

Provider of Supercritical Fluid Simulated Moving Bed Chromatography





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## SF-SMBC

#### **Overview:**

SF-SMBC, Supercritical Fluid Simulated Moving Bed Chromatography is a highly efficient green chromatography that is developed, designed, and assembled by JOPE Technology Co., Ltd.. By using supercritical fluid as the mobile phase, SF-SMBC combines various advantages in one, including high productivity, high efficiency, low energy consumption, as well as environment friendly, hygiene, and safe. JOPE devotes to promote and advance the chromatographic processes with low costs and high performances, which can mainly be applied to the purification of pharmaceuticals, natural products, and fine chemicals. The SF-SMBC is especially suitable for the separation of lipophilic molecules and can completely replace the traditional normal phase chromatography and the chiral separation. SFE, Supercritical Fluid Extraction can also be integrated as an add-up to the SF-SMBC system. With JOPE's integration, the process from raw material extraction to the downstream separation and purification can be fulfilled in one unit. JOPE has more than two decades of experiences in SMBC and more than thirty years of SFE know-how. In 2019, JOPE further commenced two industrial production scale SF-SMBC for plant based active ingredients separation and the purification of EPA and DHA from fish oil, leading SF-SMBC towards mass production as the global pioneer.



### Features:

- SF-SMBC, a continuous chromatography with multiple columns connected in series to enable high efficiency for production and preparation.
- Supercritical fluid CO<sub>2</sub> is used throughout the process. Easy to recycle and saves solvent costs, a best choice for green, environment, and economic friendly processes.
- Combining the characteristics of SMBC, high yield and high purity, and the advantages of supercritical fluid CO<sub>2</sub>, high solubility, high diffusivity and low viscosity, the production process has higher efficiency and lower energy consumption.
- The use of supercritical fluid CO<sub>2</sub> reduces the amount of organic solvents used by 5 to 20 times, making the process more environmentally friendly.
- Piping, key components, and accessories are international brands, stable and reliable.
- Excellent quality guarantees efficient and robust operation.



### Customized production scale system:

LQ-SMBC and SF-SMBC system in production scale require special design and manufacture according to individual needs. In general, columns of different sizes will have different capacity performances.

Columns	200mm	300mm	600mm	1000mm	1200mm
Annual Capacity (Tons)	15-25	45-65	160-200	480-60	650-750
CO₂ Circulation (Ton/h)	0.3-0.5	0.65-1.125	2.7-4.5	7.5-12.5	10.8-18
Cosolvent Circulation(L/h)	20-100	45-225	180-900	500-2500	720-3600



### JOPE offers four standard SF-SMBC, and provides custom design and add-ons.

### 1. P-SFSMBC-PX

P-SFSMBC-PX is a preparative-scale supercritical fluid simulated moving bed, which comes with 6 to 12 columns with diameters ranging from 30 to 50 mm, suitable for 100-1000 gram purification needs. The standard system uses stainless steel columns, but an upgrade to the SAC columns (static axial compression columns) is also available. In this model, both liquid and  $CO_2$  can be used as running solvent. When  $CO_2$  is used, it is completely recycled and reused to save  $CO_2$  consumption and emissions.

### 2. P-SFSMBC/E-PX

P-SFSMBC/E-PX is specially designed for products that need supercritical fluid extraction. This model mainly adds supercritical fluid extraction function on P-SFSMBC-PX. The extraction tank is 5 liters and the maximum operating pressure is 500 bar.

Model	P-SFSMBC-PX	P-SFSMBC/E-PX				
Solvent Pump	100 mL/min x 3, 40 mL/min x1 200bar					
Column	Packing columns with 30-50 mm in diameter					
UV Detector	Wavelength range 190-700nm x 2					
CO₂ Pump	Diaphragm pump with refrigerator 500 g/min, 300bar	Diaphragm pump with refrigerator 500 g/min, 500bar				
CO₂ Recycle	15L working tank and demister, 10 MPa					
CO <sub>2</sub> Extractor 1L buffer tank, 30s MPa and Separator 1GaL separator x 3, 10bar		5L extractor, 50 MPa 3GaL separator x 3, 10bar				
Valves and Fittings	From Swagelok, VICI Valco, or equivalents					
Instrument and Tubing	Stainless steel 1/8"-1/4"					
Operating System	PLC – Mitsubishi electric Touch screen monitor – Delta electronics Microsoft windows					

### Specifications of P-SFSMBC



### 3. KG-SFSMBC-DX

KG-SFSMBC-DX is a ten-kilogram scale SF-SMBC. It is equipped with 6 to 12 columns with diameters ranging from 80 to 120 mm, which can meet the production of several kilogram levels. The standard system uses DAC columns(dynamic axial compression columns), which can also be replaced by SAC or packing columns. Both liquid and CO<sub>2</sub> can be used as running solvent. When CO<sub>2</sub> is used, it is completely recycled and reused to save CO<sub>2</sub> consumption and emissions.

