Solvent free extraction, fractionation, and isolation of chemical compounds

Superior purity, selectivity, and yield. Lower operating costs.
The demand for analytical laboratory techniques is driven by the need for enhanced information about a target material, including its chemical, physical, nutritional, and pharmaceutical properties.

Increasing concern about the quality, safety, usage, and disposal of hydrocarbon-based solvents, as well as stricter regulations on the residual levels of solvents have all contributed to many industries switching to SFE technology for the extraction, fractionation, and isolation of chemical compounds.

Waters® Supercritical Fluid Extraction (SFE) Systems extract chemical compounds using CO₂ in its supercritical state in place of organic solvents. The result is
to keep your product safe, uncontaminated, and natural.

an extract with little or no residual solvent, superior purity, selectivity, yield, and lower operating costs compared to traditional hydrocarbon-based solvent extraction systems. SFE provides a faster, safer, and cleaner technology for analysts from the food, natural product, flavor, fragrance, pharmaceutical, nutraceutical, polymer, chemical, and cleaning industries, as well as regulatory agencies and quality control laboratories.

**Green Technology**

Waters SFE systems extract chemical compounds using supercritical CO$_2$ instead of an organic solvent. The supercritical fluid state occurs when a fluid is above its critical temperature (Tc) and critical pressure (Pc). This supercritical state allows CO$_2$ to take on the properties of a gas (high diffusivity, low surface tension), as well maintaining the solvent power of a liquid when it is between the typical gas and liquid states. Manipulating the temperature and pressure of CO$_2$ alters the solvent power and allows the material of interest to be selectively extracted.

The biggest advantage of SFE is that it leaves no traces in the product. After extraction, the carbon dioxide is either depressurized and vented, or it can be recycled for further extraction use. Any residual trace of carbon dioxide in the product dissipates into the atmosphere within a few hours. As a tunable solvent, CO$_2$ is non-toxic, non-flammable, and physiologically compatible.

**The biggest advantage of SFE** is that you can extract your compound with little or no residual solvent, leaving no traces in your product.
Ideal tool for a range of applications

SFE is a selective technique that is capable of extracting compounds from solid matrices to isolate the analyte of interest. Hydrocarbon-based solvent extraction requires a distillation/dry down step that may alter the taste, aroma, and/or chemical composition of the product. Many other applications have been fully developed and commercialized incorporating the SFE technique, including:

- Extraction and fractionation of edible fats and oils
- Purification of solid matrices
- Separation of tocopherols and other antioxidants
- Cleanup of herbal medicines and food products from pesticides and herbicides
- Detoxification of shellfish
- Concentration of fermentation broth, fruit juices, etc.
- Flavors, spice extracts, herbs, decaffeination
- Fragrances
- Natural food colors
- Desolvation within tablets
- Dietary supplements, such as St. John’s Wort, saw palmetto, kava-kava, ginger, garlic, and ginseng
- Production of denicotined tobacco
- Production of active ingredients from herbal plants for avoiding thermo or chemical degradation
- Active compounds of all kinds, including steroids and polymer/monomer separation
- Precision parts cleaning
Extract compounds without altering the taste, aroma, or chemical composition of your product

By manipulating the pressure and temperature, CO₂ can selectively extract the desired material. The sample is placed in an extraction vessel and pressurized with CO₂ and a small percentage of co-solvent to extract the compound of interest. This compound is then transferred from the extraction vessel to a fraction collector. The automated Back Pressure Regulator (BPR), located between these vessels, allows for controlled depressurization of the compounds of interest and the CO₂. After exiting the automated BPR, the system pressure is reduced to near atmospheric conditions, causing the CO₂ to lose its solvating power. The extracted material precipitates out of the solution into the fraction collector. The condensed CO₂, now a gas, is sent to vent, or it can be recycled.
Major system components:

High pressure CO₂ pump

Known for quality, Waters’ dual-piston CO₂ pumps are used by academic and corporate research scientists in over 40 countries. This pulseless flow pump requires no air, operates quietly, and can be used in a pressure-control or flow-control mode. Safety features include mechanical and electrical overpressure protection.

High pressure vessel

The finger-tight high pressure vessel is designed for simple opening and closing, and even distribution of the fluid contacting the sample. A threaded cap with a spring-loaded seal enhances safety and enables effortless sample loading and unloading. Waters’ unique stainless steel is 60% stronger than traditional 304 and 316 stainless steel, which minimizes heat up and cool down times. All vessels are designed per the ASME pressure code and CE code if applicable.

Automated Back Pressure Regulator (BPR)

Our state-of-the-art BPR features a pressure sensor for closed-loop feedback control of the back pressure, and built-in heating to prevent freezing.

Easy-to-use software tailored to your application

Waters SFE Systems include a PC with custom software for instrument control and data management. Regardless of your native language, the comprehensive, yet simple icon-based interface is easy to use. The user controls the pressure, temperature, flow rates, as well as data logging, data mining, and the ability to write scripts tailored to your application.
High pressure collection

A Waters cyclonic-style collection separator can collect particles or liquids from gases or liquids. Collection starts with fluid being introduced at high velocity into the fraction collector, where centrifugal forces press heavier particles against the inner wall of the separator, while the lighter particles exit through the tapered bottom of the fraction collector. The self-sealing, finger-tight cap is easy to open and close.

Benchtop to Cart-Mounted Systems
Ranging From 100 CC to 2 X 5000 CC

Waters’ benchtop to cart-mounted systems are pre-assembled and ready to install. Customer training courses are available on-site, or at our training facilities in the US or UK.

- SFE 100
- SFE 500
- SFE 1000
- SFE 2000
- SFE 5000
- SFE 2 X 5 LF

System options include:

- CO₂ Flow Meter
- Multiple Extraction Vessels
- Multiple Fraction Collectors
- Recycle System
- Counter Current Column