

SHIMSEN Styra SPE

# Sample Preparation Product Guidebook

**CoreFocus**



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# Introduction of Solid Phase Extraction

## What is SPE



### • The purification mechanism of SPE method

The purification mechanism of SPE method can be divided into two modes including target compound retention mode and interference retention mode.

#### ① Target Compound Retention Mode

Target compound retention mode is mainly used to concentrate the target compound in aqueous samples.

#### ② Interference Retention Mode

Interference retention Mode is mainly used to remove the interference from samples.

### • Steps of SPE method

The universal steps of SPE method are showed as follows:

#### ① Condition

To immerse the sorbent, remove the interferences in the sorbent and create a suitable loading environment.

#### ② Load

The target compound and part of the interferences are retained by the sorbent, and most of the interferences flow out of the cartridge with the sample solvent.

#### ③ Wash

To remove the interferences retained by the sorbent.

#### ④ Elute

Collection of the target compound.

### • Flow rate control

The following four methods are commonly used for flow rate control.

#### ① Positive pressure

#### ② Negative pressure

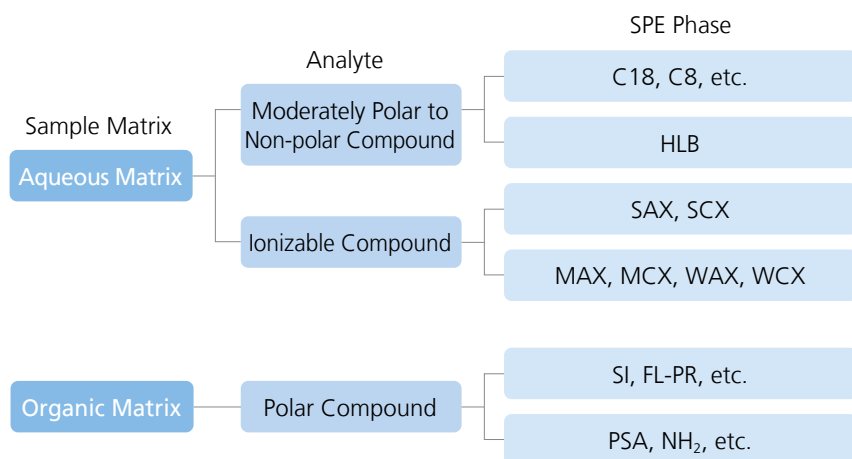
#### ③ Centrifuge

#### ④ Gravitation

# Introduction of Solid Phase Extraction

## Selection of Proper Sorbent

### • Sorbent selection by matrix and analyte



It is a standard of SPE phase selection that the SPE phase should be consistent with the property of the analytes.

Besides, it is necessary to consider the characteristics of sample matrix, analytes and the solubility of the solvent used.

Solid phase extraction sorbent can be divided into reverse phase, normal phase and ion exchange according to chemical properties.

### • Retention mechanisms

SPE Phase Type	Analyte	Sample Matrix Type	Mechanisms
Reverse Phase	Nonpolar Compound	Polar	Reverse phase sorbent is used to extract analytes from aqueous samples using a non-polar (hydrophobic) retention mechanism.
Normal Phase	Polar Compound	Nonpolar	Normal phase sorbent is used to extract analytes from non-polar (typically solvent) matrices using polar retention mechanisms.
Ion Exchange	Ionizable Compound	Aqueous, Nonpolar, etc	Ion exchange sorbent is used to extract ionizable analytes from aqueous samples using an ion exchange retention mechanism.
Mixed Mode	Ionizable Nonpolar Compound	Aqueous, Nonpolar, etc	Mixed mode sorbent is used to extract ionizable analytes from aqueous or nonpolar samples using an ion exchange retention mechanism combined with non-polar retention mechanism.

## Introduction of Solid Phase Extraction

### Selection of solid phase extraction columns

#### ① Selection of ion exchange columns

Target	Solid phase			pKa	Functional group	Ion	
						Weak	Strong
Acidic compounds	Anion exchange	MAX	Quaternary amino	-	-CH <sub>2</sub> -N(R) <sub>3</sub>	√	
		WAX	Tertiary amine	11.0	-CH <sub>2</sub> -N(R) <sub>2</sub>		√
		NH <sub>2</sub>	Aminopropyl	9.8	-CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> NH <sub>2</sub>		√
		PSA	Ethylenediamine-N-propyl	10.1 10.9	-CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> - NHCH <sub>2</sub> CH <sub>2</sub> NH <sub>2</sub>		√
		SAX	Quaternary amino	-	-CH <sub>2</sub> -N(R) <sub>3</sub>	√	
Alkaline compounds	Cation exchange	MCX	sulfonic acid	1.0	-CH <sub>2</sub> -SO <sub>3</sub> <sup>-</sup>	√	
		WCX	Hydroxyacid	4.8	-CH <sub>2</sub> -COO <sup>-</sup>		√
		SCX	Benzene sulfonic acid	1.0	-CH <sub>2</sub> CH <sub>2</sub> C <sub>6</sub> H <sub>4</sub> SO <sub>3</sub> <sup>-</sup>	√	

\*pKa is the reference value of the functional group.

The ion exchange column was selected by the pH and ion strength of the analytes.

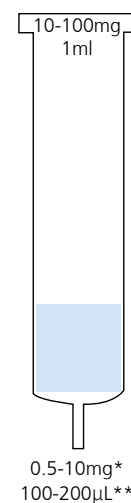
#### ② General specifications for column size and adsorbent

Bed Weight	Tube Volume	Bed Capacity	Minimum Elution Volume
10-100 mg	1 mL	0.5-10 mg	100-200 µL
60-500 mg	3 mL	25-100 mg	1-3 mL
0.5-1 g	6 mL	25-100 mg	2-6 mL
2g	12 mL	0.1-0.2 g	10-20 mL
5 g	20 mL	1.25-2.5 g	20-40 mL
10 g	60 mL	0.5-1 g	40-100 mL

\*The bed capacity can be estimated with ~5% of the bed weight.

\*\*The minimum elution volume is not less than twice the bed volume.

#The bed volume is the amount of solvent required to fill the void in the solid phase, about 120µL/100mg of sorbent.



In addition, the total amount of the analytes is calculated according to the sample volume and the estimated concentration, which is used to select the tube volume of the SPE column, bed capacity and other indicators.

## Introduction of Solid Phase Extraction

### The process of solid phase extraction

#### ① Condition

Condition is a necessary step before the sample enters the solid phase, and the load of an unactivated solid phase to the target compound will be greatly reduced. In addition, the type of solid phase is different, and the condition of the solvent is also different. Please refer to the following content to choose the appropriate solvent.

Solid phase	Activating solvent
Reversed phase (C18, C8, etc.)	(1) Rinse with methanol equal to column volume. (2) Rinse with water twice of column volume. (3) As needed, use the sample matrix as an activating solvent for rinsing. (4) As needed, use chelate or ion pair reagent for rinsing.
Normal phase (SI, FL, etc.)	Rinse with a low-polarity solvent such as hexane in the same amount as the column volume.
Ion exchange (SAX, SCX, etc.)	(1) Rinse with methanol equal to the volume of the column. (2) Rinse with water equal to the volume of the column. (3) Rinse with a pH=6~7 buffer solution equal to the volume of the column, as needed.

#### ② Loading conditions (load sample)

Loading conditions vary depending on the matrix of the sample, the polarity of the target compound, and the type of solid phase. Please refer to the table below for experimental confirmation.

Solid phase	Loading conditions
Reversed phase (C18, C8, etc.)	(1) When the sample is plasma or serum, dilute it with water or pH buffer at a ratio of 1:1 or 1:2. (2) If the sample contains hydrophilic solvents such as methanol and acetonitrile, the concentration should be adjusted to less than 10%. (3) The concentration of pH buffer used in dilution should be kept below 0.1M. (4) To attain a greater loading effect, according to the characteristics of various compounds, adjust to the most suitable pH conditions: <ul style="list-style-type: none"><li>• Neutral compounds: Adjust to pH=6~7 with water or pH buffer.</li><li>• Acidic compounds: Adjust to pH=2~4 with hydrochloric acid, acetic acid, or pH buffer.</li><li>• Alkaline compounds: Adjust to pH=7-9 with pH buffer. For strongly alkaline compounds, adjust to pH=9 with ammonium carbonate solution, sodium carbonate solution, or sodium hydroxide solution.</li></ul>
Normal phase (SI, FL, etc.)	Low polarity solvents such as hexane.
Ion exchange (SAX, SCX, etc.)	(1) Adjust to pH=6~7 with water or pH buffer. (2) SCX is only used under acidic conditions. (3) The concentration of the pH buffer used for dilution should be adjusted below 0.1M.

## Introduction of Solid Phase Extraction

### The process of solid phase extraction

Solvent polarity and applicable solid phase.

Solvent polarity	Solvent	
<div style="display: flex; align-items: center; justify-content: center;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">Low</div> <div style="width: 100px; height: 100px; background: linear-gradient(to bottom, #add8e6 49%, #007bff 49% 51%, #007bff 51% 99%, #add8e6 99%); margin: 0 auto;"></div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">High</div> </div> <div style="display: flex; align-items: center; justify-content: center; margin-top: 10px;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">Polarity</div> <div style="width: 100px; height: 100px; background: linear-gradient(to bottom, #add8e6 49%, #007bff 49% 51%, #007bff 51% 99%, #add8e6 99%); margin: 0 auto;"></div> </div>	Hexane	SI FL and other positive phase columns
	Isooctane	
	Methylbenzene	
	Benzene	
	DCM	
	THF	
	Diethyl Ether	C18 and other inverting columns
	Ethyl Acetate	
	Acetone	
	Acetonitrile	
	Isopropanol	
	Methyl Alcohol	
	Water	SAX and other ionexchange columns

The table shows the polar strength of the solvent and the suitable solvent for elution of the target substance. The solvent used for solid phase extraction is generally referred to in the table.

### ③ Remove interference compounds.

Interference compounds refer to everything in the sample except the target compounds and solvent. Interference compounds can affect the accuracy of the analysis of the target compounds by GC, GC/MS, HPLC, LC/MS(MS), etc. To minimize the influence of interference compounds, it is necessary to wash the solid phase after the sample is finished. This step is very important. Please select the washing solvent suitable for the target compounds according to the following table.