### 4. KG-SFSMBC/E-DX

KG-SFSMBC/E-DX adds supercritical fluid extraction function on KG-SFSMBC-DX model. The extraction tank size is 5 liters and the maximum operating pressure is 500 bar.

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Model	KG-SFSMBC-DX	KG-SFSMBC/E-DX				
Solvent Pump	500 mL/min x 3, 100 mL/min x1 200bar					
Column	DAC columns with 80-120 mm in diameter					
UV Detector	Wavelength range 190-700nm x 2					
CO <sub>2</sub> Pump	Diaphragm pump with refrigerator 500 g/min, 300bar	Diaphragm pump with refrigerator 500 g/min, 500bar				
CO <sub>2</sub> Recycle	15L working tank and demister, 10 MPa					
CO <sub>2</sub> Extractor and Separator	2L buffer tank, 30 MPa 1GaL separator x 3, 10bar	5L extractor, 50 MPa 3GaL separator x 3, 10bar				
Valves and Fittings	From Swagelok, VICI Valco, or equivalents					
Instrument and Tubing	Stainless steel 1/4"-3/8"					
Operating System	PLC – Mitsubishi electric Touch screen monitor – Delta electi Microsoft windows	itsubishi electric reen monitor – Delta electronics windows				

### Specifications of KG-SFSMBC



## LQ-SMBC

### **Overview:**

The Liquid Simulated Moving Bed Chromatography (LQ-SMBC) designed and assembled by JOPE is an efficient, easy to operate, and reliable continuous chromatography that can be applied in the separation of pharmaceutical, fine chemical (including biopharmaceutical), active ingredients of natural products, and enantiomers. The rapid separation and purification of LQ-SMBC can effectively solve the shortcomings of low efficiency, high solvent consumption, and serious product dilution problems caused by conventional liquid chromatography.

### Features:

- Continuous operation contributes to lower solvent consumption, higher productivity and adsorbent efficiently.
- High-performance pump system, separation system and various control valves provide precise accuracy and reproducibility, ensuring stable and long-term operation.
- Excellent quality assurance to ensure efficient and robust operation.
- Modular design for convenient operation and maintenance, combined with powerful software to support automatic operation along with friendly human-machine interface design.



# JOPE provides two standard LQ-SMBC models, and can custom design for mass production.

### 1. P-SMBC-PX

P-SMBC-PX is a pilot scale simulated moving bed. It is equipped with 6 to 12 columns with diameter ranging from 30 to 50 mm according to customer needs. It is suitable for the preparation of hundred grams to kilograms. The standard system comes with stainless steel packing columns, which can also be upgraded to a SAC column (static axial compression column).

### 2. KG-SMBC-DX

KG-SMBC-DX is a kilogram scale simulated moving bed. Depends on customer needs, it is equipped with 6 to 12 DAC columns(dynamic axial compression columns) with diameters ranging from 80 to 120 mm to fulfill pilot production of several kilograms. The columns can also be replaced by SAC columns.

Model	P-SMBC-PX	KG-SMBC-DX			
Solvent Pump	HPLC pump x 4 100 mL/min x 3, 40 mL/min x1 200bar	HPLC pump x 4 500 mL/min x 3, 100 mL/min x1 200bar			
Column	30-50 mm packing column, 200bar	80-120 mm DAC column, 200bar			
UV Detector	Wavelength range 190-700nm x 2				
Fraction Valve Six-way valve, 200 bar Back pressure regulator x 2 Temp. controlled by oven		On-off single way valve Back pressure regulator x 2 Temp. controlled by water			
Valves and Fittings	Swagelok and VICI Valco				
Instrument and Tubing	Stainless steel 1/8"	Stainless steel 1/4"			
Operating System	PLC – Mitsubishi electric Touch screen monitor – Delta elec Microsoft windows	ctronics			

### Specifications of LQ-SMBC

## SFC

### **Overview:**

Supercritical Fluid Chromatography (SFC) uses supercritical carbon dioxide as the mobile phase, which has good solubility and fast mass transfer characteristics. Small amount of organic solvents (such as ethanol, methanol, isopropanol, etc.) can also be added as co-solvent to improve the solubility and separation efficiency. SFC is especially suitable for the separation and preparation of small and medium molecules, and has an irreplaceable advantage in mass production and chiral separation. The SFC system from JOPE is a pilot to large scale production system that can be used to purify various compounds. In addition, it can also be combined with supercritical fluid extraction unit to integrate extraction and chromatography separation as one system.

