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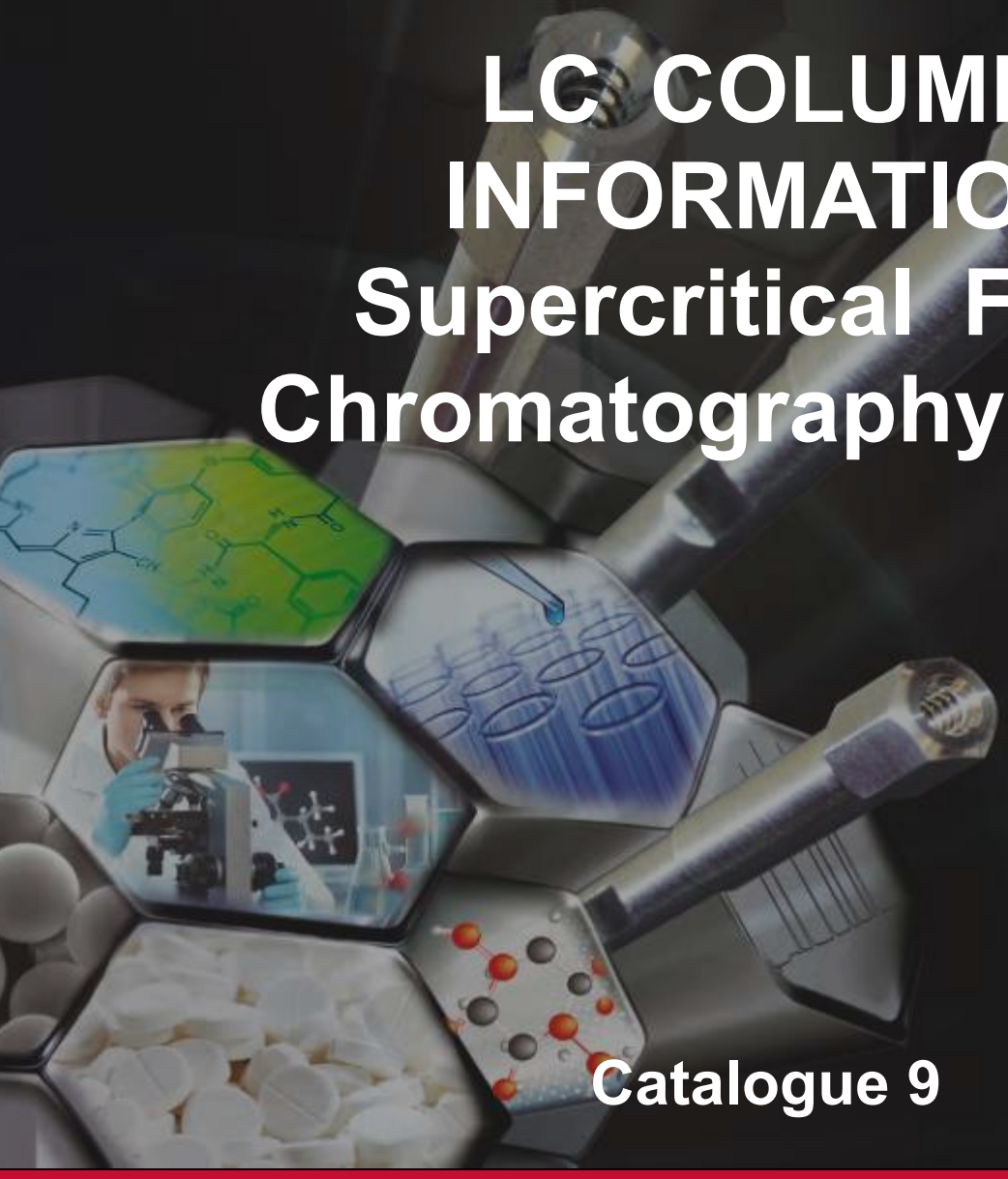
Chromatography Columns and Supplies

LC COLUMN INFORMATION Supercritical Fluid Chromatography (SFC)



Catalogue 9

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SUPERCRITICAL FLUID CHROMATOGRAPHY (SFC)

- Fast analyses
- Reduced solvent consumption
- High flow rates possible
- Lower cost per sample
- Compatible with MS
- Excellent for preparative separations

Introduction

Supercritical fluid chromatography (SFC) is a chromatographic technique which uses a supercritical fluid as the mobile phase. Although SFC has been around for some time, its adaptation as an orthogonal technique to HPLC, particularly in the pharmaceutical industry, has seen an increase over the last few years. This interest has been fuelled by the increasing requirement for high throughput and a desire for 'greener' techniques. Large reductions in the use of solvents have significant benefits in terms of decreased sample processing and drying-down times, as well as providing cost and safety benefits.