Solid Phase	Washing conditions
Reversed phase (C18, C8, etc.)	(1) Wash with water, control the volume of the eluent, and do not elute the target compounds. (2) Wash with water, if the target compounds are found to be eluted, washed with buffer, diluted acid, or base, the pH of the cleaning solution is the same as that of the sample matrix. (3) To improve the washing effect, use 5-40% methanol or 5-30% acetonitrile for washing. The specific concentration and volume are judged according to whether the target compounds are eluted.
Normal phase (SI, FL, etc.)	(1) Wash with low polarity solvents such as hexane. (2) To improve the washing effect, acetone or isopropyl alcohol can be added to the solvent
Ion exchange (SAX, SCX, etc.)	(1) Wash with water. (2) Wash with 40-100% methanol, the specific concentration and volume according to whether the target compound is eluted.

## Introduction of Solid Phase Extraction

### The process of solid phase extraction

#### ④ Eluting solvent (elution and recovery)

To improve the enrichment effect, try to use a small amount of solvent to elute the target compounds on the solid phase. In addition, the suitable eluting solvent has a significant impact on the accuracy of analysis and the reproducibility of results, so many factors should be taken into account when selecting the solvent, such as the sample matrix, the target compounds, and the type of solid phase.

Solid Phase	Eluting solvent
Reversed phase (C18, C8, etc.)	(1) Generally use methanol or acetonitrile, the amount is 2 to 5 times the bed volume. (2) When the elution efficiency of some acidic substances is low due to strong retention, a small amount of ammonia or triethylamine can be added to methanol or acetonitrile for elution. (3) When some alkaline substances are difficult to eluate, an appropriate amount of hydrochloric acid or acetic acid can be added to methanol or acetonitrile for elution. (4) According to the properties of the target compounds, choose ethyl acetate or dichloromethane for elution.
Normal phase (SI, FL, etc.)	(1) Elution with polar solvents such as acetone or methanol. (2) In hexane, dichloromethane, and other low-polarity solvents, an appropriate amount of acetone and methanol are added for elution.
Ion exchange (SAX, SCX, etc.)	(1) Promote the dissociation of the target compounds from the solid phase, which can lead to elution. Therefore, according to the acid dissociation constant (pKa) of the solid phase or the target compounds, the elution conditions are formulated, generally using the following solvent: Acidic substances: ① 5% ammonia in MeOH (NH <sub>2</sub> , PSA treatment of strong ionic substances) ② 2% formic acid in MeOH (SAX for weak ionic substances) Alkaline substances: ① 2% formic acid in MeOH ② 5% ammonia in MeOH (SCX for weak ionic substances) (2) Increase the concentration of salt for elution, pay attention to the selection of salt that does not interfere with the analysis results. Generally choose the following elution solvent: ① Sodium chloride or potassium chloride solution with a concentration above 0.2M. ② Potassium dihydrogen phosphate solution with a concentration above 0.2M.

\* In principle, the bed volume is the amount of solvent required to fill the void in the solid phase, about 120μL/100mg of sorbent.



## Introduction of Solid Phase Extraction

### SPE phase physical properties.

Stationary phase	Matrix	Functional group	Tail capping	Extraction mechanism	Particle size (µm)	Aperture (Å)	BET (m <sup>2</sup> /g)	C%	pKa	Recommended pH
HLB	PS-DVB	Pyrrolidone, divinylbenzene	-	Reversed-phase (hydrophilic lipophilic balance)	50	80	800	-	-	1-14
WCX		Pyrrolidone, divinylbenzene, hydroxyacid	-	Reversed-phase, weak cation exchange	50	80	800	-	4.2	1-14
WAX		Pyrrolidone, divinylbenzene, ethylenediamine	-	Reversed-phase, weak anion exchange	50	80	800	-	5.7 9.5	1-14
MCX		Pyrrolidone, divinylbenzene, sulfonic acid	-	Reversed-phase, cation exchange	50	80	800	-	<1.0	1-14
MAX		Pyrrolidone, divinylbenzene, quaternary amino	-	Reversed-phase, anion exchange	50	80	800	-	-	1-14
SCX	silicone	Benenesulfonic acid	-	Strong cation exchange	50	60	500	-	<1.0	2-8
SAX		Quaternary amino group	-	Strong anion exchange	50	60	500	-	-	2-8
C18		Octadecyl	Y	Reversed-phase	50	60	500	17.0	-	-
C18-U		Octadecyl, silicon hydroxyl	N	Reversed-phase	50	60	500	17.0	-	-
C8		octyl	Y	Reversed-phase	50	60	500	11.0	-	-
C2		ethyl	Y	Reversed-phase	50	60	500	2.7	-	-
Ph		phenyl	Y	Reversed-phase	50	60	500	8.0	-	-
CN		Cyanopropyl	Y	Reversed-phase	50	60	500	6.5	-	-
SI		Silicon hydroxyl group	N	Normal phase	50	60	500	-	-	-
NH2		Aminopropyl	N	Normal phase, weak anion exchange	50	60	500	3.5	9.8	2-8
PSA		Ethylenediamine-N-propyl	N	Normal phase, weak anion exchange	50	60	500	7.0	10.1 10.9	2-8
SAX/PSA		Quaternary amino group Ethylenediamine-N-propyl	N	Anion exchange	-	-	-	-	-	-
DNPH		2,5-Dinitrophenylhydrazine (DNPH)	N	Derivatization	-	-	-	-	-	-
AL-A	Acid alumina	-	-	Normal phase	125	-	200	-	-	-
AL-B	Alkaline alumina	-	-	Normal phase	125	-	200	-	-	-
AL-N	Neutral alumina	-	-	Normal phase	125	-	200	-	-	-
FL-PR	Magnesium silicate	-	-	Normal phase	150-200	-	-	-	-	-
GCB	Carbon black	-	-	adsorption	120-400	-	100	-	-	-
GAC	Activated carbon	-	-	adsorption	-	-	-	-	-	-
Na <sub>2</sub> SO <sub>4</sub>	Anhydrous sodium sulfate	-	-	adsorption	-	-	-	-	-	-
SLE	anhydrous sodium sulfate	-	-	-	-	-	-	-	-	-

DVB: Divinylbenzene copolymer

# Introduction of Solid Phase Extraction

## Q & A

### • FAQ

- Low Recovery
- Bad Reproducibility
- Poor Purification Ability
- Improper Flow Rate

### • Method optimization to improve analyte recovery

Low analyte recovery can be caused by low retention of analytes or inefficient retention disruption during the elution step.

#### ① Low retention of analytes

Issue and Possible Cause	Action
Unsuitable SPE sorbent	Select suitable sorbent with improved retention of analytes
Unsuitable loading condition or washing solvent	Adjust loading condition or washing solvent
Unsuitable loading volume	Reduce loading volume or increase sorbent weight
Sorbent overdried	Concern for sorbent overdrying is critical during experiment

#### ② Inefficient retention disruption during elution

Issue and Possible Cause	Action
The retention of the analyte is too much	Select suitable sorbent with proper retention of analytes
Unsuitable elution solvent	Adjust elution solvent
Unsuitable elution volume	Adjust elution volume

#### ③ Tips

Issue and Possible Cause	Action
Insufficient extraction	Adjust extraction method
Unstable analyte	Pay attention to pH manipulation and temperature
Analyte bounded with the impurity	Remove impurities before loading
High impurity content	Reduce loading volume or increase sorbent weight

## Introduction of Solid Phase Extraction

### Q & A

- Method optimization to improve reproducibility

Issue and Possible Cause	Action
Personal error	Try simplified methods
Poor impurity removal ability	Change sample preparation method
Column flow rate is too fast	Control flow rate with the help of SPE Vacuum Manifolds
Sorbent overdried	Re-Conditioning

- Method optimization to improve impurity removal ability

- Adjust the pH of the sample if necessary
- Adjust the fraction of the washing solvent or elution solvent
- Choose SPE cartridge with proper sorbent and weight
- Improve SPE operation

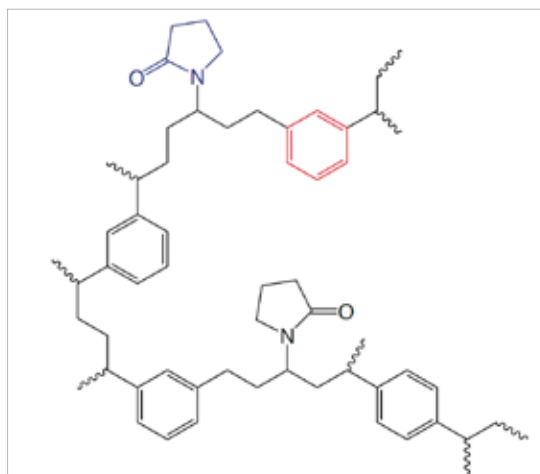
- Method optimization to control flow rate

Issue and Possible Cause	Action
Improper particle size of the sorbent	Choose sorbent with proper particle size
Suspended insoluble residual, such as lipids and proteins	Centrifuge, refrigeration or other sample pretreatment methods before loading
High viscosity liquid samples	Dilute the sample by organic solvent
Improper solvent flow	Adjust valves of SPE Vacuum Manifolds for precise flow control

## Polymeric Cartridge

### SHIMSEN Styra HLB / Hydrophilic-Lipophilic Balanced Cartridge

SHIMSEN Styra HLB is a hydrophilic-lipophilic balanced cartridge, which is based on styrene-divinylbenzene as the matrix and introduced into the polar functional group containing -N. It has good retention effect on non-polar compounds, and also has a certain retention effect on polar compounds.



#### Application:

**Environmental monitoring:** PAHs, PAEs, phenolic compounds, bisphenol A, triazine herbicides in water and soil;

**Food safety testing:** analysis of drug residues in animal samples, such as tetracycline drugs, chloramphenicol, sulfonamides, avermectin, macrolides antibiotics, furan drugs and their metabolites, and pesticide residues in plant samples;

**Biological samples:** analysis of drugs in blood and urine, such as tetracycline drugs, cocaine and its metabolites, morphine and its metabolites, barbiturates, tricyclic drugs, ranitidine, etc.