### Features:

- Compared with traditional preparative HPLC, the separation efficiency of SFC is improved by 4 to 5 times, which provides an additional option to accelerate separation process.
- The use of supercritical fluid CO<sub>2</sub> lowers the use of organic solvents by 3 to 4 times, making the process more green to the environment.
- The design of the closed system has good and stable operation performance.
- The design of multiple separation tanks enables collections of multiple products.

JOPE offers two standard SFC models, and is also skilled with large-scale SFC system.



### Semi-Prep SFC & Prep SFC

- ✓ Semi-Prep SFC is a semi-preparative supercritical fluid chromatography system, using a chromatography column with inner diameter between 3 to 5 cm to efficiently and robustly obtain ten grams to thousand grams of high purity samples.
- ✓ Prep-SFC is a preparative-grade supercritical fluid chromatography system that can be used with a column of more than 5 cm to prepare samples of kilograms. This system can be equipped with supercritical fluid extraction with an extraction tank of 5 liters according to customer needs to incorporate both functions of extraction and separation. The standard Prep-SFC system is equipped with CO₂ recovery system. CO₂ is purified and liquefied for recycling and reusing again to reduce CO₂ consumption.

Specifications of Semi-Prep SFC						
Model	SFC 20A	SFC 20D	SFC/E 20D			
Solvent Pump	HPLC pump x 2 - 40 mL/min x 2 200bar					
Column	20-30 mm column					
Oven (Optional)	From room tempe					
UV Detector	Wavelength range	e 190-700nm				
Fraction Valves Separators	Six-way valve, 20 Back pressure reg 1 GaL separator x Temp. controlled	0 bar gulator x 2, 200 bar x 6, 122 bar by oven	Six-way valve, 200 bar Back pressure regulator x 1, 500 bar Back pressure regulator x 1, 200 bar 1 GaL separator x 6, 122 bar Temp. controlled by oven			
CO₂ Pump	Air driven pump 120 g/min 300 bar Refrigerator 0.5L buffer tank	Diaphragm pump 167 g/min 300 bar Refrigerator 0.5L buffer tank	Diaphragm pump 500 g/min 500 bar Refrigerator Sampling tank x 6			
CO₂ Recycle	Not Available		15L Working tank Demister			
CO <sub>2</sub> Extractor and Separator	Not Available		5L extractor 3L separator x 2			
Valves and Fittings	Swagelok and VICI Valco					
Instrument Stainless steel 1/8"			Stainless steel 1/8"-3/8"			
PLC and Software	PLC – Mitsubishi electric Touch screen monitor – Delta electronics Microsoft windows					



Specifications of Prep SFC						
Model	SFC 50D	SFC/E 50D				
Solvent Pump	HPLC pump x 2 - 500 mL/min x 1, 40mL/min x 1 200bar					
Column	50-100 mm DAC or SAC column Max. length of column 250-600 mm					
Oven (Optional)	From room temperature to 100 °C					
UV Detector	Wavelength range 190-700nm					
Fraction Valves Separators	Six-way valve, 200 bar Back pressure regulator x 2, 300 bar 1 GaL separator x 6, 122 bar Temp. controlled by oven	Six-way valve, 200 bar Back pressure regulator x 2, 500 bar 1 GaL separator x 6, 122 bar Temp. controlled by oven				
CO₂ Pump	Diaphragm pump 500 g/min 300 bar Refrigerator 0.5L buffer tank x 2	Diaphragm pump 500 g/min 500 bar Refrigerator Sampling tank x 6				
CO₂ Recycle	15L Working tank Demister	/orking tank ster				
CO <sub>2</sub> Extractor and Separator	Not Available	5L extractor 3L separator x 2				
Valves and Fittings	Swagelok and VICI Valco					
Instrument and Tubing	Stainless steel 1/4"-3/8"	Stainless steel 1/8"-3/8"				
PLC and Software	PLC – Mitsubishi electric Touch screen monitor – Delta electronics Microsoft windows					









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