Shiv Chhatrapati Shikshan Sanstha, Latur
|| आरोह तमसो ज्योतिः ||

# Welcome

Shiv Chhatrapati Shikshan Sanstha, Latur
|| आरोह तमसो ज्योतिः ||

# Supercritical Fluid Chromatography (SFC)

Subject: Analytical Chemistry

Std: T.Y.B.Sc. (Sem-VI)

**Dr. Kundan Chandramani Tayade**
(Asst. Prof. in Analytical Chemistry)
Rajarshi Shahu Mahavidyalaya (Autonomous), Latur.

**E-mail: kundantayade@gmail.com**

# *Introduction of SFC…*

- SFC is a hybrid of gas & liquid chromatography that combines one of the best feature of each.
- This technique is play an important role in the analysis of environmental, biomedical & food samples.
- This Technique is based on use of supercritical fluids were developed during 1970 & early 1980.

# *Characteristics of SFC…*

- A SCF is defined as a substance above its critical temperature (Tc) & critical pressure (Pc)
- The critical temperature of substance can not exist in liquid phase without affecting pressure.
- SCF have densities, viscosities & other properties are intermediate between those substances which are present in gaseous or liquid state.

# *Comparison of SFC…*

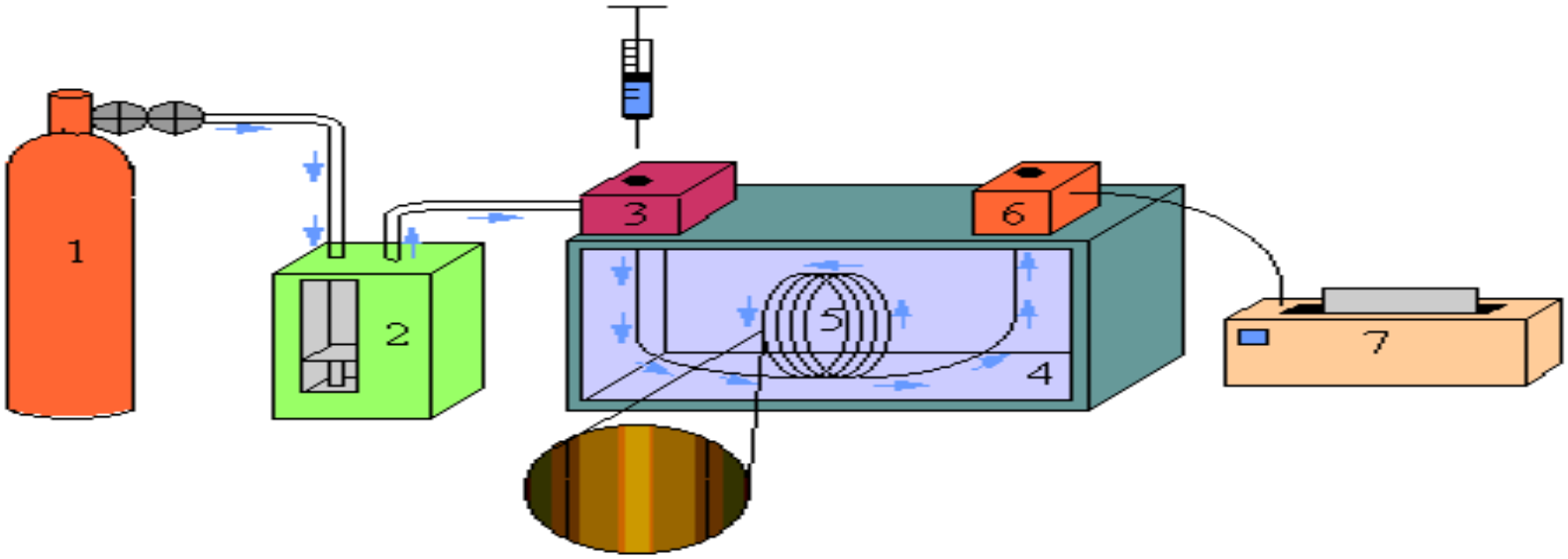
| Particulars | Gas | Supercritical Fluid | Liquid |
|---|---|---|---|
| Density ($g/cm^3$) | $(0.6–2.0) \times 10^{-3}$ | 0.2 – 0.5 | 0.6 – 2.0 |
| Diffusion coefficient ($cm^2/s$) | $(1.0 – 4.0) \times 10^{-1}$ | $10^{-3} – 10^{-4}$ | $(0.2 – 2.0) \times 10^{-3}$ |
| Viscosity ($gcm^{-1}s^{-1}$) | $(1.0 – 3.0) \times 10^{-4}$ | $(1.0 – 3.0) \times 10^{-4}$ | $(0.2–3.0) \times 10^{-3}$ |