- Polystyrene / Divinylbenzene copolymer spherical particles
- Particle size 50  $\mu\text{m}$ , pore size 80  $\text{\AA}$ , specific surface area 800  $\text{m}^2/\text{g}$
- Function groups: phenyl, vinyl, pyrrolidone

#### SHIMSEN Styra HLB Product Information:

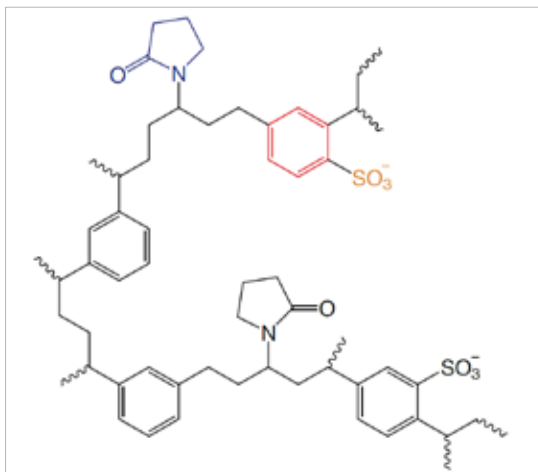
Product Number	Specification	Package
380-00855-03	60 mg / 3 mL	50pcs
380-00855-04	60 mg / 1 mL	100pcs
380-00855-05	6 g / 60 mL	10pcs
380-00855-06	500 mg / 3 mL	50pcs
380-00855-07	500 mg / 6 mL	30pcs
380-00855-08	500 mg / 12 mL	20pcs
380-00855-09	30 mg / 1 mL	100pcs
380-00855-10	200 mg / 6 mL	30pcs
380-00855-11	150 mg / 6 mL	30pcs
380-00855-12	100 mg / 6 mL	30pcs
380-00855-13	1000 mg / 6 mL	30pcs
380-00855-14	1 g / 20 mL	20pcs
380-00855-51	10mg/1mL 96-well plate	1pcs
380-00855-53	30mg/1mL 96-well plate	1pcs

## Polymeric Cartridge

### SHIMSEN Styra MCX / Mixed-Mode Strong Cation Exchange Reversed Phase Cartridge

SHIMSEN Styra MCX uses a polymeric cation-exchange resin that combines the outstanding properties of SHIMSEN Styra HLB with strong cation exchange functionalities.

MCX is suitable for the enrichment and purification of basic compounds with pKa 2-10.



**Retention mechanism:** strong cation exchange interaction (primary), non-polar interaction (primary), polar interaction (secondary)

#### Application:

**Food safety testing:** melamine analysis; analysis of alkaline drug residues in animal samples, such as sulfonamides, clenbuterol hydrochloride and other drugs; alkaline pesticides in vegetables, fruits and fruit juices, such as carbendazim, thiamethoxam and other fungicides.

**Biological samples:** analysis of alkaline drugs in blood and urine

- Polystyrene-divinylbenzene copolymer bonded with sulfonic acid groups
- Particle size 50  $\mu\text{m}$ , pore size 80  $\text{\AA}$ , specific surface area 800  $\text{m}^2/\text{g}$
- Function groups: sulfonic acid group, phenyl, vinyl, pyrrolidone
- pKa: <1.0

#### SHIMSEN Styra MCX Product Information:

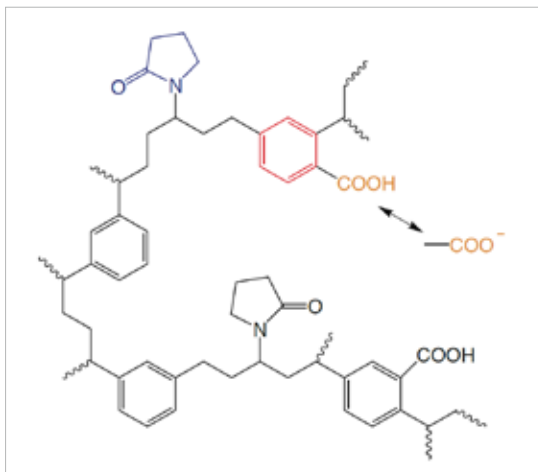
Product Number	Specification	Package
380-00853-01	60 mg / 3 mL	50pcs
380-00853-02	6 g / 60 mL	10pcs
380-00853-03	500 mg / 12 mL	20pcs
380-00853-04	30 mg / 1 mL	100pcs
380-00853-05	20 mg / 3 mL	50pcs
380-00853-06	200 mg / 6 mL	30pcs
380-00853-07	150 mg / 6 mL	30pcs
380-00853-08	1 g / 20 mL	20pcs
380-00853-51	10mg/1mL 96-well plate	1pcs
380-00853-53	30mg/1mL 96-well plate	1pcs

## Polymeric Cartridge

### SHIMSEN Styra WCX / Mixed-Mode Weak Cation Exchange Reversed Phase Cartridge

SHIMSEN Styra WCX uses a polymeric cation-exchange resin that combines the outstanding properties of SHIMSEN Styra HLB with weak cation exchange functionalities.

WCX is suitable for the enrichment and purification of strong basic compounds with pKa 10 or more.



**Retention mechanism:** weak cation exchange interaction (primary), non-polar interaction (primary), polar interaction (secondary)

#### Application:

Separation and purification of strong basic compounds, such as compounds with quaternary ammonium groups

- Polystyrene-divinylbenzene copolymer bonded with carboxyl groups
- Particle size 50  $\mu\text{m}$ , pore size 80  $\text{\AA}$ , specific surface area 800  $\text{m}^2/\text{g}$
- Function groups: carboxyl, phenyl, vinyl, pyrrolidone
- pKa: 4.2

#### SHIMSEN Styra WCX Product Information:

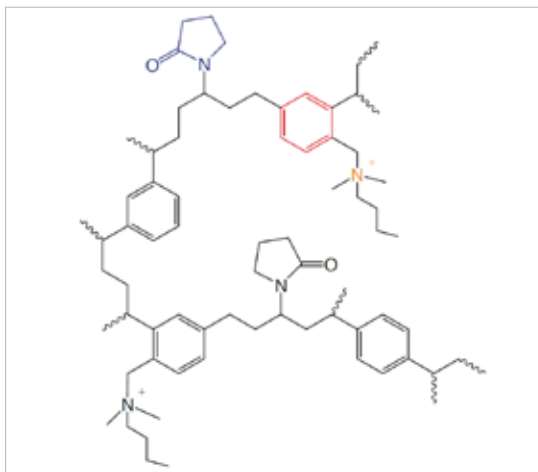
Product Number	Specification	Package
380-00850-01	60 mg / 3 mL	50pcs
380-00850-02	500 mg / 6 mL	30pcs
380-00850-03	500 mg / 3 mL	50pcs
380-00850-04	30 mg / 1 mL	100pcs
380-00850-05	150 mg / 6 mL	30pcs
380-00850-51	10mg/1mL 96-well plate	1pcs
380-00850-53	30mg/1mL 96-well plate	1pcs

## Polymeric Cartridge

### SHIMSEN Styra MAX / Mixed-Mode Strong Anion Exchange Reversed Phase Cartridge

SHIMSEN Styra MAX uses a polymeric anion-exchange resin that combines the outstanding properties of SHIMSEN Styra HLB with anion exchange functionalities.

MAX is suitable for the enrichment and purification of acidic compounds with pKa 2-8.



**Retention mechanism:** anion exchange interaction (primary), non-polar interaction (primary), polar interaction (secondary)

#### Application:

Separation and purification of acidic compounds, such as compounds containing carboxyl and phenolic hydroxyl groups

- Polystyrene-divinylbenzene copolymer bonded with quaternary ammonium groups
- Particle size 50  $\mu\text{m}$ , pore size 80  $\text{\AA}$ , specific surface area 800  $\text{m}^2/\text{g}$
- Function groups: quaternary ammonium group, phenyl, vinyl, pyrrolidone group
- pKa: completely dissociated

#### SHIMSEN Styra MAX Product Information:

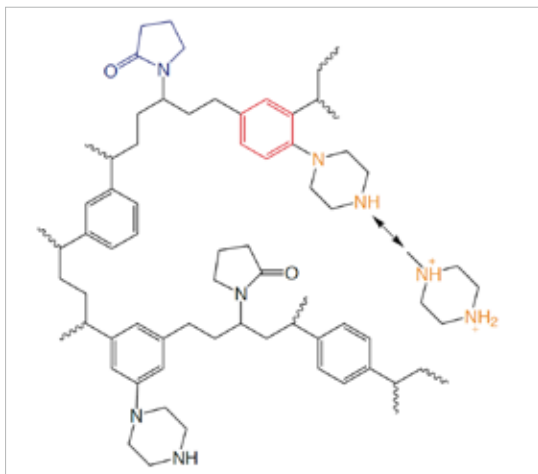
Product Number	Specification	Package
380-00854-01	60 mg / 3 mL	50pcs
380-00854-02	6 g / 60 mL	10pcs
380-00854-03	500 mg / 6 mL	30pcs
380-00854-04	500 mg / 12 mL	20pcs
380-00854-05	30 mg / 1 mL	100pcs
380-00854-06	150 mg / 6 mL	30pcs
380-00854-07	1000 mg / 6 mL	30pcs
380-00854-08	1 g / 20 mL	20pcs
380-00854-51	10mg/1mL 96-well plate	1pcs
380-00854-53	30mg/1mL 96-well plate	1pcs

## Polymeric Cartridge

### SHIMSEN Styra WAX / Mixed-Mode Weak Anion Exchange Reversed Phase Cartridge

SHIMSEN Styra WAX uses a polymeric anion-exchange resin that combines the outstanding properties of SHIMSEN Styra HLB with weak anion exchange functionalities.

WAX is suitable for the enrichment and purification of strong acidic compounds with pKa 1 or less.



**Retention mechanism:** anion exchange interaction (primary), non-polar interaction (primary), polar interaction (secondary)

#### Application:

Separation and purification of strong acidic compounds, such as compounds containing sulfonic acid groups

- Polystyrene-divinylbenzene copolymer bonded with piperazine group
- Particle size 50  $\mu\text{m}$ , pore size 80  $\text{\AA}$ , specific surface area 800  $\text{m}^2/\text{g}$
- Function groups: piperazine group, phenyl, vinyl, pyrrolidone
- pKa: 9.5, 5.7 (the pKa value of the conjugated acid of the piperazine group)

#### SHIMSEN Styra WAX Product Information:

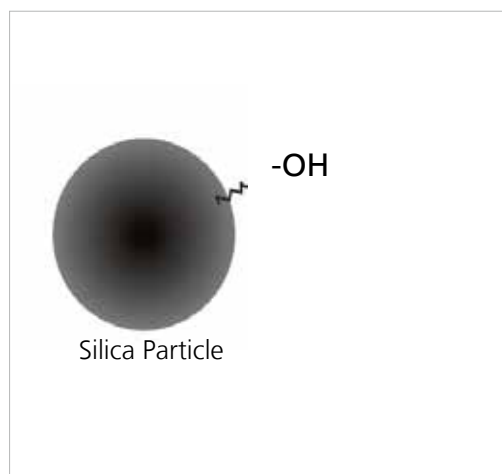
Product Number	Specification	Package
380-00852-03	60 mg / 3 mL	50pcs
380-00852-04	500 mg / 6 mL	30pcs
380-00852-05	30 mg / 1 mL	100pcs
380-00852-06	150 mg / 6 mL	30pcs
380-00852-51	10mg/1mL 96-well plate	1pcs
380-00852-53	30mg/1mL 96-well plate	1pcs



## Normal Phase Cartridge

### SHIMSEN Styra SI / Normal Phase Silica Cartridge

SHIMSEN Styra SI is based on unbonded silica gel particles. The primary interaction available is strong polar interaction due to the silanol groups. It can be used for enrichment of polar compounds from low-polar solvents or removal of polar impurities from non-polar solvents. It is necessary to prevent moisture absorption before use.



