

FUJI SILYSIA CHEMICAL

# CHROMATOREX

*Silica gel* for chromatography



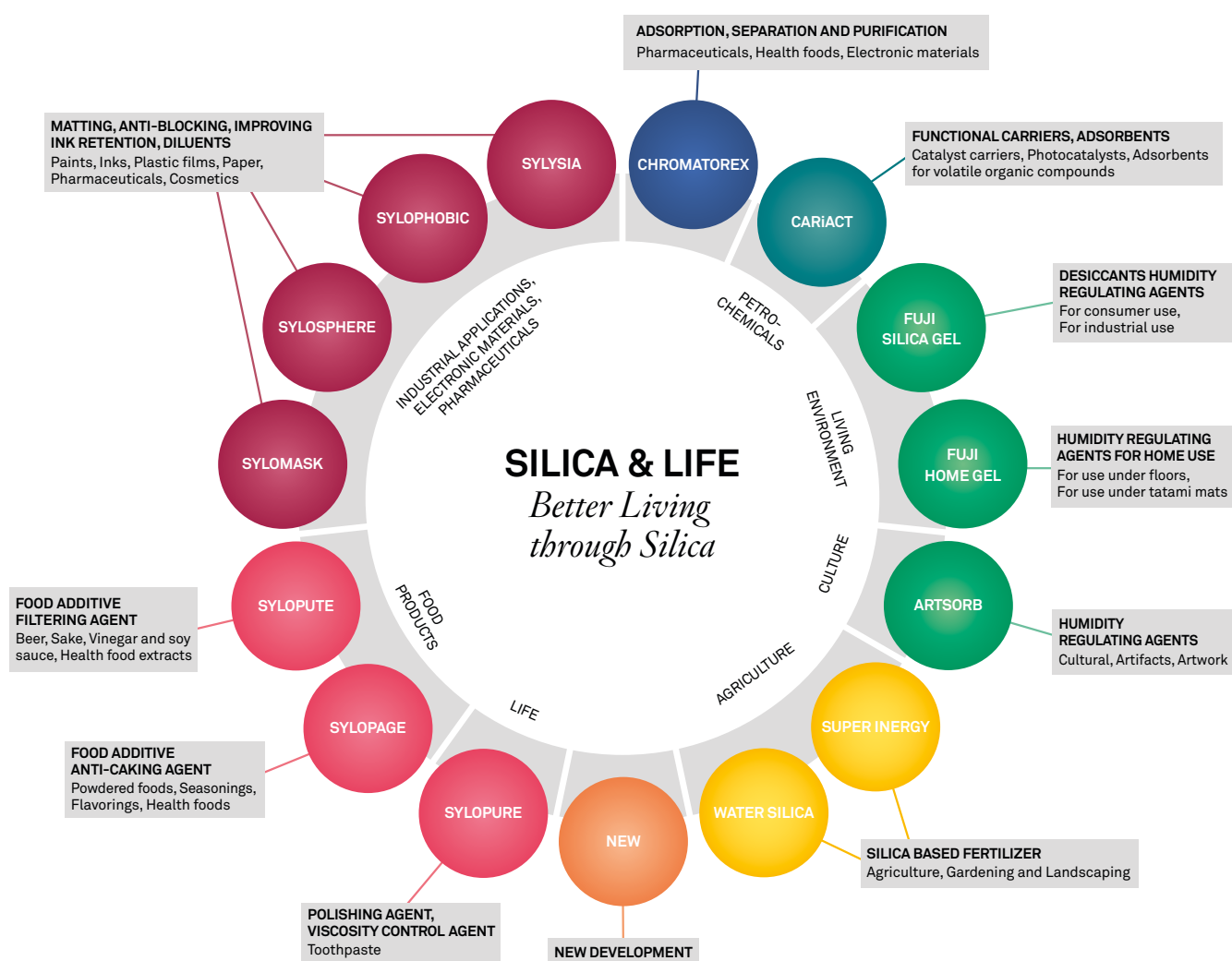
# BUSINESS FOCUS

**Fuji Silysia Chemical Ltd.** was established in 1965, based on a solid foundation since 1932 with the manufacture of sodium silicate under the company name Takahashi Water Glass Manufacturer. Ever since 1965, Fuji Silysia Chemical Ltd. has been devoted to the development of specialty silica gels for many industrial applications.

