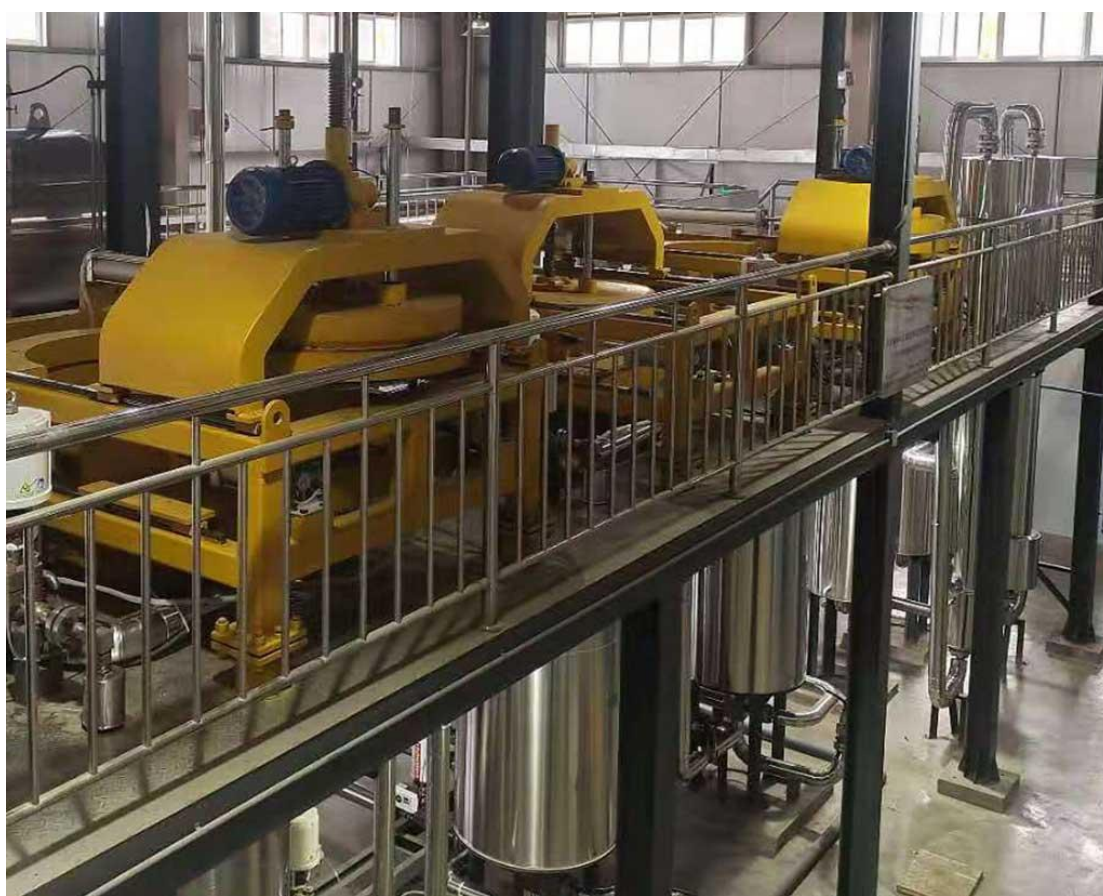


# Supercritical CO<sub>2</sub> Extraction Machine

The supercritical CO<sub>2</sub> extraction machine is the best highly integrated CO<sub>2</sub> essential oil extraction equipment used in food, medicine, cosmetics, and other fields. A supercritical CO<sub>2</sub> extractor uses the fluid physical properties of the CO<sub>2</sub> gas in the supercritical state to dissolve the effective target extract of the extracted biomass, by adjusting the pressure and temperature of the CO<sub>2</sub> fluid, the useful components can be maximized get, and they can be selectively extracted and separated. The CO<sub>2</sub> extraction machine is suitable for the extraction and separation of active ingredients such as volatile oil, fatty oil, coumarin, terpenes, alkaloids, and quinones.



## What is CO<sub>2</sub> Extraction

The supercritical CO<sub>2</sub> extraction process creates phase changes in carbon dioxide utilizing “temperature and pressure” to the combination of extraction and separation processes.

**Temperature & Pressure:** It is carried out by utilizing the influence of supercritical CO<sub>2</sub> fluid solubility, Contacting the extracted substance with a supercritical co<sub>2</sub> fluid and controlling temperature and pressure,

extracting the components of polarity, boiling point, and molecular weight in turn. Thereby the target extracted(such as CO2 essential oil) substances are completely or basically extracted, so as to achieve the purpose of separation and purification.

CO2 extraction yield: Within CO2 extraction for biomass material(For example, the oil content of cannabis is 4-7%, and the oil content of vanilla is 5-6%.), you can get 100% of these essential oils because the CO2 extraction process is the strongest oil extraction process on the planet. For 100 grams of cannabis or ginger, the CO2 extraction yield is 4-7 grams of CBD oil and 5-6 grams of ginger essential oil.



In BIT, The Supercritical CO<sub>2</sub> Extraction Machines can achieve the stability in operating conditions required to develop truly effective and efficient methodologies for your manufacturing business.