**Retention mechanism:** Strong polar interaction

#### Application:

Extraction of compounds with polar groups from lipid samples; Adsorption of interfering substances in pesticide residue analysis.

- Matrix: Spherical silica particles, particle size 50  $\mu\text{m}$ , pore size 60  $\text{\AA}$ , specific surface area 500  $\text{m}^2/\text{g}$
- Function groups: Silicon Hydroxy
- Endcapped: No

#### SHIMSEN Styra SI Product Information:

Product Number	Specification	Package
380-00856-01	5 g / 20 mL	20pcs
380-00856-02	500 mg / 6 mL	30pcs
380-00856-03	500 mg / 3 mL	50pcs
380-00856-04	2 g / 12 mL	20pcs
380-00856-05	200 mg / 3 mL	50pcs
380-00856-06	2000 mg / 6 mL	30pcs
380-00856-07	10 g / 60 mL	10pcs
380-00856-08	1000 mg / 6 mL	30pcs
380-00856-09	100 mg / 1 mL	100pcs

## Normal Phase Cartridge

### SHIMSEN Styra FL-PR / Florisil Cartridge

SHIMSEN Styra FL-PR is based on natural Florisil silica ( $\text{MgO} \bullet \text{SiO}_2$ ) and is used for the recovery or cleanup of polar substances from non-polar solvents. This sorbent is high in polarity and can be used to extract polar compounds from non-polar solutions. The larger particle size (200  $\mu\text{m}$ ) of the sorbent enables fast flow for large sample volumes and is therefore an attractive alternative to silica if the sample matrix is particularly viscous. FL-PR can not only separate chlorinated insecticides, but also be used in AOAC, EPA and other methods. In addition, FL-PR is an excellent replacement for alumina cartridge when the acidic nature of alumina affects the extraction effect.



Florisil

**Retention mechanism:** Polar interaction

**Application:**

Environmental samples and pesticide residue analysis

Food: SHIMSEN Styra FL-PR is suitable for the purification of pesticide residues in crops

- Adsorbent: Magnesium silicate particles with size of 150-200  $\mu\text{m}$
- Function groups: Silicon Hydroxy

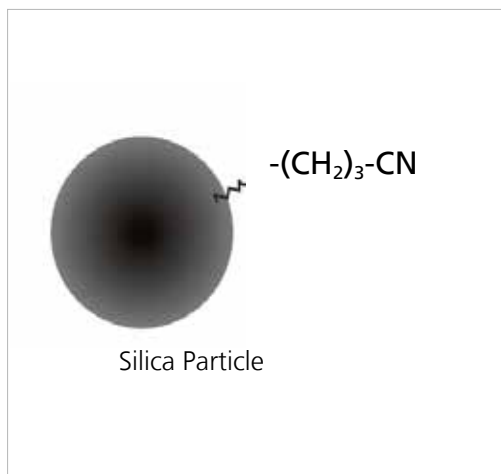
#### SHIMSEN Styra FL-PR Product Information:

Product Number	Specification	Package
380-00862-01	500 mg / 6 mL	30pcs
380-00862-02	500 mg / 3 mL	50pcs
380-00862-03	5 g / 20 mL	20pcs
380-00862-04	2 g / 6 mL	30pcs
380-00862-05	2 g / 12 mL	20pcs
380-00862-06	200 mg / 3 mL	50pcs
380-00862-07	1000 mg / 6 mL	30pcs
380-00862-08	100 mg / 1 mL	100pcs
380-00862-09	10 g / 60 mL	10pcs

## Normal Phase Cartridge

### SHIMSEN Styra CN / Cyano-bonded Silica Cartridge

SHIMSEN Styra CN exhibits both non-polar and polar interactions with target compound. It is a good choice when sorbents such as C18, C8 or Si do not provide the desired selectivity.



**Retention mechanism:** Polar interaction and non-polar interaction

**Application:**

Pesticides, drugs and their metabolites in aqueous samples.

- Matrix: Particle size 50  $\mu m$ , pore size 60  $\text{\AA}$
- Spherical silica particles with a specific surface area of 500  $m^2/g$
- Function groups: Cyanopropyl
- Endcapped: Yes
- Carbon load (C%): 6.5%

#### SHIMSEN Styra CN Product Information:

Product Number	Specification	Package
380-00864-01	500 mg / 3 mL	50pcs
380-00864-02	5 g / 20 mL	20pcs
380-00864-03	200 mg / 3 mL	50pcs
380-00864-04	2 g / 12 mL	20pcs
380-00864-05	1000 mg / 6 mL	30pcs
380-00864-06	100 mg / 1 mL	100pcs
380-00864-07	10 g / 60 mL	10pcs

## Normal Phase Cartridge

### SHIMSEN Styra AL-N / Neutral Alumina Cartridge

SHIMSEN Styra AL-N is packed with neutral alumina ( $\text{Al}_2\text{O}_3$ ) to retain or remove polar compounds. Similar to silica gel, neutral  $\text{Al}_2\text{O}_3$  is a strongly polar sorbent. However, the neutral alumina tends to be slightly more stable under high pH conditions than silica gel. The neutralized surface allows interaction with compounds whose heteroatoms are electronegative (e.g., O, P, S) or with an electron-rich, highly aromatic structure.



Alumina

**Retention mechanism:** Lewis acid-base interaction, polar interaction and ion exchange interaction

#### Application:

SHIMSEN Styra AL-N is used to extract polar or non-polar compounds from both aqueous and non-aqueous solutions, such as sample preparation of malachite green and crystal violet in aquatic products.

- Adsorbent: Neutral  $\text{Al}_2\text{O}_3$  particles with size of 125  $\mu\text{m}$
- pH : 7.5

#### SHIMSEN Styra AL-N Product Information:

Product Number	Specification	Package
380-00865-01	500 mg / 6 mL	30pcs
380-00865-02	500 mg / 3 mL	50pcs
380-00865-03	5 g / 20 mL	20pcs
380-00865-04	250 mg / 3 mL	50pcs
380-00865-05	200 mg / 3 mL	50pcs
380-00865-06	2 g / 12 mL	20pcs
380-00865-07	1000 mg / 6 mL	30pcs
380-00865-08	100 mg / 1 mL	100pcs
380-00865-09	10 g / 60 mL	10pcs

## Normal Phase Cartridge

### SHIMSEN Styra AL-A / Acidic Alumina Cartridge

SHIMSEN Styra AL-A is packed with acidic alumina ( $\text{Al}_2\text{O}_3$ ) to retain or remove polar compounds and acidic compounds. Acidic alumina is a typical Lewis acid with two electrons missing from the aluminum atom. Acid treatment enhances the Lewis acid property of alumina, and results in a weak cationic property, allowing strong interaction with electron-rich compounds and retention of polar compounds and anionic compounds.



Alumina

**Retention mechanism:** Lewis acid-base interaction, polar interaction and ion exchange interaction

**Application:**

Retention of polar compounds and anionic compounds.

- Adsorbent: Acidic  $\text{Al}_2\text{O}_3$  particles with size of 125  $\mu\text{m}$
- pH : 4.5

#### SHIMSEN Styra AL-A Product Information:

Product Number	Specification	Package
380-00867-01	500 mg / 6mL	30pcs
380-00867-02	500 mg / 3 mL	50pcs
380-00867-03	5 g / 20 mL	20pcs
380-00867-04	2 g / 12 mL	20pcs
380-00867-05	1000 mg / 6 mL	30pcs
380-00867-06	100 mg / 1 mL	100pcs
380-00867-07	10 g / 60 mL	10pcs

## Normal Phase Cartridge

### SHIMSEN Styra AL-B / Basic Alumina Cartridge

SHIMSEN Styra AL-B is packed with basic alumina ( $\text{Al}_2\text{O}_3$ ) to retain or remove polar compounds and basic compounds. Basic alumina has anionic properties and cation exchange function, and tends to retain compounds with positive charges or hydrogen bonds. In addition, it can be used to retain electronic samples, such as neutral amines.



Alumina

**Retention mechanism:** Lewis acid-base interaction, polar interaction and ion exchange interaction

**Application:**

Retention of polar compounds and anionic compounds. It is suitable for the detection of Sudan red in hot pepper.

- Adsorbent: Basic  $\text{Al}_2\text{O}_3$  particles with size of 125  $\mu\text{m}$
- pH : 10

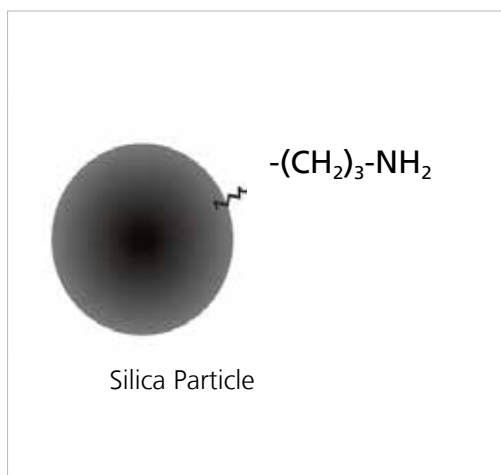
#### SHIMSEN Styra AL-B Product Information:

Product Number	Specification	Package
380-00866-01	500 mg / 3 mL	50pcs
380-00866-02	5 g / 20 mL	20pcs
380-00866-03	2 g / 12 mL	20pcs
380-00866-04	1000 mg / 3 mL	50pcs
380-00866-05	1000 mg / 6 mL	30pcs
380-00866-06	100 mg / 1 mL	100pcs
380-00866-07	10 g / 60 mL	10pcs

## Normal Phase Cartridge

### SHIMSEN Styra NH<sub>2</sub> / Amino Bonded Silica Cartridge

SHIMSEN Styra NH<sub>2</sub> is an amino bonded silica cartridge and can act either as a weak anion exchanger (aqueous solutions) or polar phase sorbent (non-polar organic solutions). When conditioned with a non-polar solvent, e.g., hexane, it tends to form hydrogen bond with any molecule containing -OH, -NH, or -SH functional groups. In an aqueous environment with pH 7.8 or less, it can function as a weak anion exchanger.