Our main products have earned a stellar reputation because of their quality, and each occupies the largest share in its

respective market. Fuji Silysia Chemical Ltd. believes that the application of silica will spread even further into various fields as industrial chemical technology develops.

Silica has enormous future growth potential. In order to meet the needs of the next generation, we are now stressing the development of innovative products which can immediately respond to novel situations in an ever-changing world.



# THE SILICA NETWORK

*One Application, One Grade, Chromatorex*



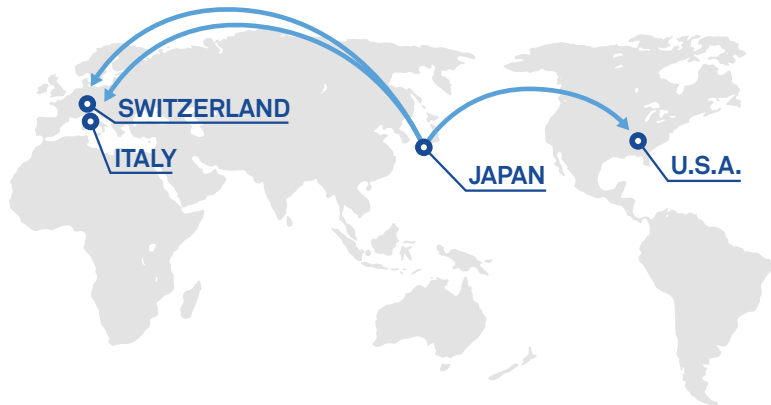
Hyuga, Japan



Greenville, NC, USA



Hyuga, Japan



## JAPAN

*3 Manufacturing Plants  
1 Technical Center*

## WORLD

*2 Manufacturing Plants*

Silica gel is the most widely used substrate for **Liquid Chromatography** stationary phases. Its physical and chemical properties make it suitable for a wide variety of analytical and preparative separations.

Silica gel also provides outstanding characteristics regarding selectivity, capacity, and efficiency for all types of chromatography.

**Spherical** silica gels consist of rigid beads, manufactured by dry or wet processes, capable of withstanding high flow rate and high pressure.

**Granular** (or irregular) silica gels are produced by batch gelling, and then milled to obtain small particles, and these

products are robust only at small pore sizes. Granular silica gels are widely used in industrial separations and are economical for single use applications.

Silica gel surfaces exhibit high chemical activity with surface hydroxyl groups determining adsorption characteristics. It also provides an excellent support for chemically bonded functional groups.

Of the 14 product lines manufactured by Fuji Silysia Chemical Ltd., **Chromatorex** is the chromatography product line covering all fields of liquid chromatography from HPLC / UHPLC, flash, semi-preparative, and preparative to pilot and industrial. Fuji Silysia Chemical Ltd. has production capacity capable of meeting any scale-up size.

# CHROMATOREX

*A unique source for Liquid Chromatography  
Stationary Phases with the widest product range covering*

## HPLC ANALYTICAL GRADES

*For HPLC, U-HPLC, SFC, Capillary LC*

## HPLC SEMI- PREPARATIVE & FLASH GRADES

*For semiprep HPLC and SFC*

## PREPARATIVE & FLASH GRADES

*For Flash LC, SFC and gravity LC*

## INDUSTRIAL GRADES

*For low pressure LC, gravity mode  
and batch adsorption LC*

*What makes  
the difference?*

### SILICA STRUCTURE

- › Surface Area within the Pores
- › Volume within the Pores
- › Pore Size and Pore Size Distribution
- › Particle Size and Particle Size Distribution