Operator have no business intervening in the CO2 extraction cycle once the parameters for temperature, pressure, flow rate, run duration, and density have been entered. Even the opening of all valves can be controlled by the control system. Real fully automatic supercritical CO2 extraction machine.

## Three Types of CO2 Extraction Equipment

Conventionally, CO2 extraction equipment is divided into three types according to its extraction capacity: tabletop CO2 extractor, small CO2 extraction machine, and industrial CO2 extraction machine.

**Tabletop CO2 Extractor:** The extraction capacity is from a few milliliters to 200 milliliters, mainly for some small CO2 extraction process experiments.

**Small CO2 Extraction Machine:** They have a larger extraction capacity than tabletop CO2 extractors, from 500 to 10,000 ml, and in special cases are equipped with two CO2 extraction vessels or a supercritical CO2 fractionation column. They are used for scale-up experiments of CO2 extraction processes.

**Industrial CO2 Extraction Machine:** Their extraction capacity ranges from 20L up to 9000L. There are two types of structures, frame type, and platform type.

Frame type: The capacity of the CO2 extraction vessel is less than 100L, and in special cases, it is a machine of 100L and 150L combined with a double CO2 extraction vessel.

Platform type: CO2 extractor combined with three CO2 extraction vessels of 100L and 150L and a CO2 extraction vessel larger than 150L.

Read More: [CO2 extraction vessel](#)

## Industrial CO2 Extraction Machine Standard Parameter Table

Models	Capacity liter	Extraction Capacity (24 hours/kg)	Work Pressure (MPa)	Extraction Vessels Number	Separation Vessels Number
P-10D	20(10L×2)	27.5	50	2	2
P-30D	60(30L×2)	82.5	45	2	2
P-50D	100(50L×2)	137.5	40	2	2
P-30F	120(30L×4)	165	40	4	3
P-50F	200(50L×4)	275	40	4	2

P-50S	300(50L×6)	412.5	40	6	3
I-150D	300(150L×2)	412.5	40	2	3
I-150T	450(150L×3)	787.5	40	3	3
I-200T	600(200L×3)	1050	35	3	3
I-300T	900(300L×3)	1575	35	3	3
I-500D	1000(500L×2)	1375	35	2	3
I-500T	1500(500L×3)	2625	35	3	3
I-600T	1800(600L×3)	3150	35	3	3
R-1000D	2000(1000L×2 )	2750	35	2	3
R-1500D	3000(1500L×2 )	4125	35	2	3
R-1000T	3000(1000L×3 )	5250	35	3	3
R-2000D	4000(2000L×2 )	5500	35	2	3
R-1500T	4500(1500L×3 )	7875	35	3	3
R-3000D	6000(3000L×2 )	8250	35	2	3
R-2000T	6000(2000L×3 )	10500	35	3	3
R-3000T	9000(3000L×3 )	15750	35	3	3

Biomass reference value of 24H extraction capacity: moisture content: <10%, specific gravity: 0.25KG/L

### **Read More: CO2 Essential Oil Extraction Equipment, Industrial Extractor**

When choosing a correct supercritical CO2 extraction machine, the most basic performance indicators are always temperature, pressure, and flow rate. But based on the above three basic parameters, what you need is to customize a CO2 extraction machine that suits you.

## 5 Notes to Choose the Right Supercritical CO2 Extraction Machine



As you can imagine, not all supercritical CO2 extractors are made the same. Because each customer's CO2 extraction process requirements are different, there are almost no identical machines, customize a particular CO2 extraction machine will be for your intended purpose.

- **Extraction Vessel Size:** The first factor that determines the size of the CO2 extraction vessel is the daily working hours of the plant, which determines the daily extraction batch.
- **How many extraction vessels will be used?** Supercritical co2 extractors can have three structural forms, single extraction vessel, double extraction vessel, and triple extraction vessel. co2 extraction vessel set helps improve extraction work efficiency and save gas and energy.
- **Separator (Collection Chambers):** We suggest a minimum of two to three cascading separators to produce the highest quality extracts. This also gives you the ability to step down the pressure in the system more gradually, which will greatly improve the overall quality.
- **The pressure rating of the extraction vessel:** Generally, the higher the pressure, the more expensive the unit will be. You can purchase a system at the lower end of the supercritical curve around 350 bar or as high as 1050 bar. It is important to note that larger volume systems become exponentially more expensive with higher-pressure ratings. Depending on your extraction technique, a lower-pressure system might be completely adequate.
- **CO2 recovery system:** When we extract material, some CO2 gas is lost. If you choose an extraction vessel of 10L or less, our recommendation is to ignore these gases, they are not worth the increased investment in a gas recovery system. But when the container is larger than 10L, we need a system to recover the CO2 gas in the extraction container, we call it the CO2 recovery system.

## 4 Tips for CO2 Extraction

There are some tricks to any job, and the CO2 extraction process is no exception. The four tips of CO2 extraction we provide below determine not only the type, quality, and yield of CO2 extraction, but also the ease and cost of the CO2 extraction process.