**Retention mechanism:** Polar interaction and weak anion exchange

#### Application:

It can be used to separate structural isomers; extract compounds with polar groups from lipid samples; remove polar compounds (such as carbohydrates, pigments), organic acids, and phenols, etc. in pesticide residue analysis.

- Matrix: Particle size 50  $\mu m$ , pore size 60 Å
- Spherical silica particles with a specific surface area of 500 m<sup>2</sup>/g
- Function groups: Cyanopropyl
- Endcapped: No
- Carbon load (C %): 3.5%
- pKa: 9.8 (the pKa of its conjugated acid)

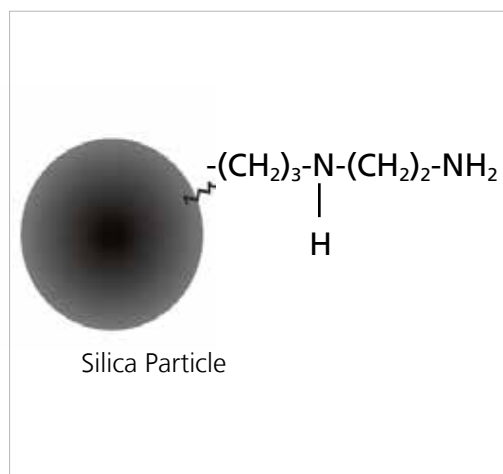
#### SHIMSEN Styra NH<sub>2</sub> Product Information:

Product Number	Specification	Package
380-00861-01	6 g / 60 mL	10pcs
380-00861-02	500 mg / 6 mL	30pcs
380-00861-03	500 mg / 3 mL	50pcs
380-00861-04	5 g / 20 mL	20pcs
380-00861-05	200 mg / 3 mL	50pcs
380-00861-06	2 g / 12 mL	20pcs
380-00861-07	1000 mg / 6 mL	30pcs
380-00861-08	100 mg / 1 mL	100pcs
380-00861-09	10 g / 60 mL	10pcs

## Normal Phase Cartridge

### SHIMSEN Styra PSA / Ethylenediamino Bonded Silica Cartridge

SHIMSEN Styra PSA is based on silica gel particles bonded with ethylenediamino-N-propyl which contain two different amino—the pKa of one is 10.1, and other is 10.9. It is similar to NH<sub>2</sub> cartridge but has stronger ion exchange functionalities. At the same time, PSA can be used to extract metal ion due to the chelation with metal ion.



**Retention mechanism:** Weak anion exchange, polar interaction, chelation

#### Application:

It can be used to separate structural isomers; extract compounds with polar groups from lipid samples, and remove polar compounds (such as carbohydrates, pigments), organic acids, phenols, etc. in pesticide residue analysis.

- Matrix: Particle size 50  $\mu$ m, pore size 60 Å
- Spherical silica particles with a specific surface area of 500 m<sup>2</sup>/g
- Function groups: Ethylenediamine-N-propyl
- Endcapped: No
- Carbon load (C%): 7%
- pKa: 10.1 and 10.9 (the pKa of its conjugated acid)

#### SHIMSEN Styra PSA Product Information:

Product Number	Specification	Package
380-00859-01	500 mg / 6 mL	30pcs
380-00859-02	500 mg / 3 mL	50pcs
380-00859-03	5 g / 20 mL	20pcs
380-00859-04	200 mg / 3 mL	50pcs
380-00859-05	2 g / 12 mL	20pcs
380-00859-06	1000 mg / 6 mL	30pcs
380-00859-07	100 mg / 1 mL	100pcs
380-00859-08	10 g / 60 mL	10pcs



# FEATURES OF SILICA-BASED REVERSED-PHASE CARTRIDGES

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1. The functional groups bonded on the surface of silica gel play a major role in the retention of the target compounds. Based on the types of bonded functional groups, there are three mechanisms by which sorbents retain the target compounds: reversed phase retention, normal phase retention and ion exchange retention.
  2. Bonded silica sorbents are stable from pH 2 to 7.5.
  3. The bonded silica sorbent are rigid, neither shrink nor expand during solvent conversion, and can reach equilibrium rapidly in new solvents.
  4. The matrix of bonded silica sorbents is spherical silica gel with a particle size of 50  $\mu\text{m}$ . The particle size is uniform and its surface is smooth, which reduces the resisting force of the passing solvent. The characteristic pore size of bonded silica sorbents is 60 Å, which are suitable for compounds with molecular weight less than 15,000.
  5. Reverse phase sorbents are endcapped, while normal phase sorbents and ion exchange sorbents are not endcapped.
- 



## Silica-based Reversed-phase Cartridge

### SHIMSEN Styra C18 / Octadecyl Bonded Silica Cartridge

SHIMSEN Styra C18 is an octadecyl bonded silica cartridge and can retain target compounds by non-polar interaction. Highly endcapping of this sorbent inhibits cation exchange interaction caused by silanol groups, resulting in less adsorption of basic compounds.

It is a good choice when non-polar interaction is needed.



**Retention mechanism:** Strong non-polar interaction

#### Application:

Extraction of organic pollutants from water: PAHs, PAEs, PCBs, pesticides, herbicides, phenols, etc.;

Life sciences: extraction of drugs and their metabolites from plasma, serum, and urine;

Extraction of pesticide and veterinary drug residues from food;

Animal and plant extracts: aromatic oils, fat-soluble vitamins, water-soluble vitamins, carbohydrates, organic acids, steroids, etc.;

Desalination of biological macromolecules.

- Matrix: Particle size 50  $\mu\text{m}$ , pore size 60  $\text{\AA}$
- Spherical silica particles with a specific surface area of 500  $\text{m}^2/\text{g}$
- Function groups: Octadecyl
- Endcapped: Yes
- Carbon load (C%): 17%

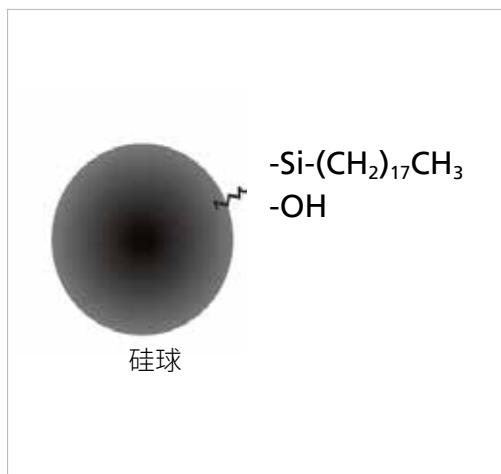
#### SHIMSEN Styra C18 Product Information:

Product Number	Specification	Package
380-00872-01	60 mg / 3 mL	50pcs
380-00872-02	500 mg / 6 mL	30pcs
380-00872-03	500 mg / 3 mL	50pcs
380-00872-04	50 mg / 1 mL	100pcs
380-00872-05	5 g / 20 mL	20pcs
380-00872-06	250 mg / 3 mL	50pcs
380-00872-07	200 mg / 6 mL	30pcs
380-00872-08	200 mg / 3 mL	50pcs
380-00872-09	2 g / 12 mL	20pcs
380-00872-10	100 mg / 6 mL	30pcs
380-00872-11	100 mg / 3 mL	50pcs
380-00872-12	1000 mg / 6 mL	30pcs
380-00872-13	100 mg / 1 mL	100pcs
380-00872-14	10 g / 60 mL	10pcs
380-00872-51	10mg/1mL 96-well plate	1pcs
380-00872-53	30mg/1mL 96-well plate	1pcs

## Silica-based Reversed-phase Cartridge

### SHIMSEN Styra C18-U / Octadecyl Bonded Silica Cartridge

SHIMSEN Styra C18-U is an octadecyl bonded silica cartridge and can retain target compounds by non-polar interaction. The phase is non-encapped which enhances retention of polar compounds.



**Retention mechanism:** Non-polar interaction (primary) , polar interaction (secondary)

#### Application:

C18-U is a non-encapped version of the octadecyl bonded phases. The residual silanols on the surface of the silica gel matrix have polar interaction with polar compounds, which can enhance retention of polar compounds, especially amine compounds (such as tetracycline drugs), and is suitable for the extraction of polar and non-polar compounds.

- Matrix: Particle size 50  $\mu\text{m}$ , pore size 60  $\text{\AA}$
- Spherical silica particles with a specific surface area of 500  $\text{m}^2/\text{g}$
- Function groups: Octadecyl
- Endcapped: No
- Carbon load (C%): 17%

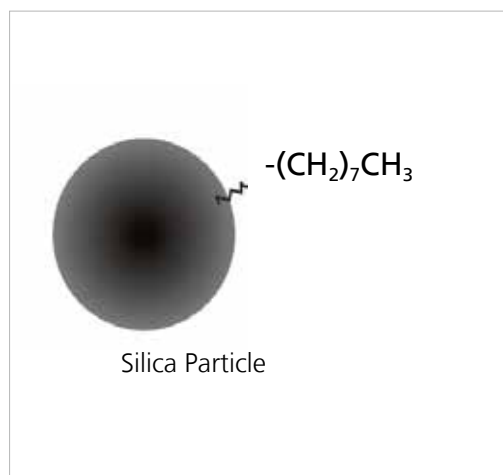
#### SHIMSEN Styra C18-U Product Information:

Product Number	Specification	Package
380-00876-01	60 mg / 3 mL	50pcs
380-00876-02	500 mg / 20 mL	20pcs
380-00876-03	500 mg / 6 mL	30pcs
380-00876-04	500 mg / 3 mL	50pcs
380-00876-05	50 mg / 1 mL	100pcs
380-00876-06	5 g / 20 mL	20pcs
380-00876-07	200 mg / 3 mL	50pcs
380-00876-08	2 g / 12 mL	20pcs
380-00876-09	1000 mg / 6 mL	30pcs
380-00876-10	100 mg / 1 mL	100pcs
380-00876-11	10 g / 60 mL	10pcs

## Silica-based Reversed-phase Cartridge

### SHIMSEN Styra C8 / Octyl Bonded Silica Cartridge

SHIMSEN Styra C8 is an octyl bonded silica cartridge and has weaker non-polar interaction compared to C18. C8 is an excellent replacement for C18 when highly hydrophobic compounds are too strongly retained for effective elution. Highly endcapping of this sorbent inhibits secondary interaction caused by silanol groups, resulting in less adsorption of basic compounds.



**Retention mechanism:** Moderate non-polar interaction

#### Application:

It is suitable for retention of moderate polar compounds, drugs and their metabolites from biological samples, and extraction of peptides from biological samples, etc.

