The Development and Utilization of Sub-2 Micron Chromatography Columns for SFC Applications

Matthew Przybyciel, PhD
VP & Technical Director
ES Industries
WWW.ESIND.COM

SFC Advantages

SFC as a chromatographic technique excels in several areas over LC. One of the main advantages of SFC is the diffusion coefficient of solutes in the SFC mobile phases have been shown to be 3-10 times higher than in normal liquids potentially allowing for very rapid separations. Another SFC advantage is the viscosity of SFC mobile phases is significantly less than LC mobile phases producing much lower pressure drop across the column thus allowing the use of much smaller particles for both analytical and preparative applications. SFC excels particular well in the area of preparative chromatography where the SFC solvents are easily removed enabling the rapid recovery of isolated compounds.

SFC chromatography is an excellent orthogonal technique to reversed-phase HPLC because of its robustness and its relationship to normal phase LC. SFC when used with polar-bonded stationary phases is normal phase chromatography minus many of the problems inherent in normal phase LC. Such as retention time changes depending on very small amounts of polar compounds in the mobile phase

Mobile Phase Characteristics

The most widely used mobile phase solvents for SFC is carbon dioxide. Super critical carbon dioxide can are easily obtainable at reasonable pressures and temperatures. Carbon dioxide has several other favorable advantages including:

Carbon dioxide has been described as a quadrupolar solvent because of its significant quadrupole moment.

The potential to act as both a weak Lewis acid and Lewis base, it can participate in conventional or nonconventional hydrogen bonding interactions.

Its diffusion coefficient of solutes is 3 – 10 times higher than in liquids used routinely in LC

Its viscosity of SFC mobile phases is significantly less than LC mobile phases producing much lower pressure drop across the column thus allowing the use of much smaller particles for both analytical and preparative applications.

Carbon dioxide is easily removed enabling the rapid recovery of isolated compounds.

Carbon dioxide used for SFC is recovered from the atmosphere making it a “Green” solvent.

SFC Applications

SFC works very well for small molecule applications

Range of molecules separated by SFC increasing – including some peptides and proteins

Excels at preparative chromatography

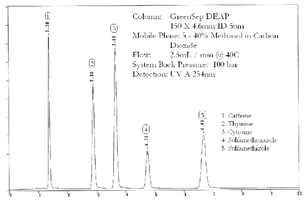
Typical SFC Performance

Packed column SFC has traditionally relied on 3 & 5 um columns

Variety of stationary phases has been limited

Instruments were not designed to utilize the performance of sub-2 micron columns

GreenSep™ DEAP



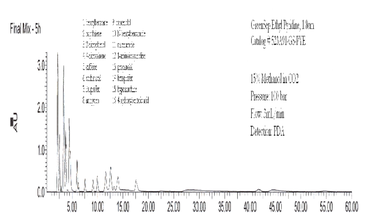
Sub 2 micron SFC Performance

High resolution

High speed analysis

High resolution and high speed analysis

GreenSep™ Ethyl Pyridine Sub-2um



ES Industries the Leader in the Development of Unique High Performance Sub 2 Micron–
GreenSepTM SFC Columns
Current products
GreenSep Ethyl Pyridine
GreenSep Pyridyl Amide
GreenSep Nitro
GreenSep PFP
GreenSep Silica
GreenSep DEAP
GreenSep Amino Phenyl

Conclusion

SFC instruments are now available to utilize the performance of sub-2 micron columns

A variety of polar bonded stationary phases for sub-2 micron SFC are available.