Shritara Engineers &
Project Consultants

Quality Supplies Guaranteed

Super Critical Fluid Extraction

The Current global trends show a growing preference for products from natural sources. Also there is an increasing concern for safe, eco-friendly and pollution free manufacturing processes. SCFE technology provides a ready and total solution to these challenges. Its superiority over the conventional technologies of extraction, especially for natural products in the food and pharmaceutical industry is well recognized.

Moves like a Gas and behaves like a Liquid

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Advantages of SCFE in Extracting Essential Oils & Oleoresins:

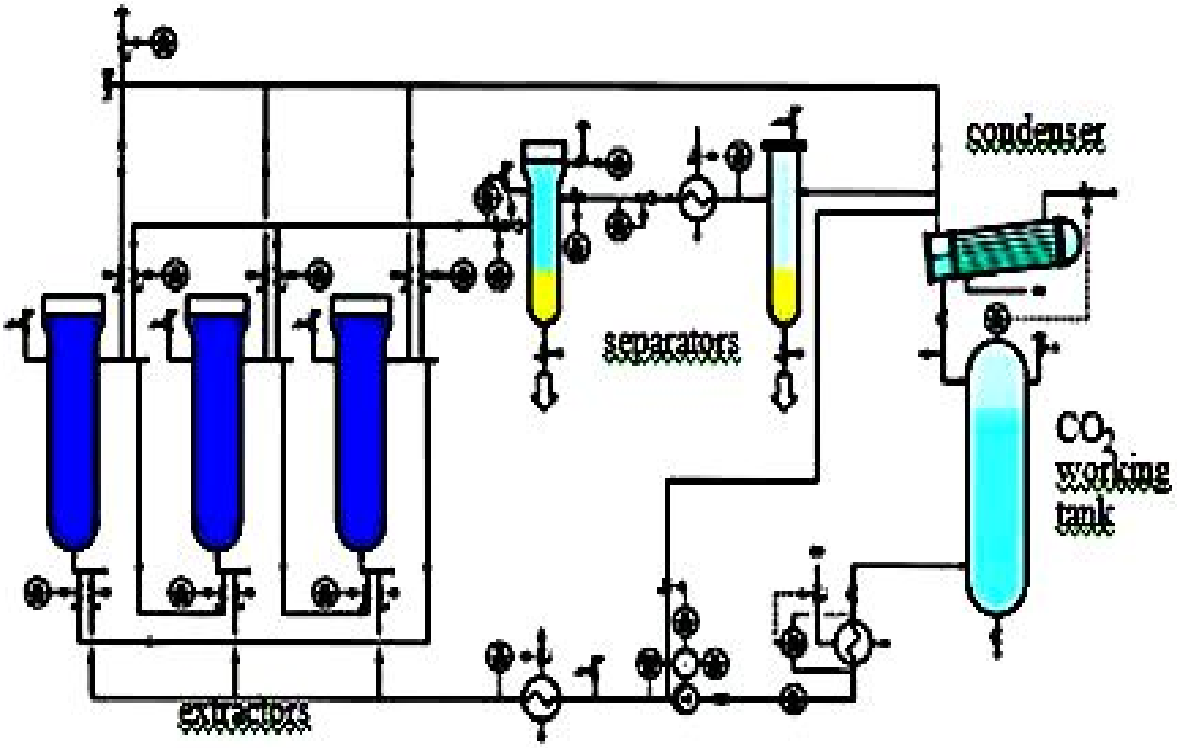
SCFE process has inbuilt features, which improve the quality of extracts Superior Product : -

1. "Nearly forever lasting" extracts with delicacy and freshness close to natural fragrances, flavor and taste -
2. High concentration of desired active components, Preserving the synergistic bio-activity of molecules in the extract -
3. No residual solvent -
4. Free of biological (microbial) contaminants -
5. Longer shelf life Superior Process
6. Simultaneous fractionation of extract possible to get spice oil and oleoresin in a single step -

Supercritical fluids (SCFs) are increasingly replacing the organic solvents that are used in industrial purification and re-crystallization operations because of regulatory and environmental pressures on hydrocarbon and ozone-depleting emissions.