- Matrix: Particle size 50  $\mu\text{m}$ , pore size 60  $\text{\AA}$
- Spherical silica particles with a specific surface area of 500  $\text{m}^2/\text{g}$
- Function groups: Octyl
- Endcapped: Yes
- Carbon load (C %): 11%

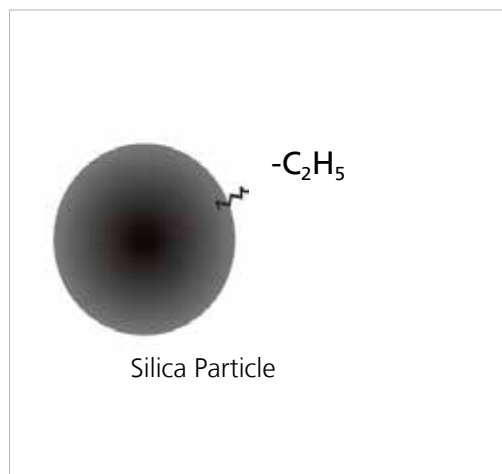
#### SHIMSEN Styra C8 Product Information:

Product Number	Specification	Package
380-00870-01	500 mg / 6 mL	30pcs
380-00870-02	500 mg / 3 mL	50pcs
380-00870-03	5 G / 20 mL	20pcs
380-00870-04	200 mg / 3 mL	50pcs
380-00870-05	2 g / 12 mL	20pcs
380-00870-06	1000 mg / 6 mL	30pcs
380-00870-07	100 mg / 1 mL	100pcs
380-00870-08	10 g / 60 mL	10pcs

## Silica-based Reversed-phase Cartridge

### SHIMSEN Styra C2 / Ethyl Bonded Silica Cartridge

SHIMSEN Styra C2 is an ethyl bonded silica cartridge and has weaker non-polar interaction compared to C8. It is an excellent replacement for C8 when highly hydrophobic compounds are too strongly retained for effective elution. Highly endcapping of this sorbent inhibits secondary interactions caused by silanol groups, resulting in less adsorption of basic compounds. It is an excellent replacement for C8 and C18 when analytes are too strongly retained for effective elution.



**Retention mechanism:** Non-polar interaction (primary) and polar interaction (secondary)

#### Application:

The polarity of C2 group is slightly lower than CN group. SHIMSEN Styra C2 is usually used to extract drugs from plasma and serum samples.

Extraction of drugs and metabolites from blood samples.

- Matrix: Particle size 50  $\mu\text{m}$ , pore size 60  $\text{\AA}$
- Spherical silica particles with a specific surface area of 500  $\text{m}^2/\text{g}$
- Function groups: Ethyl
- Endcapped: Yes
- Carbon load (C%): 2.7%

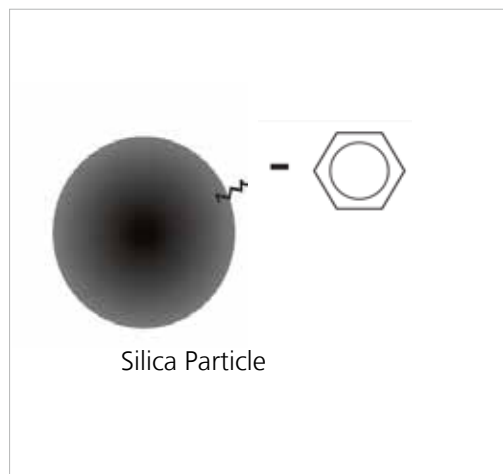
#### SHIMSEN Styra C2 Product Information:

Product Number	Specification	Package
380-00871-01	500 mg / 3 mL	50pcs
380-00871-02	5 g / 20 mL	20pcs
380-00871-03	2 g / 12 mL	20pcs
380-00871-04	1000 mg / 6 mL	30pcs
380-00871-05	100 mg / 1 mL	100pcs
380-00871-06	10 g / 60 mL	10pcs

## Silica-based Reversed-phase Cartridge

### SHIMSEN Styra Ph / Phenyl Bonded Silica Cartridge

SHIMSEN Styra Ph is a phenyl-bonded silica cartridge. It has the same non-polar interaction as C8, and also has the unique  $\pi$ -electron pair interaction due to phenyl. It is a good choice for sample preparation when C8 could not provide the desired selectivity. And it has good selectivity for aromatic compounds with benzene ring.



**Retention mechanism:** Moderate non-polar interaction

#### Application:

Extraction of organic pollutants from water: PAHs, PAEs, PCBs, pesticides, herbicides, phenols, etc.;

Life sciences: such as the extraction of drugs and their metabolites from plasma, serum, and urine; the extraction of pesticides and veterinary drug residues from food;

Animal and plant extracts: aromatic oils, fat-soluble vitamins, water-soluble vitamins, carbohydrates, organic acids, steroids, etc.

- Matrix: Particle size 50  $\mu\text{m}$ , pore size 60  $\text{\AA}$
- Spherical silica particles with a specific surface area of 500  $\text{m}^2/\text{g}$
- Function groups: Phenyl
- Endcapped: Yes
- Carbon load (C %): 8%

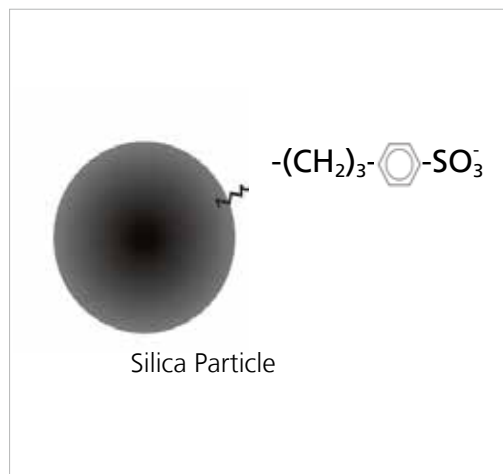
#### SHIMSEN Styra Ph Product Information:

Product Number	Specification	Package
380-00860-01	500 mg / 3 mL	50pcs
380-00860-02	5 g / 20 mL	20pcs
380-00860-03	2 g / 12 mL	20pcs
380-00860-04	1000 mg / 6 mL	30pcs
380-00860-05	100 mg / 1 mL	100pcs
380-00860-06	10 g / 60 mL	10pcs

## Silica-based Ion Exchange Cartridge

### SHIMSEN Styra SCX / Strong Cation Exchange Cartridge

SHIMSEN Styra SCX is a propyl benzenesulfonate bonded silica cartridge and has strong cation exchange functionalities. The presence of the benzene ring in the functional group increases its nonpolar characteristics. Besides, SHIMSEN Styra SCX is suitable for the separation of basic compounds.



**Retention mechanism:** Strong cation exchange interaction and reverse phase interaction (primary); - electron pair interaction (secondary)

#### Application:

Enrichment and purification of alkaline compounds from aqueous samples, biological fluids and organic phases.

- Matrix: Particle size 50  $\mu\text{m}$ , pore size 60  $\text{\AA}$
- Spherical silica particles with a specific surface area of 500  $\text{m}^2/\text{g}$
- Function groups: P-propylbenzene sulfonic acid
- Endcapped: No
- Carbon load (C%): 10.9%
- pKa : <1.0

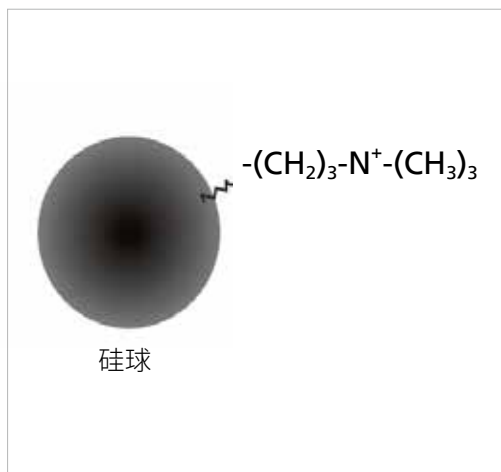
#### SHIMSEN Styra SCX Product Information:

Product Number	Specification	Package
380-00857-01	60 mg / 3 mL	50pcs
380-00857-02	500 mg / 6 mL	30pcs
380-00857-03	500 mg / 3 mL	50pcs
380-00857-04	5 g / 20 mL	20pcs
380-00857-05	2 g / 12 mL	20pcs
380-00857-06	100 mg / 12 mL	20pcs
380-00857-07	1000 mg / 6 mL	30pcs
380-00857-08	100 mg / 1 mL	100pcs
380-00857-09	10 g / 60 mL	10pcs

## Silica-based Ion Exchange Cartridge

### SHIMSEN Styra SAX / Strong Anion Exchange Cartridge

SHIMSEN Styra SAX is a trimethylaminopropyl-bonded silica cartridge and has strong anion exchange functionalities. It can provide selective retention for anionic organic compounds (such as compounds containing carboxyl groups and phenolic hydroxyl groups). The non-polar interactions are weak due to its short carbon chain on the quaternary ammonium group.



**Retention mechanism:** Strong anion exchange interaction (primary), non-polar interaction (secondary)

#### Application:

SHIMSEN Styra SAX is generally used for the retention of weak anionic compounds containing carboxylic acid groups.

Enrichment and purification of anionic organic compounds from aqueous samples, biological fluids and organic phases.

- Matrix: Particle size 50  $\mu\text{m}$ , pore size 60  $\text{\AA}$
- Spherical silica particles with a specific surface area of 500  $\text{m}^2/\text{g}$
- Function groups: Trimethylaminopropyl
- Endcapped: No
- Carbon load (C%): 7.5%
- pKa : Completely dissociated

#### SHIMSEN Styra SAX Product Information:

Product Number	Specification	Package
380-00858-01	500 mg / 6 mL	30pcs
380-00858-02	500 mg / 3 mL	50pcs
380-00858-03	5 g / 20 mL	20pcs
380-00858-04	2 g / 12 mL	20pcs
380-00858-05	100 mg / 1 mL	100pcs
380-00858-06	10 g / 60 mL	10pcs



## Carbon-based and Composite Cartridge

### SHIMSEN Styra GCB / Carbon Black Cartridge



SHIMSEN Styra GCB is packed with planarized carbon, mainly used to remove pigment components from crops. The polarity and ion exchange property of this cartridge are used to purify all kinds of sample substrates. The typical application of this cartridge is the analysis of pesticide residues in agricultural products. Plant samples often contain various pigments, such as chlorophyll, lutein, carotenoids, etc, which need to be removed in order to eliminate its interference with the analysis results and experimental instruments.

