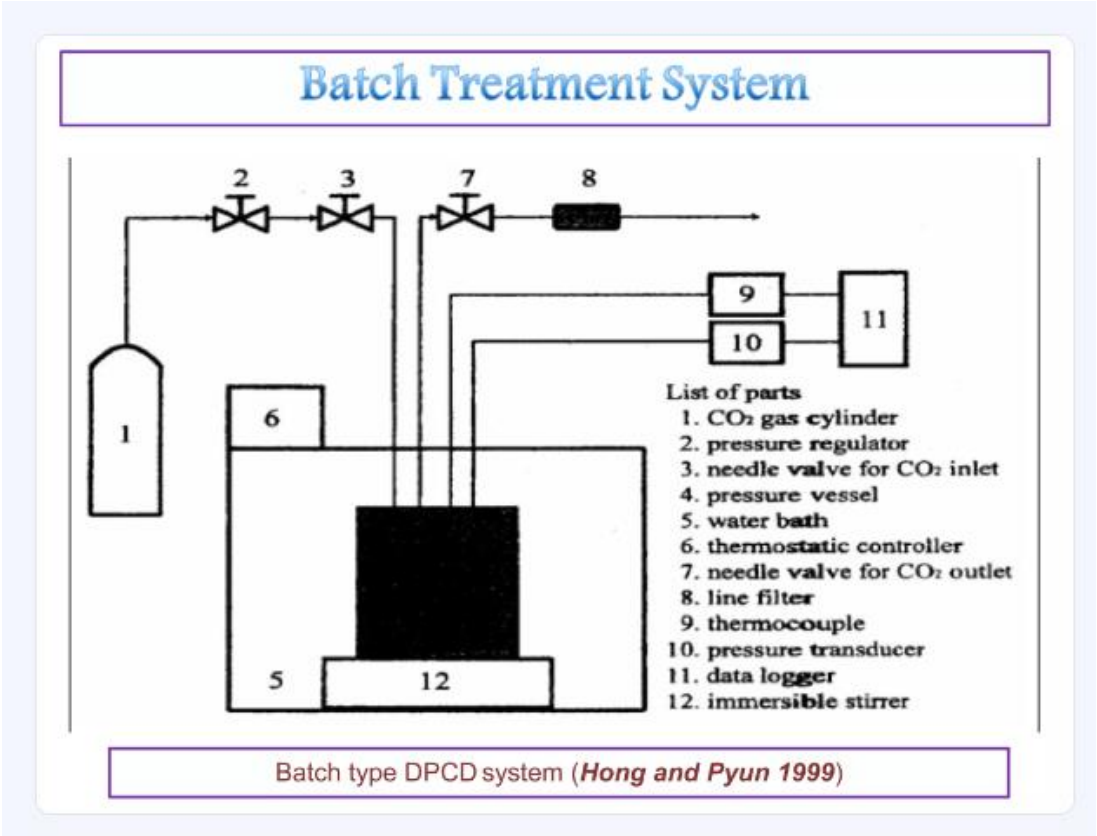
UNIT - 4

Dense Carbon Dioxide Treatment for Extracting Nutraceutical Compounds:

Dense carbon dioxide treatment, often referred to as supercritical carbon dioxide (scCO2) extraction, is a widely used method for extracting nutraceutical compounds from food sources. This technique leverages the unique properties of carbon dioxide when it is in a supercritical state, allowing for efficient extraction of bioactive compounds.

Principle:

Supercritical CO2 acts as a solvent that can selectively extract compounds based on their solubility while maintaining a relatively low temperature, thus preserving the integrity of sensitive nutraceuticals.



Preparation of Raw Material:

The food source (e.g., herbs, seeds, fruits) is cleaned and ground into a suitable particle size to increase the surface area for extraction.

Loading into Extraction Vessel:

The prepared raw material is placed in an extraction chamber or vessel designed to withstand high pressure.

Creation of Supercritical CO2:

Carbon dioxide is compressed to reach a supercritical state. This occurs above its critical temperature (31.1°C) and critical pressure (73.8 bar). In this state, CO2 exhibits properties of both gas and liquid, allowing it to diffuse through solids and dissolve compounds.

Extraction Process:

Supercritical CO2 is passed through the raw material in the extraction vessel. The supercritical fluid interacts with the target nutraceutical compounds, dissolving them as it flows through the material.

Separation of Extract:

After the extraction period, the CO2 is directed into a separation chamber. Here, the pressure is gradually released, which causes the supercritical CO2 to return to a gaseous state, reducing its solvent capacity and leading to the precipitation of the extracted compounds.

Collection of Extract:

The extracted compounds are collected from the separation chamber. The CO2 can be recaptured and recycled for further use, making the process environmentally friendly.

Purification (if necessary):

The final extract can be further purified or concentrated based on the desired product specifications.

Advantages of Dense CO2 Treatment

- **Selective Extraction:** The ability to adjust pressure and temperature allows for the selective extraction of specific compounds, enhancing the quality of the extract.
- **Non-Toxic Solvent:** CO2 is non-toxic, making it an ideal choice for food and nutraceutical applications.
- **Low Temperature:** The process occurs at low temperatures, preserving heat-sensitive compounds.
- **Environmentally Friendly:** The closed-loop system minimizes waste, and CO2 can be recycled.

Hence,

Dense carbon dioxide treatment, or supercritical CO2 extraction, is an effective and efficient method for extracting nutraceutical compounds from food sources. This technique not only enhances the yield and quality of the extracts but also aligns with environmentally sustainable practices, making it a popular choice in the nutraceutical industry.