SCF-based processes has helped to eliminate the use of hexane and methylene chloride as solvents. With increasing scrutiny of solvent residues in pharmaceuticals, medical products, and neutraceuticals, and with stricter regulations on VOC and ODC emissions, the use of SCFs is rapidly proliferating in all industrial sectors.

Substance	P_c (bar)	T_c (^{o} C)	Q_c (g mL^{-1})
CO2 (Carbon Dioxide)	72.9	31.3	0.47
N2O (Nitrous Oxide)	72.5	36.5	0.45
SF_6 (Sulfur Hexaflouride)	37.1	45.5	0.74
Xe (Xenon)	58.4	16.6	1.10
CH3 OH (Methanol)	78.9	240.5	0.27
CH3CH(OH)CH3 (Isopropyl Alcohol)	47.0	235.3	0.27
H2O (Water)	218	374	0.32



Scheme of a supercritical fluid extraction plant

Why Carbon Dioxide gas?

Carbon Dioxide or CO2, complies with environmental pollution control standards. It **Reduces** saves energy and reduces pollution; It can be **Re-used** repeatedly over many production cycles. **Recycle**-sustainable resources, recycling. **Inexhaustible**

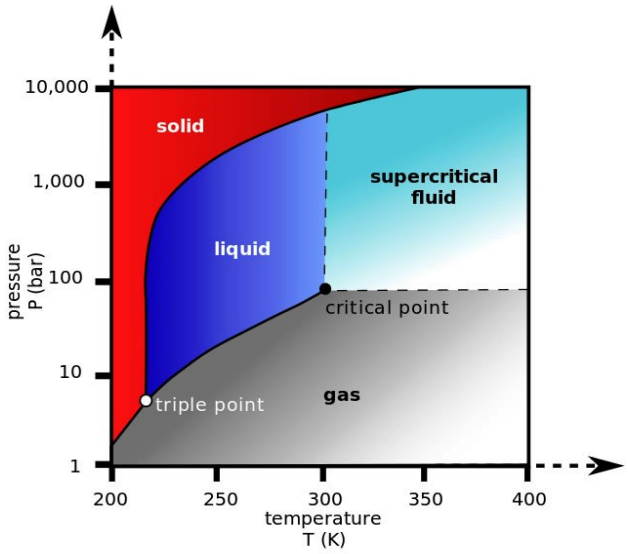
Carbon dioxide is an industrial by-product, in the fermentation industry, the petrochemical industry with processes having high concentration of carbon dioxide. Carbon Dioxide in this form is collected, purified & liquefied.

Sterile

CO2 is used to create a sterile environment in restricting bacterial growth in products.

Non-toxic, safe

CO2 is not explosive, non-corrosive, chemically stable, non-toxic; does not need to meet requirements of fire, explosion or anti-corrosion of special protective equipment. Carbon Dioxide is specially suitable as its critical point is near room temperature (31.1 ℃) avoiding damage to the delicate organic substances.



More than 95% of CO2 can be recovered very easily and can be completely separated from solute, without leaving residual reserves.

CO2 extraction technology replaces the traditional high pollution wet process

- Low critical temperature (31.1°C)
- Moderate critical pressure (73 bar)
- Mixable with organic solvents
- Diffuses faster than conventional fluid solvents
- GRAS status (Generally recognized as Safe) by U.S. FDA
- Approved by the FDA for use in food and pharmaceuticals
- Cost-effective

Extractions:

- Essential oils
- Fats and lipids
- Nutraceuticals and vitamins
- Flavors and fragrances

Material Processing:

- Removing monomers and oligomers from polymers
- Electronics cleaning
- Medical implants cleaning
- Protein and biologically active material purification
- Aero gel formation

Reaction Chemistry:

- Organic and inorganic synthesis
- Catalysis and hydrogenation
- Pharmaceutical compound synthesis

Area of Application of SCFE

- Spice Extracts (Oil & Oleoresin).
- Extraction of essential oils– Vegetable, Fish oil.
- Flavors & Fragrances Natural resources.
- Natural Food Colors.
- Food Preservatives (antioxidants).
- Herbal Medicines (Nutraceuticals).
- Natural Pesticides – Neem.
- Decaffeination of Coffee & Tea.
- Hop Extracts (Bitters).
- De-oiling Of Fast Foods.
- Cholesterol- Free Food Products.
- Nicotine Controlled Tobacco.
- Particle design (micronization).
- Sterilization (Preservation).
- Precision cleaning
- Photo-resist Cleaning.