**Retention mechanism:** Surface adsorption

#### Application:

Sample cleanup in pesticide residue analysis of vegetables, fruits, tea and plant products.

- Adsorbent: carbon with lamellar structure
- Particle size: 120-400 mesh

#### SHIMSEN Styra GCB Product Information:

Product Number	Specification	Package
380-00869-01	500 mg / 3 mL	50pcs
380-00869-02	500 mg / 6 mL	30pcs
380-00869-03	2 g / 12 mL	20pcs
380-00869-04	250 mg / 3 mL	50pcs
380-00869-05	200 mg / 6 mL	30pcs
380-00869-06	1 g / 6 mL	30pcs
380-00869-07	125 mg / 3 mL	50pcs
380-00869-08	100 mg / 3 mL	50pcs
380-00869-09	100 mg / 1 mL	100pcs

## Carbon-based and Composite Cartridge

### SHIMSEN Styra GCB / PSA Carbon Composite PSA Cartridge SHIMSEN Styra GCB / NH<sub>2</sub> Carbon Composite Amino Cartridge

SHIMSEN Styra GCB/PSA and SHIMSEN Styra GCB/NH<sub>2</sub> are mixed sorbent SPE cartridges consisting of carbon black particles (GCB) and silica gel particles bonded with PSA or NH<sub>2</sub> group. The GCB can remove pigments, while PSA and NH<sub>2</sub> can remove anionic compounds. They are mainly used for the analysis of multi-pesticide residues in food samples.

**Retention mechanism:** Surface adsorption and anion exchange function

#### Application:

They are widely used in the analysis of multiple pesticide residues in food.

#### SHIMSEN Styra GCB/PSA Product Information:

Product Number	Specification	Package
380-00868-01	500 mg / 500 mg / 6 mL	30pcs
380-00868-02	500 mg / 500 mg / 20 mL	20pcs
380-00868-03	250 mg / 250 mg / 6 mL	30pcs

#### SHIMSEN Styra GCB/NH<sub>2</sub> Product Information:

Product Number	Specification	Package
380-00868-04	500 mg / 500 mg / 6 mL	30pcs
380-00868-05	500 mg / 500 mg / 20 mL	20pcs
380-00868-06	250 mg / 250 mg / 6 mL	30pcs

## Carbon-based and Composite Cartridge

### SHIMSEN Styra SAX/PSA / Mixed-Mode Strong Anion Exchange Normal Phase Cartridge

SHIMSEN Styra SAX/PSA is packed with 2 layers of anion exchange packing to enhance the removal of anionic impurities in samples. It is widely used in the analysis of multiple pesticide residues in food.

#### SHIMSEN Styra SAX/PSA Product Information:

Product Number	Specification	Package
380-00877-05	250 mg / 250 mg / 6 mL	30pcs

## Special Cartridge / Glass Cartridge

### SHIMSEN Styra Glass / Glass Cartridge

SHIMSEN Styra Glass is developed specifically for high-purity extraction and suitable for detection on ppt level. The inert glass tube completely eliminates contamination from plasticizers, such as phthalates. The sorbent and the specially cleaned sieve plate used in SHIMSEN Styra glass cartridge are all high-grade to ensure stability and repeatability.

#### SHIMSEN Styra Glass Product Information:

Product Number	Packing	Specification	Package
380-00855-01	HLB	500 mg / 6 mL	30pcs
380-00873-01		200 mg / 6 mL	30pcs
380-00873-02	SI	500 mg / 6 mL	30pcs
380-00873-03		2000 mg / 6 mL	30pcs
380-00873-04	GCB/NH <sub>2</sub>	500 mg / 500 mg / 6 mL	30pcs
380-00873-05	C18	500 mg / 6 mL	30pcs
380-00873-06	FL-PR	1 g / 6 mL	30pcs
380-00873-07		500 mg / 6 mL	30pcs
380-00873-08	PSA/SI	500 mg / 500 mg / 6 mL	30pcs
380-00873-11	PSA	1 g / 6 mL	30pcs
380-00873-12		500 mg / 6 mL	30pcs

## Special Cartridge / Glass Cartridge

### SHIMSEN Styra $\text{Na}_2\text{SO}_4$ / Dehydration / Drying Cartridge



SHIMSEN Styra  $\text{Na}_2\text{SO}_4$  is a special dehydrating column filled with anhydrous sodium sulfate.

## $\text{Na}_2\text{SO}_4$

Ultra-pure anhydrous sodium sulfate

### SHIMSEN Styra $\text{Na}_2\text{SO}_4$ Product Information:

Product Number	Specification	Package
380-00875-01	5 g / 6 mL	30pcs
380-00875-02	500 mg / 3 mL	50pcs
380-00875-03	4 g / 6 mL	30pcs
380-00875-04	3 g / 6 mL	30pcs
380-00875-05	2 g / 6 mL	30pcs
380-00875-06	1 g / 6 mL	30pcs
380-00875-07	1 g / 3 mL	50pcs



## Special Cartridge / Glass Cartridge

### SHIMSEN Styra for special applications

PN	Product Number	Application
380-00877-01	SHIMSEN Styra VD, 2g/12mL, 20pcs	Determination of Vitamins A, D2, D3, and E in Rice Noodles
380-00877-05	SHIMSEN Styra SAX/PSA, 250mg/250mg/6mL, 30pcs	Analysis of Multiple Pesticide Residues in Food Products
380-00877-06	SHIMSEN Styra RES, 6mL, 30pcs	Detection of Resveratrol in Wine
380-00877-07	SHIMSEN Styra RED, 6mL, 30pcs	Quantification of Sudan Red Dyes in Food Products
380-00877-09	SHIMSEN Styra p-NIT, 3mL, 50pcs	Measurement of p-Nitrophenol Levels in Urine Samples
380-00877-10	SHIMSEN Styra PGR, 500mg/6m, 30pcs	Assessment of Plant Growth Regulator Residues in Bean Sprouts
380-00877-12	SHIMSEN Styra PAEs Glass, 6mL, 30pcs	Quantitative Analysis of Multiple Phthalates in Edible Oils
380-00877-14	SHIMSEN Styra MPV, 3g/12mL, 20pcs	Quantification of Multiple Pesticide Residues in Grains and Cereals
380-00877-15	SHIMSEN Styra MER, 350mg/6mL, 30pcs	Detection of Thiomersal (Thimerosal) in Cosmetics
380-00877-16	SHIMSEN Styra MEL, 60mg/3mL, 50pcs	Determination of Melamine Content in Milk and Dairy Products
380-00877-17	SHIMSEN Styra SAX/PSA, 500mg/500mg/6mL, 30pcs	Analysis of High Pesticide Residues in Food
380-00877-18	SHIMSEN Styra DMY, 3mL, 50pcs	Determination of DMH and DEY in Food
380-00877-19	SHIMSEN Styra DICY, 1g/12mL, 20pcs	Detection of Dicyandiamide in Dairy Products
380-00877-20	SHIMSEN Styra CPS, 1.5g/12mL, 20pcs	Determination of Pesticide Residues in Cereals and Grains
380-00877-28	SHIMSEN Styra GLYPHOSATE, 6mL, 30pcs	Determination of Glyphosate and Its Metabolites in Tea

## 96-Well SPE Product

### 96-Well Sample Plate

When biological samples are stored or incubated in standard vessels, most of the analytes may be lost within 24 hours as a result of adsorption of biomolecules to the plastic surface.

SHIMSEN Low-Adsorption (LA) 96-Well Sample plates maximize analytes recovery by reducing sample adsorption to the surface.



#### Features

- High quality pure PP material to reduce adsorption of analytes
- Optimized well geometry for maximum sample recovery
- Conformed to international SBS Standards

#### Application:

- Storage of Polypeptide compounds;
- Oligonucleotides; Alkaline compound;
- Low concentration sample;
- Metal sensitive compounds, etc.

#### SHIMSEN LA Sample Plate Product Information:

Product No.	Product Description	Package
380-00813-01	SHIMSEN 96-Well Plate LA-Sample plate, 2.0mL, U, Round	10
380-00817-01	SHIMSEN 96-Well Plate LA-Sample plate Mat, 2.0mL, Round	10
380-00887-50	SHIMSEN 96-Well Plate LA-Sample plate Mat, 2.0mL, Round	50
380-00888-50	SHIMSEN 96-Well Plate LA-Sample plate, 2.0mL, U, Round	50



## A brief overview of the method of QuEChERS-method

- QuEChERS (Quick, Easy, Cheap, Effective, Rugged and Safe) was originally proposed by the US Department of Agriculture as a sample preparation method in 2003.
- It has been applied to a variety of sample preparations, especially for pesticide residue pretreatment.
- It's simpler, more economical, and faster than traditional methods.

## Principle of EN 15662

The homogeneous sample is extracted with the help of acetonitrile. Samples with low water content (< 80 %) require the addition of water before the initial extraction to get a total of approximately 10 g of water. After addition of magnesium sulfate, sodium chloride and buffering citrate salts, the mixture is shaken intensively and centrifuged for phase separation. An aliquot of the organic phase is cleaned-up by dispersive solid phase extraction (D-SPE) employing bulk sorbents as well as magnesium sulfate for the removal of residual water.

Following clean-up with amino-sorbents (e.g. primary secondary amin sorbent, PSA) extracts are acidified by adding a small amount of formic acid, to improve the storage stability of certain base-sensitive pesticides. The final extract can be directly employed for GC- and LC-based determinative analysis. Quantification is performed using an internal standard, which is added to the extract after the initial addition of acetonitrile.

# The Procedure of QuEChERS-method

## AOAC 2007.01 Method

Weigh 15g Homogenized sample,  
then add 15mL acetonitrile with 1% Acetic acid (V/V) ,  
6g MgSO<sub>4</sub>+1.5g NaOAc+ Internal standards solution.

Shake or Vortex vigorously for 1min,  
centrifuge > 1500x g, 1min.

Transfer 1mL or 8mL Supernatant to the dSPE Tube  
depending on the dSPE specification.  
Shake or Vortex vigorously for 1min, and then  
centrifuge > 1500x g, 1min.

## EN 15662 Method

Weigh 10g Homogenized sample <sup>①</sup>,  
then add 10mL acetonitrile and internal standards.  
Shake or Vortex vigorously for 1min.  
(If the sample's water content is <80%,  
water must be added after  
Homogenization, please see the following  
EN15662:2008 (E) 5.2 <sup>②</sup>)

Add extraction salts (4g MgSO<sub>4</sub>, 1g NaCl, 1g  
TSCD, 0.5g DHS) into the above sample extraction  
solution. Shake or vortex vigorously for 1min, and  
then centrifuge > 3000x g, 5min.

