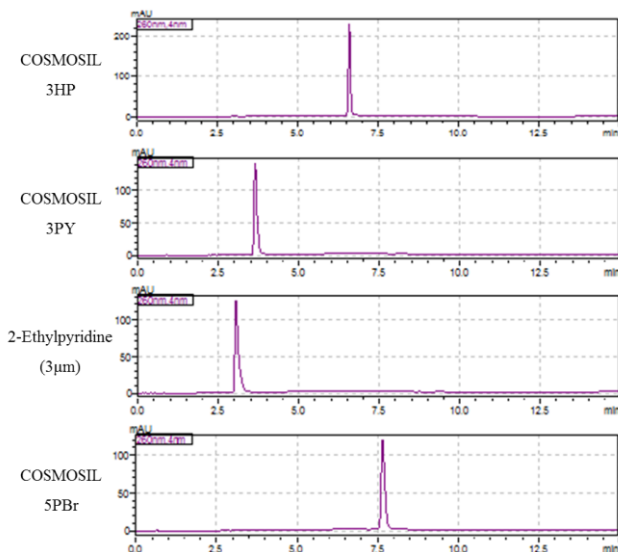
When used with SFC, COSMOSIL Cholester can separate fat-soluble vitamins and their impurities. COSMOSIL Cholester exhibits strong retention for fat-soluble vitamins and is suitable for on-line SFE-SFC using Shimadzu's Nexera UC. The on-line extraction from food also produced triglyceride impurities, which were successfully separated from the vitamins.



Column: COSMOSIL 5Cholester
 Column size: 4.6 mm I.D. x 250 mm
 Mobile phase: IPA in CO₂
 IPA conc. 0→10%(0→10min),10%(10→12min)
 Flow rate: 3.0 ml/min
 BPR: 15 MPa
 Temperature: 40°C
 Detection: UV-VIS
 Sample conc: 2.0 mg/ml
 Inj. Vol: 1.0 µl

Data courtesy of Shimadzu Corporation

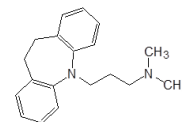
Comparison of Retention Behavior



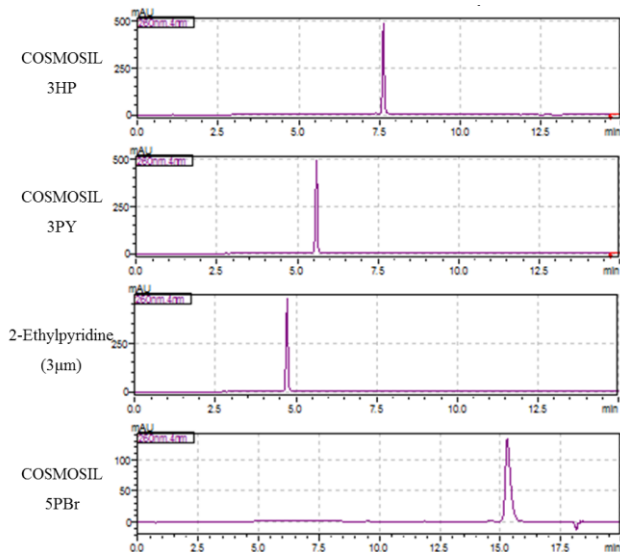
Column: COSMOSIL **
 Column size: 2.1mmI.D.-150mm
 Mobile phase: A: CO₂
 B: 0.1% CH₃COONH₄ -Methanol
 B conc. 0→60% (0→14min), 60% (14-17min)

Flow rate: 0.8 ml/min
 BPR: 10 MPa
 Temperature: 40 °C
 Detection: UV260nm

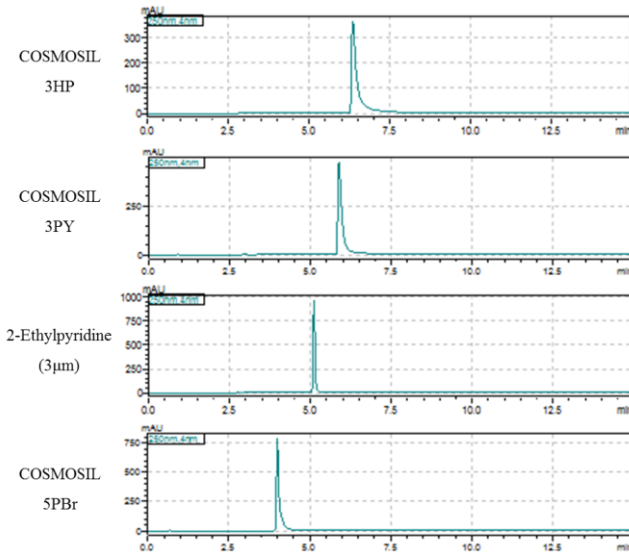
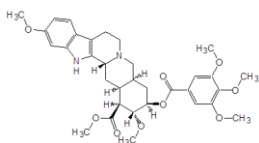
Sample: Imipramine (1mmol/l)
 Inj.Vol.: 2.0µl



Comparison of Retention Behavior



Column: COSMOSIL **
 Column size: 2.1mmI.D.-150mm
 Mobile phase: A: CO₂
 B: 0.1% CH₃COONH₄ -Methanol
 B conc. 0→60% (0→14min), 60% (14-17min)
 Flow rate: 0.8 ml/min
 BPR: 10 MPa
 Temperature: 40 °C
 Detection: UV260nm
 Sample: Reserpine (1mmol/l)
 Inj.Vol.: 2.0µl



Column: COSMOSIL **
 Column size: 2.1mmI.D.-150mm
 Mobile phase: A: CO₂
 B: 0.1% CH₃COONH₄ -Methanol
 B conc. 0→60% (0→14min), 60% (14-17min)
 Flow rate: 0.8 ml/min
 BPR: 10 MPa
 Temperature: 40 °C
 Detection: UV250nm
 Sample: *m*-Aminobenzoic Acid (10mmol/l)
 Inj.Vol.: 2.0µl



Data courtesy of Kyushu University Medical Institute of Bioregulation Research Center for Transomics Medicine Division of Metabolomics

Reference:

Hirose, T., Keck, D., Izumi, Y. and Bamba, T., 2019. Comparison of retention behavior between supercritical fluid chromatography and normal-phase high-performance liquid chromatography with various stationary phases. *Molecules*, 24(13), p.2425.

Ordering Information

For more information, please visit our website by scanning the QR code below.



COSMOSIL SFC



COSMOSIL PBr
 COSMOCORE PBr



COSMOSIL Cholester
 COSMOCORE Cholester



COSMOSIL Application
 (HPLC / UHPLC / SFC)

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