Supercritical Fluid Extraction Technology (SCFE)

World-class technology for natural products

There is a tremendous demand for high purity & residual solvent free extracts of natural products. Also there is an increasing safety concern & requirement of eco-friendly manufacturing processes for the extraction of natural products. Supercritical fluid extraction technology provides an economical solution to these challenging tasks. Its superiority over the conventional technologies of extraction, especially for natural products in the food and pharmaceutical industry is well recognized.

Supercritical CO2 textile dyeing is an emerging innovative waterless technology for dyeing of textile fabrics that will revive the textile industries.

Commercial applications
- Extraction of natural products such as spice oil & oleoresins, flavors, fragrances, colors.
- Decaffeination of Tea & Coffee.
- Production of uniform & ultra fine particles.
- SC02 Textile dyeing of fabrics.
- SC02 cleaning of high precision metal components.
- Drying of aerogels.

Advantages of SCFE
- Extract with delicacy & freshness close to natural.
- High potency of active components.
- Longer shelf life extracts.
- No residual solvent, no effluents, eco-friendly & green technology.
- High flexibility of process conditions.
- Simultaneous fractionation of extracts.
- High yields compared to solvent extracted products.
- Low extraction batch times.
- Recycling of CO2.

Advantage of CO2 as a solvent
- Carbon dioxide generally regarded as safe (GRAS) for food products.
- Inexpensive & easily available.
- Non-toxic, non-flammable and Inert to most materials.

Amar advantage
- Established in 1974 with 5 years of experience in SCFE technology.
- 0.5 lit. lab scale to 1000 lit. commercial plants offered.
- Pressures upto 700 bar for lab scale & 350 bar for commercial.
- Semi or fully automated PLC based plants with CO2 recycling.
- CE-PED, U stamp, CSA, UL certification optional.
- Can customize designs as per client requirement.

Process description for lab-scale plant

The Carbon dioxide gas from the cylinder is first liquefied & then pressurized above the critical pressure of CO2 (73.8 bar) to the required pressure necessary for extraction. This high pressure liquid CO2 is then heated above the critical temperature of CO2 (31 °C) to the required temperature. The CO2 which is now in supercritical phase (SCCO2) enters the extractor where the raw material is fed in powder form & the extraction is achieved on the basis of solubility. The compounds dissolved in SCCO2 finally come to the separator at atmospheric pressure & gets precipitated. The CO2 leaving the separator is measured by passing it through a CO2 gas flow meter.
The raw material in powder form is fed to the extractor. The liquid carbon dioxide from the CO2 tank is precooled by passing it through the precooler. This precooled liquid carbon dioxide is then pressurized by means of a positive displacement plunger pump to a pressure above the critical pressure of CO2 (i.e. 73.8 bar). High pressure liquid CO2 is then heated above the critical temperature of CO2 (i.e 31 °C) by passing it through the preheater. CO2 which is now in the supercritical state enters the extractor in which the raw material is loaded. The SCCO2 dissolves substances on the basis of solubility, depending on the operating conditions. The SCCO2 with soluble extracts enters the separators where the pressure & temperature are reduced sequentially so that solubility decreases & extract precipitates in the separators. Finally the clean CO2 without any traces is recycled back to the CO2 tank via condenser.

**Specifications**

Lab scale SCFE plant (0.5 & 1 lit.):
- Design Pressure: Upto 700 bar.
- Design Temperature: 150 °C

Commercial Scale SCFE plant (10 - 1000 lit.):
- Design Pressure: Upto 350 bar.
- Design Temperature: 80 °C

M.O.C: SS316

### SCFE standard models

<table>
<thead>
<tr>
<th>SCFE plants with Utilities</th>
<th>Working volume (lit.)</th>
<th>Feed cap. (kg/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab-scale</td>
<td>0.1</td>
<td>0.24</td>
</tr>
<tr>
<td>Lab-scale</td>
<td>0.25</td>
<td>0.6</td>
</tr>
<tr>
<td>Lab-scale</td>
<td>0.5</td>
<td>1.0</td>
</tr>
<tr>
<td>Lab-scale</td>
<td>1.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Pilot-scale with PLC system</td>
<td>5.0</td>
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</tr>
<tr>
<td>Pilot-scale with PLC system</td>
<td>10</td>
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<tr>
<td>Pilot-scale with PLC system</td>
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<td>48</td>
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<tr>
<td>Commercial-scale with PLC system</td>
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<td>Commercial-scale with PLC system</td>
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<td>Commercial-scale with PLC system</td>
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<td>960</td>
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<tr>
<td>Commercial-scale with PLC system</td>
<td>1000</td>
<td>2400</td>
</tr>
</tbody>
</table>

**Our motto, customer’s delight & not mere satisfaction**

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