Spice Extracts (Oil & Oleoresin)

Super critical CO2 extracts is the answer to the growing

demand for pure and natural substances in the food industry. Supercritical Fluid Extracts (SCFE) are often used in highly selective extractions like lilac, nutmeg and essential oils. Its non-toxicity and low critical temperature makes SCFE great for aroma recovery, colour boosting and pesticide removal. Known to be one of the gentlest extraction processes, supercritical fluid extraction has garnered a lot of attention due to its effectiveness in producing exceptionally pure and solvent free extracts.

- Black pepper
- Black tea
- Capsicum
- Cardamom
- Cassia
- Celery
- Cinnamon
- Clove
- Coffee
- Coriander
- Fennel
- Fenugreek
- Garlic
- Ginger
- Green tea
- Mace
- Paprika
- Pimento
- Nutmeg
- Cumin
- Onion
- Paprika
- Pimento
- Pink pepper
- Rosemary
- Sesame
- Star anise
- Thyme
- Turmeric
- Vanilla
- White pepper

Extraction of essential oils– Vegetable, Fish oil.

Flavors & Fragrances Natural resources

Natural Food Colors

Food Preservatives (antioxidants).

Herbal Medicines (Nutraceuticals)

Natural Pesticides – Neem.

Decaffeination of Coffee & Tea.

Tea decaffeinated using the CO2 method retains 92 percent of its polyphenols (antioxidants) compared to tea decaffeinated using the ethyl acetate process, which only retains 18 percent. We also support the CO2 decaffeination method because the CO2 used for decaffeination is filtered and recycled at a rate of around 99% and emits very little CO2 into the atmosphere.

Carbon Dioxide – a non-toxic, non-flammable, colorless, and odorless inert gas – locks onto, and removes the caffeine. Unlike other methods, this process maintains levels of antioxidants, healthy nutrients, and the flavor of pure tea, leaving no trace of chemicals or potentially-harmful solvents on the leaves.

Hop Extracts (Bitters)

CO_2 Hop extract is all the good parts of the hop removed from the plant matter – the α-acids and essential oils such as farnesene and myrcene are stripped by the carbon dioxide leaving behind the plant matter which is essentially 'filler'.

1. Reduced kettle losses from hop trub at the end of the boil,
2. Tannins and other plant polyphenols aren't introduced to the kettle
3. CO_2 hop extract has better storage properties than hop-pellets

CO_2 hop extract will not replace the use of cones, plugs and pellets – it cannot be placed in a hop-back, which aside from imparting flavor also acts to filter the fresh wort

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De-oiling Of Fast Foods

Raw Material	Extract
Star Fruit	Polyphenol from carambola
Rosemary	Terpene - catechol
Japanese Honeysuckle	Chlorogenic Acid, Syringic acid, Pryan
Tomato Peel	Lycopene
Rhodiola rosea	Salidroside
Glycyrrhiza uralensis	Glycyrrhizic acid & Glycyr-rhetinic Acid
Semen Platycladi	Semen Platycladi Oil
Ganoderma tsugae	Ganoderma triterpenes
Cinnamomum osmo-phloeum	Cinnamaldehyde and Cyn-namic acid
Lard	Cholestrol
Garlic	Garlic Essential Oil & al-licin
Chilli pepper	Chilli Oil & Pigment
Hibiscus Mutabilis	Hibiscus Mutabilis essential oil
Indian sandalwood (Agarwood)	Santalum Album essential oi
Chamaecyparis /Amber	Chamaecyparis essential oil / Amber essential oil
Propolis	Flavonoids
Soyabean	Isoflavone
China Star anise	Shikimic acid

Textile dyeing Process

Currently dye is dissolved in water and then applied to textiles. The process renders large quantities of water that must be cleaned before it can be reused or released from a factory. If dye is dissolved in Super-critical CO_2 rather than in water, the cleanup process is simplified. The Supercritical CO_2 is depressurized at the end of the process, the dye drops out of solution, and the gaseous CO_2 and dye are easily separated.

Dyes made using CO2 extracts last longer when exposed to sunlight.