# *Examples of SFC…*

| Fluid | Critical Temp. ($^{O}$C) | Critical Pressure (atm) | Critical Point Density (g/mL) | Density at 400 atm (g/mL) |
|---|---|---|---|---|
| **$CO_2$** | **31.3** | **72.9** | **0.47** | **0.96** |
| $N_2O$ | 36.5 | 71.7 | 0.45 | 0.94 |
| $NH_3$ | 132.5 | 112.5 | 0.24 | 0.40 |
| N-Butane | 152.0 | 37.5 | 0.23 | 0.50 |

Many solvents can be used, but the SFC $CO_2$ (obtained using the operating limits) can be easily recovered by simply reducing the pressure & maintain the ambient laboratory condition. Also, it is readily available, cheap & nontoxic.

# *Instrumentation of SFC…*




**1.Cylinder containing gas to be converted into supercritical fluid e.g. $CO_2$**

**2. Pressure generator** **3. Sample Injection System**

**4. Thermostat** **5. Column**

**6. Gas Outlet** **7. Detector**

# *Construction & Working…*

- A column placed in thermostat & oven, similar to that used in gas chromatography is required to precisely control temperature of the mobile phase (SFC).

- Restrictor, black pressure control device is used to maintain the pressure in the column at requisite level. Also, it is used to convert the eluent (mobile phase supercritical fluid) into gas during transfer to the detector.

# *Construction & Working…*

## Stationary Phases

- Similar to GC both open tubular & packed columns are used for SFC.
- Open tubular columns are similar to the fused silica columns, with internal coating of bonded & cross linked siloxanes of various types.
- Packed columns used in partition liquid chromatography are employed in SFC.

# *Construction & Working…*

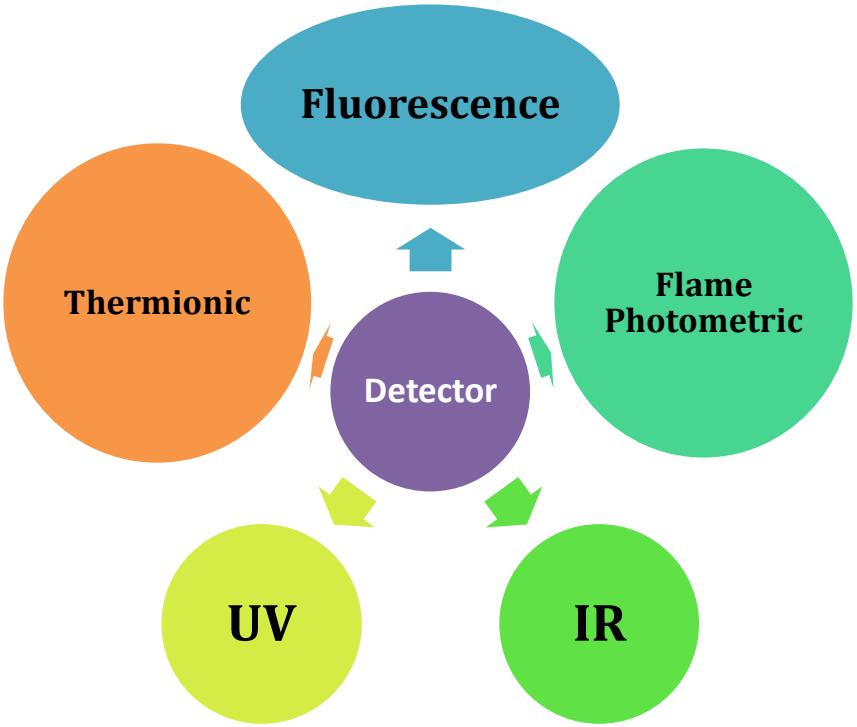
## Mobile Phases

- The most widely used mobile phase for SFC is $CO_2$.
- It is an excellent solvent for a variety of non-polar organic molecules.
- A number of other substances have served as mobile phase for SFC including ethane, butane, nitrous oxide, dichlorodifluro methane, diethyl ether, ammonia, tetrahydrofurron (THF), etc.

# *Construction & Working…*

## Detectors

Highly sensitive detectors exhibiting a general response towards organic compounds are used.




Thank You
graphicsarcade.com