### Tips 1: Control the CO2 extraction temperature

The supercritical CO2 extraction equipment needs to control the temperature in many processes during operation, from the initial CO2 liquid to the supercritical CO2 fluid to the last stage of the separator, we need to control the temperature at each working point to Get the best extraction results. But the main concern is the temperature of the CO2 extraction vessel (here the CO2 extraction vessel includes the separation vessel).

Different biomass, oil composition, and different target extracts will have different optimal extraction temperatures. This means that in any kind of different biomass, there will be different extraction temperatures, and even the same biomass will have slightly different CO2 extraction parameters in different places of origin.

Increasing the extraction temperature: Decrease terpenoid concentration in the extract, risks of possible denaturing of the product, and increases wax/resin extraction (thereby increasing extract quantity), also increases chlorophyll in the extract..

Decreasing the extraction temperature: Increases the oil proportion of the extract, and reduces the wax proportion of the extract.

### Tips 2: Control the CO2 extraction Pressure

The pressure of the solvent is the most important and harshest physical condition for supercritical fluid extraction. The extraction pressure of some extracts will be higher than 700 bar, such as astaxanthin, which also brings some difficulties to the manufacture of CO2 extraction machines.

Like temperature, the pressure of the CO2 fluid also determines the efficiency of extraction and the quality of the CO2 extract.

### CO2 Extraction Pressure Example

- For the extraction of seasonings and flavors, parameters can be selected in a relatively wide range. For materials containing only high-solubility substances, selecting a low-pressure region of 7.0 MPa to 12.0

MPa is conducive to selective separation. In the research of various products, the pressure is mostly between 12.0MPa and 25.0MPa.

- Terpenoids can achieve high solubility in CO<sub>2</sub> at 9.1MPa~12.2MPa, while neutral oils generally need more than 16.2MPa.
- In the SC-CO<sub>2</sub> extraction of cardamom oil, when the pressure was between 10MPa and 60MPa, the yield was relatively stable, but the content of non-volatile components increased with the increase of pressure, while the loss of volatile components increased;
- When the temperature is the same, the solubility of pepper essential oil in the low-pressure area increases rapidly with the increase of pressure, and when it reaches a certain value, it tends to balance; while the extraction rate of piperine increases with the increase of extraction pressure within the test range, and the high pressure ( $\geq 30$ MPa) SC-CO<sub>2</sub> can effectively extract various pigments and capsaicin in peppers.
- For some highly polar substances containing -OH, -COOH, and phenyl hydroxyl groups, higher extraction pressure is also required.

Notes: From the initial chosen extraction pressure, increasing pressure increases wax/resin concentration, and increasing pressure increases chlorophyll in the extract (Pressure over 5000 psi at 45 deg C causes chlorophyll extraction).

### **Tips 3: Control the CO<sub>2</sub> Fluid Flow Rate**

The CO<sub>2</sub> flow rate can significantly affect the supercritical extraction efficiency. At a lower CO<sub>2</sub> flow rate, the equilibrium solubility can be achieved, but the extraction rate is not high;

When the flow rate of CO<sub>2</sub> increases, the speed of supercritical CO<sub>2</sub> fluid passing through the biomass layer is accelerated, and the contact and stirring effect with the feed liquid is enhanced, which promotes the dissolving ability of CO<sub>2</sub> fluid and can relatively shorten the extraction time.

However, when the flow rate is too large, the residence time of CO<sub>2</sub> fluid in the CO<sub>2</sub> extraction vessel is relatively reduced, so that the solute and solvent CO<sub>2</sub> cannot fully interact, and the improvement of the product extraction rate is restricted, resulting in an increase in CO<sub>2</sub> consumption and an increase in production costs.

Therefore, in the actual treatment process, it is necessary to comprehensively consider and select the appropriate CO<sub>2</sub> fluid flow through a series of experiments.

Note: When the static extraction time is too long, the limited CO<sub>2</sub> can reduce the ability to carry substances with the increase of dissolved substances, which will affect the extraction yield within the same extraction time. In dynamic extraction, CO<sub>2</sub> has good fluidity and good solubility, and there is no such problem.



## Tips 4: Co-solvent

Co-solvent, also known as entrainer.

The addition of a small amount of co-solvent can significantly change the phase behavior of the supercritical fluid(SCF) system, especially it can increase the solubility of some substances with little solubility in SCF, and at the same time, it can also reduce the operating pressure of SCF or reduce the amount of SCF.

### Example

Adding 3% ethanol or methanol to egg yolk powder can more than double the solubility of egg yolk lipids at 36 MPa and 40 °C;

In the extraction of peanut oil and pepper oil, adding 10% ethanol at 34.5 MPa and 60 °C can increase the yield by 230% compared with that without adding it, and adding 10% ethanol at 20.7 MPa and 60 °C, the yield increases to 230%. 750%.

However, the use of the entrainer will increase equipment and energy consumption due to the separation of the entrainer in the extract and the recovery of the entrainer in the residue.

**Read More:** [CO2 Extraction Process: Basics, 5 Advantages, 7 Features, 4 Applications](#)