SUPERCRITICAL FLUID EXTRACTION

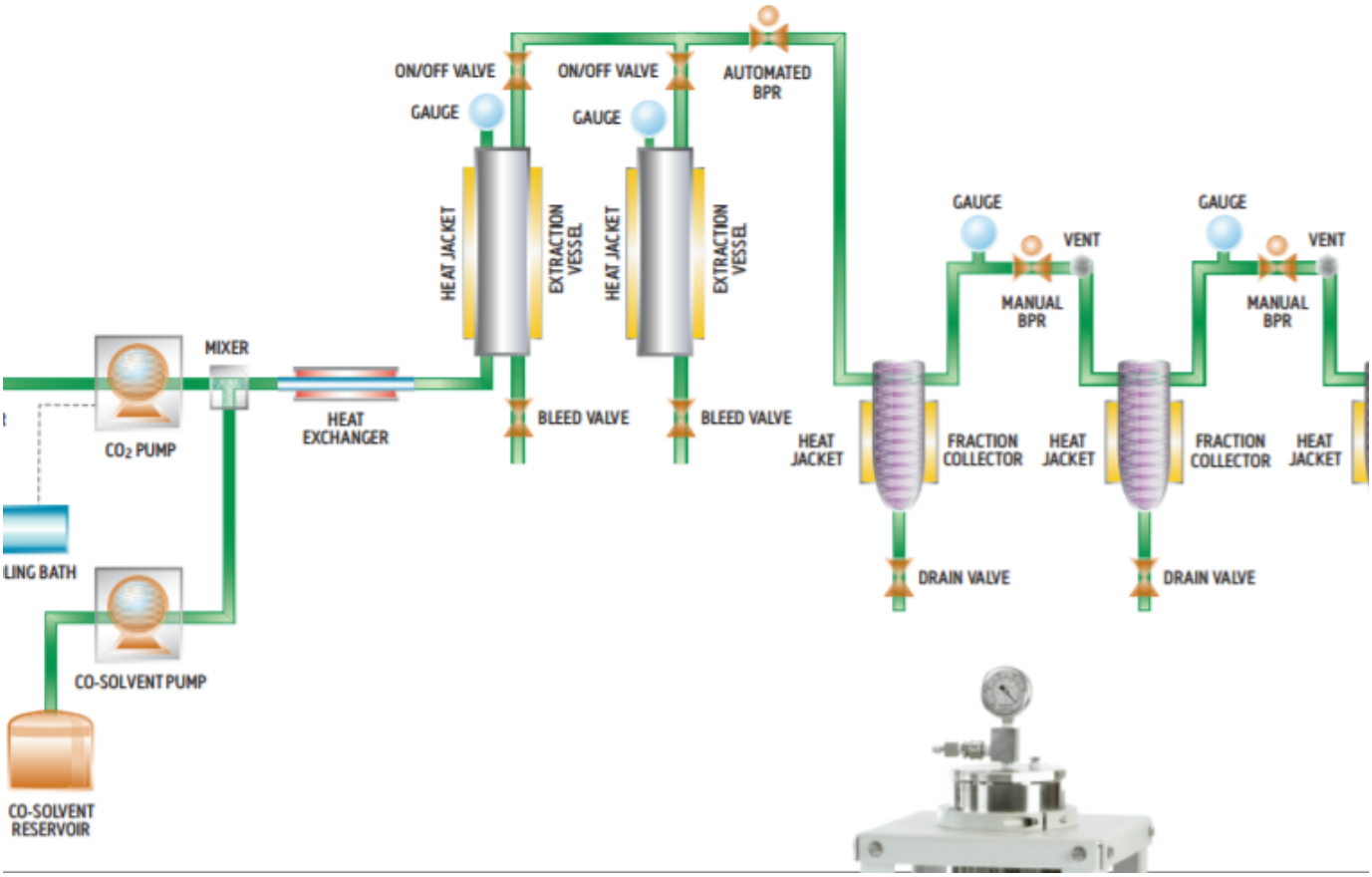
supercritical carbon dioxide

WHAT IS SFE?

by Richard Sanchez

Supercritical Fluid Extraction (SFE) Systems extract chemical compounds using supercritical carbon dioxide instead of an organic solvent. The supercritical fluid state occurs when a fluid is above its critical temperature (Tc) and critical pressure (Pc), when it is between the typical gas and liquid state. Manipulating the temperature and pressure of the fluid can solubilize the material of interest and selectively extract it. The sample is placed in an extraction vessel and pressurized with CO_2 to dissolve the sample. Transferred to a fraction collector, the contents are depressurized and the CO_2 loses its solvating power causing the desired material to precipitate. The condensed CO_2 can be recycled

IN THIS ISSUE



EXTRACTING WITH CARBON DIOXIDE

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, depending on the application, a small percentage of co-solvent, to extract the compounds of interest. These dissolved compounds are then transferred from the extraction vessel to a series of collection cyclones. The SFE BBES features either a 5-L extraction vessel (which can hold up to 4.5 lbs of material) or a 10-L extraction vessel (up to 9 lbs of material).

The automated back-pressure regulator (ABPR), located between the vessel and cyclones, allows for controlled pressurization of the compounds of interest and the CO2.After exiting the ABPR, the system pressure is reduced.

causing the CO2 to lose its solvating power. When the manual back-pressure regulators (MBPR) are properly set, the extracted material precipitates out of the solution into the collection cyclones. The cyclones are arranged in consecutive order to enable a series of decreasing pressure steps to isolate the collected compounds – this allows for extract fractionation, giving you purer, cleaner fractions requiring less post process.

The condensed CO2, now a gas, is sent to vent or a Recycler.

BENEFITS OF USING CARBON DIOXIDE

Waters SFE systems extract chemical compounds using supercritical CO_2 instead of an organic solvent or a hydrocarbon.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), while maintaining the solvating power of a liquid. Manipulating the temperature and pressure of CO_2 alters the solvent power and allows the materials of interest to be selectively extracted.

The biggest advantage of SFE is that it leaves no traces in the product. After extraction, the CO_2 is either depressurized and vented, or recycled for further extraction use. Any residual trace of CO_2 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.

SFE 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