### SILICA CHEMISTRY

- › Silanol Composition
- › Silanol Frequency and Density
- › Type and 'Homogeneity' of Si-OH
- › Silica Surface Acidity

### BONDING CHEMISTRY

- › Type of Functional Group
- › Bonding Process Method
- › Bonded Group Concentration/Density

### LC VARIOUS MODES

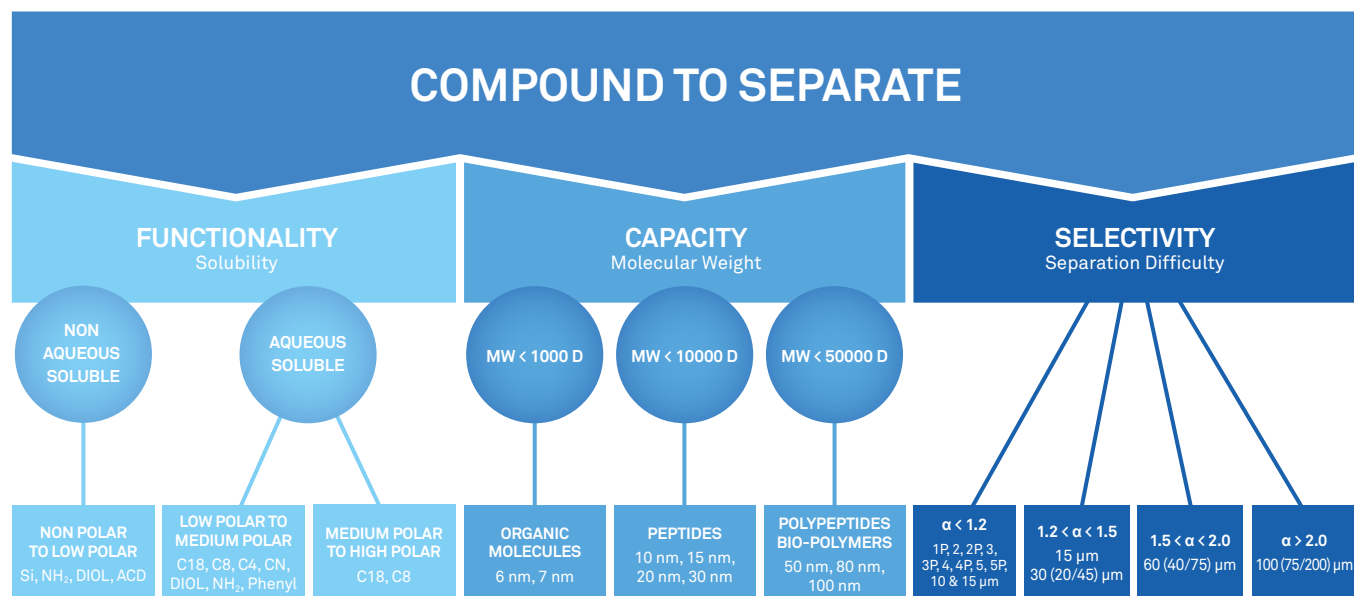
- › NP-Mode on bare & bonded silica
- › RP-Mode on wide range of hydrophobicity
- › HILIC-Mode & IEC-Mode
- › Scavengers





# HOW TO SELECT THE RIGHT PRODUCT

The selection of the right stationary phase for liquid chromatography is dictated by 3 key factors:



