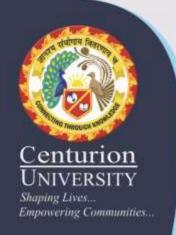


# **Super Critical Fluid Extraction**

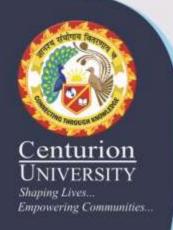
**Skill Course** 



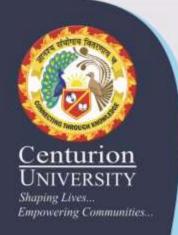
### **SCFE** applications

in the food, pharmaceutical, and fine chemical industries

- Decaffeinating of coffee and tea
- Extraction of essential oils (vegetable and fish oils)
- Extraction of flavors from natural resources (nutraceuticals)
- Extraction of ingredients from spices and red peppers
- Extraction of fat from food products
- Fractionation of polymeric materials
- Extraction from natural products
- Photo-resist cleaning
- Precision part cleaning



# Supercritical Solvent (pass through) Solids Dissolves solute Raffinate (SC solvent) Extract



#### **Extraction modes:**

At small scale, solid samples can be extracted in

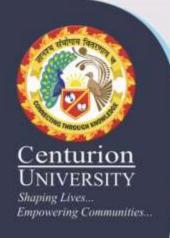
- 1. Static mode or
- 2. Dynamic modes or
- 3. In a combination of both.

Under **static conditions**, the supercritical fluid is introduced in the extraction vessel and is kept in contact with the sample for a given extraction time. Once the desired time is achieved, the extract is released through the pressure restrictor to the trapping vessel.

In a **dynamic process**, the supercritical fluid continuously enters the extraction vessel and flows through the sample to the separators for a cascade fractionation.

In the **combined mode**, a static extraction is performed for a period of time, and subsequently a dynamic extraction is carried out.

Medium and large scale SFE are carried out in dynamic conditions



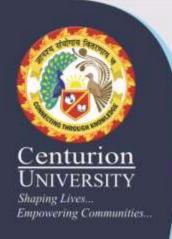
#### **Modes of SCFE**

#### **Static Extraction Mode**

- Steady state
- Sample matrix is soaked in a fixed amount of supercritical fluid

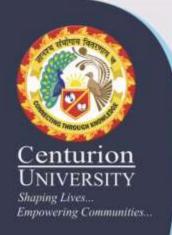
# **Dynamic Extraction Mode**

- Non-steady state
- Supercritical fluid continuously passes through the sample matrix



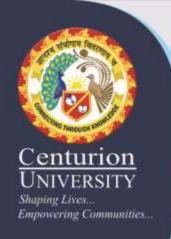
## **Advantages of SCFE**

- Complete separation of solvent from extract and raffinate
- Continuous process
- Low handling cost
- Solvent recovery is easy
- Versatile and efficient (use of co-solvents and cosolutes)



#### **Limitations of SCFE**

- ➤ Prolonged time (penetration of SCF into the interior of a solid is rapid, but solute diffusion from the solid into the SCF).
- Modeling is inaccurate
- Scale is not possible (due to absence of fundamental, molecular-based model of solutes in SCF)
- > Expensive
- Consistency & reproducibility may vary in continuous production



#### **Precautions**

- ❖ Adequate contact time (for penetration of solvent into solid particles and diffusion of solute from inside the solid particles to solvent).
- Equilibrium should be achieved (i.e. proper flow of solvent such that concentration of dissolved solutes in the solvent phase will be below the solubility of solute in solvent)