Transfer 1mL or 6mL Supernatant to the dSPE  
Tube depending on the dSPE specification. Shake  
or Vortex vigorously for 1min,  
and then centrifuge > 3000x g, 5min.

**Dilute, solvent exchange or evaporate as necessary for  
GC/MS-MS or LC/MS-MS Analysis**

① The sample size depends on the sample matrix: Fruit and vegetable samples, sampled at 10g ± 0.1g; Grain and honey samples, sampled at 5g ± 0.05g; Tea and spices, sampled at 2g ± 0.03g.

② If the water content of the sample is <80%, a sufficient amount of cold water (<4 °C) needs to be added before the sample is homogenized. The water content of common samples and the amount of water that needs to be added, Please refer to EN15662:2008(E)5.2

③ TSCD-sodium citrate, DHS-disodium hydrogen citrate





## Products for AOAC 2007.01-Method

Code Number	Product Name	Package
380-00151	Extraction Salts with 50 mL Centrifuge Tube, 6 g MgSO <sub>4</sub> , 1.5 g NaOAc	50/p
380-00152	Extraction Salts Packets only, 6 g MgSO <sub>4</sub> , 1.5 g NaOAc	50/p
380-00990-05	15 mL, 400 mg PSA, 1200 mg MgSO <sub>4</sub>	50/p
380-00990-07	15 mL, 400 mg PSA, 400 mg C18, 1200 mg MgSO <sub>4</sub>	50/p
380-00990-08	15 mL, 400 mg PSA, 400 mg C18, 400 mg GCB, 1200 mg MgSO <sub>4</sub>	50/p
380-00990-10	15 mL, 400 mg PSA, 400 mg C18, 200 mg GCB, 1200 mg MgSO <sub>4</sub>	50/p
380-00990-17	2 mL, 50 mg PSA, 150 mg MgSO <sub>4</sub>	100/p
380-00990-18	2 mL, 50 mg PSA, 50mg C18, 150 mg MgSO <sub>4</sub>	100/p
380-00990-19	2 mL, 50 mg PSA, 50 mg GCB, 150 mg MgSO <sub>4</sub>	100/p
380-00990-20	2 mL, 50 mg PSA, 50 mg C18, 50 mg GCB, 150 mg MgSO <sub>4</sub>	100/p

## Products for EN 15662-Method

Code Number	Product Name	Package
380-00148	Extraction Salts with 50 mL Centrifuge Tube, 4 g MgSO <sub>4</sub> , 1 g NaCl, 0.5 g DHS, 1 g TSCD	50/p
380-00149	Extraction Salts Packets only, 4 g MgSO <sub>4</sub> , 1 g NaCl, 0.5 g DHS, 1 g TSCD	50/p
380-00990-01	15 mL, 150 mg PSA, 15 mg GCB, 900 mg MgSO <sub>4</sub>	50/p
380-00990-02	15 mL, 150 mg PSA, 900 mg MgSO <sub>4</sub>	50/p
380-00990-03	15 mL, 150 mg PSA, 15 mg CGB, 885 mg MgSO <sub>4</sub>	50/p
380-00990-04	15 mL, 150 mg PSA, 45 mg CGB, 900 mg MgSO <sub>4</sub>	50/p
380-00990-06	15 mL, 150 mg PSA, 150 mg C18, 900 mg MgSO <sub>4</sub>	50/p
380-00990-21	2 mL, 25 mg PSA, 150 mg MgSO <sub>4</sub>	100/p
380-00990-22	2 mL, 25 mg PSA, 25 mg C18, 150 mg MgSO <sub>4</sub>	100/p
380-00990-23	2 mL, 25 mg PSA, 2.5 mg CGB, 150 mg MgSO <sub>4</sub>	100/p
380-00990-24	2 mL, 25 mg PSA, 7.5 mg CGB, 150 mg MgSO <sub>4</sub>	100/p

## Ceramic homogenizer

Code Number	Product Name	Package
380-00169	Ceramic homogenizer, Compatible with 2 mL dSPE purification tube	100/p
380-00170	Ceramic homogenizer, Compatible with 15 mL dSPE purification tube	100/p
380-00171	Ceramic homogenizer, Compatible with 50 mL extraction tube	100/p

## Product for determination of various pesticide residues in traditional Chinese medicine of 2015 Chinese Pharmacopoeia

Code Number	Product Name	Package
380-00151	Extraction Salts with 50 mL Centrifuge Tube 6 g MgSO <sub>4</sub> , 1.5 g NaOAc	100/p
380-00990-09	15 mL PSA / C18 / GCB / Silica dSPE, 300 mg PSA, 300 mg C18, 90 mg GCB, 300 mg Silica, 900 mg MgSO <sub>4</sub>	100/p
380-00990-11	15 mL, 300 mg PSA, 100 mg C18, 1200 mg MgSO <sub>4</sub>	100/p

## Product for GB 23200.113-2018

Code Number	Product Name	Package
380-00148	Extraction Salts with 50 mL Centrifuge Tube, 4 g MgSO <sub>4</sub> , 1 g NaCl, 0.5 g DHS, 1 g TSCD	50/p
380-00149	Extraction Salts Packets only, 4 g MgSO <sub>4</sub> , 1 g NaCl, 0.5 g DHS, 1 g TSCD	50/p
380-00151	Extraction Salts with 50 mL Centrifuge Tube, 6 g MgSO <sub>4</sub> , 1.5 g NaOAc	50/p
380-00152	Extraction Salts Packets only, 6 g MgSO <sub>4</sub> , 1.5 g NaOAc	50/p
380-00990-02	15 mL, 150 mg PSA, 900 mg MgSO <sub>4</sub>	50/p
380-00990-03	15 mL, 150 mg PSA, 15 mg GCB, 885 mg MgSO <sub>4</sub>	50/p
380-00990-07	15 mL, 400 mg PSA, 400 mg C18, 1200 mg MgSO <sub>4</sub>	50/p
380-00990-10	15 mL, 400 mg PSA, 40 mg C18, 200 mg GCB, 1200 mg MgSO <sub>4</sub>	50/p

## Product for GB 23200.121-2021

Code Number	Product Name	Package
380-00148	Extraction Salts with 50 mL Centrifuge Tube, 4 g MgSO <sub>4</sub> , 1 g NaCl, 0.5 g DHS, 1 g TSCD	50/p
380-00149	Extraction Salts Packets only, 4 g MgSO <sub>4</sub> , 1 g NaCl, 0.5 g DHS, 1 g TSCD	50/p
380-00151	Extraction Salts with 50 mL Centrifuge Tube, 6 g MgSO <sub>4</sub> , 1.5 g NaOAc	50/p
380-00152	Extraction Salts Packets only, 6 g MgSO <sub>4</sub> , 1.5 g NaOAc	50/p
380-00990-10	15 mL, 400 mg PSA, 400 mg C18, 200 mg GCB, 1200 mg MgSO <sub>4</sub>	50/p
380-00990-12	15 mL, 30 mg PSA, 900 mg MgSO <sub>4</sub>	50/p
380-00990-13	15 mL, 30 mg PSA, 15 mg GCB, 900 mg MgSO <sub>4</sub>	50/p
380-00990-14	15 mL, 400 mg C18, 80 mg PSA, 1200 mg MgSO <sub>4</sub>	50/p
380-00990-15	15 mL, 400 mg C18, 40 mg PSA, 1200 mg MgSO <sub>4</sub>	50/p
380-00990-16	15 mL, 30 mg PSA, 300 mg C18, 900 mg MgSO <sub>4</sub>	50/p

## Supplementary explanation 1:

- PSA is mainly used to remove impurities such as sugars, fatty acids, organic acids and anthocyanins in the sample matrix;
- C18 is mainly used to remove lipids and non-polar interference substances in the sample matrix;
- GCB (carbon black) is mainly used to remove pigments, sterols, non-polar substances;

## Supplementary explanation 2:

- 2mL purification tube is suitable for transferring 1mL extraction solution;
- 15mL purification tube is suitable for transferring 6-8mL extraction solution;

## Supplementary explanation 3:

Functions of Ceramic homogenizer

1. Excess anhydrous MgSO<sub>4</sub> needs to be added during the extraction and purification process. The ceramic protons can effectively prevent excessive salt agglomeration.
2. During oscillation and centrifugation, the ceramic homogenizer accelerates the diffusion of the adsorbent for better extraction of the purified sample.

## Dispersive- solid: phase extraction (dSPE)

Sample Type	Example	Method	Contents (mg)				Product Information		
			MgSO <sub>4</sub>	PSA	C18	GCB	Vial Volume (ml)	Pack Size	Part Number
			Removes						
			Excess water	Sugars, ffty acids, organic acids, anthocanins	Upids non- polar interferences	Pigments, sterols, nonpolar substances			
General fruits and vegetables	Celery, head lettuce, cucumber, melon	AOAC 2007.01	150	50	/	/	2	100 pcs	380-00990-17
			1200	400	/	/	15	50 pcs	380-00990-53
		EN 15662	150	25	/	/	2	100 pcs	380-00990-21
			900	150	/	/	15	50 pcs	380-00990-35
Food with fats and waxes	Citrus fruits, cereals, avocado, nuts, seeds, dairy products	AOAC 2007.01	150	50	50	/	2	100 pcs	380-00990-18
			1200	400	400	/	15	50 pcs	380-00990-38
		EN 15662	150	25	25	/	2	100 pcs	380-00990-22
			900	150	150	/	15	50 pcs	380-00990-49
Pigmented fruits and vegetables	Carrot, mango, sweet potatoes, tomatoes	AOAC 2007.01	150	50	/	50	2	100 pcs	380-00990-19
			150	50	50	50	2	100 pcs	380-00990-20
			1200	400	400	400	15	50 pcs	380-00990-60
		EN 15662	150	25	/	2.5	2	100 pcs	380-00990-23
			885	150	/	15	15	50 pcs	380-00990-34
			900	150	/	15	15	50 pcs	380-00990-52
Highly pigmented fruits and vegetables	Red peppers, spinach, chive, lamb's lettuce, spinach, blueberries	EN 15662	150	25	/	7.5	2	100 pcs	380-00990-24
			900	150	/	45	15	50 pcs	380-00990-45
General Purpose	Wide range of commodities, including fatty and pigmented fruits and vegetables	/	150	50	50	7.5	2	100 pcs	380-00990-26

MgSO<sub>2</sub> Magnesium sulfate, PSA: Primary secondary amine sortbent, GCB: Carbon black.

If you require products with other specifications or components, please consult with SGLC for customization options.



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