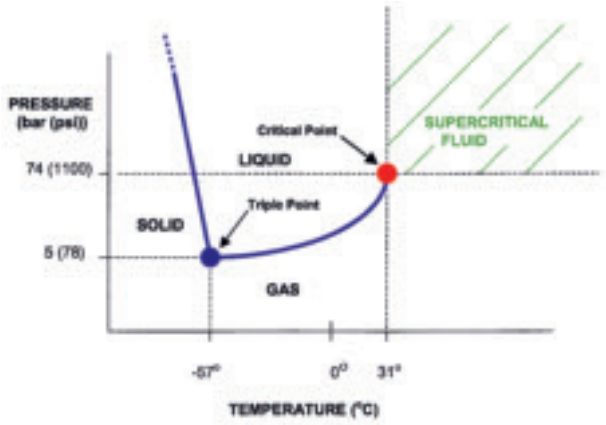

Figure 1.CO_2 Phase Diagram

In SFC the mobile phase consists of a 'fluid', either a gas or a liquid above its critical temperature and pressure. Liquefied CO_2 is most commonly used as the main fluid, with the addition of a modifier fluid such as methanol to aid elution of very polar or ionic compounds. The modifier improves the solvating power of the supercritical fluid and enhances the selectivity of the separation. Supercritical fluids can have solvating powers similar to organic solvents but with higher diffusivity, lower viscosity and lower surface tension. The lower viscosity allows higher flow rates compared to HPLC. The solvating power can be adjusted by changing the pressure. Any solute soluble in methanol or a less polar organic solvent will elute in SFC.

Packed column SFC is based on HPLC instrumentation and columns. The mobile phase is kept supercritical by an electronically controlled variable pressure restrictor positioned after the detector.

Advantages of SFC

- **Faster diffusion of mobile phase.** This leads to higher speed and throughput enabling more samples per day to be run. Typically SFC will allow a fivefold improvement in throughput and also saves time in post-chromatographic processing.
- **Lower viscosity of mobile phase.** The lower pressure drop enables higher flow rates or longer columns to be used.
- **Improved chromatographic resolution** will give better analyses and high yield and purity during purification.

Preparative SFC

SFC is an ideal preparative chromatography technique due to the speed of analysis and the vaporization at the end of the preparative process, which reduces solvent removal costs.

Chiral SFC

SFC has been shown to be particularly useful for chiral analyses and is used in enantioselective phase screening, followed by optimisation of separation conditions on the chosen column. This leads on to preparative purification of a drug in mg to kg quantities. Daicel and Regis chiral columns have been extensively used for SFC and preparative scale-up. Details of the available Daicel, Regis and Akzo Nobel SFC chiral columns are given on pages 87, 204 and 152 respectively.

Achiral SFC

For achiral SFC analyses normal-phase materials are generally used, typically silica, cyano and diol (see pages 49, 46 and 47 respectively for a selection of suitable columns). More recently, specialised bonded phases for SFC, including 2-Ethylpyridine, Pyridylamide and many others have been developed. Figure 2 shows the SFC separation of non-steroidal anti-inflammatories on a COSMOSIL 3-Hydroxyphenyl column. Column ranges specifically designed for achiral SFC can be found on the following pages:

COSMOSIL from Nacalai Tesque – see p.94
GreenSep from ES Industries – see p.103
PrincetonSFC from Princeton Chromatography – see p.202

Column: COSMOSIL 3-Hydroxyphenyl (5µm, 150 x 4.6mm)
Eluent: CO_2 – CH_3OH (95:5 to 65:35 over 6 mins)
Flow rate: 5ml/min
Temperature: 30°C
Detection: UV, 230nm

1. Ibuprofen
2. Fenoprofen
3. Flurbiprofen
4. Ketoprofen
5. Indoprofen

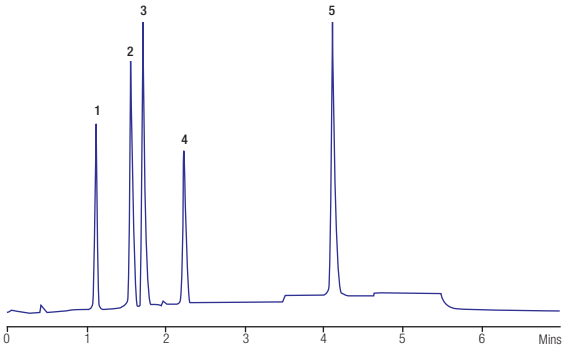

Figure 2. SFC separation of anti-inflammatory drugs