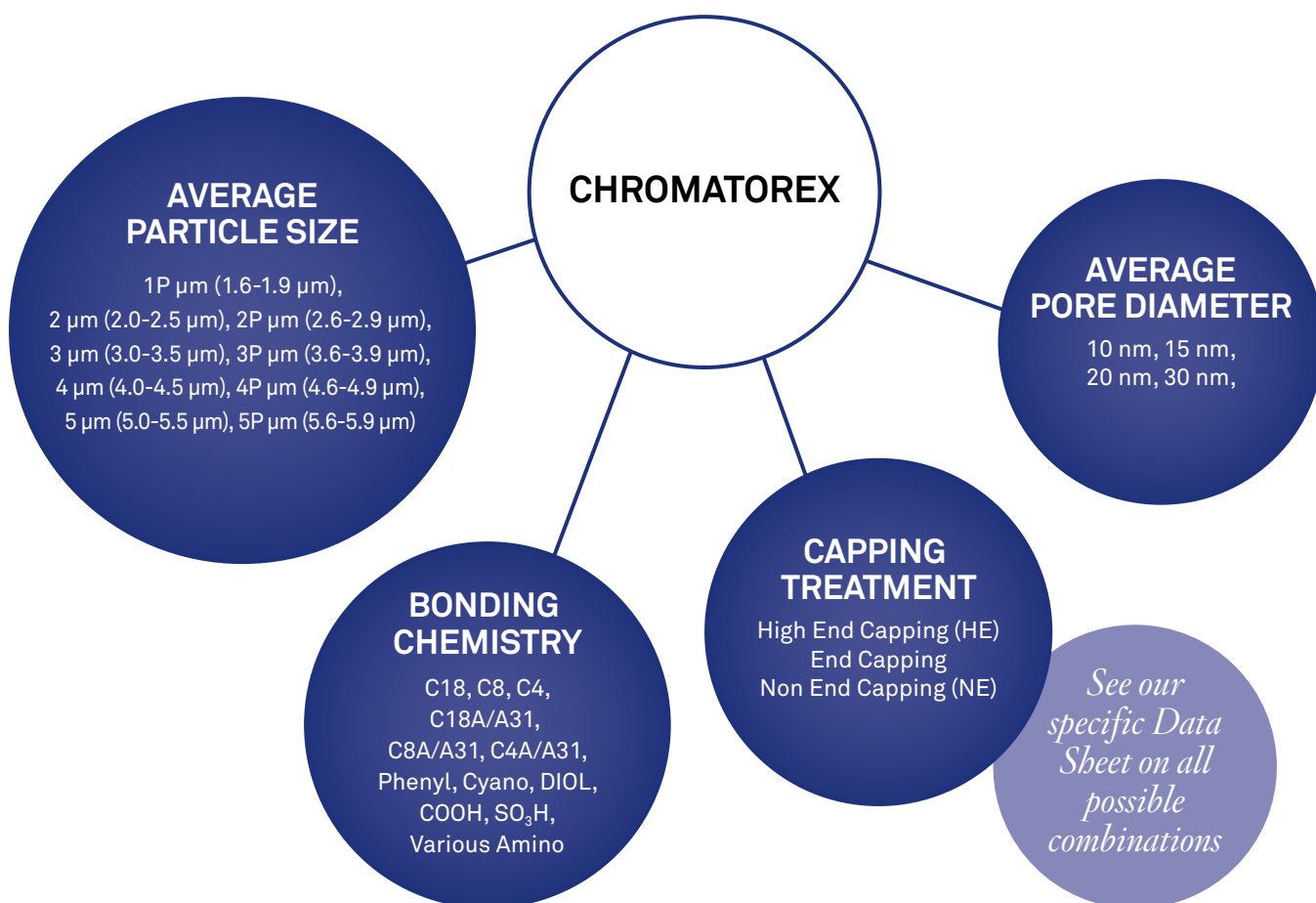
*Solubility,  
molecular  
weight and  
difficulty of  
separation*

Phase	Hydrophobic	Hydrophobic Retention	Hydrophilic	Extremely Hydrophilic	Acidic	Basic	IEX
C18---NE	✓✓	✓✓	✓✓	✓✓	✓	✓	✓
C18	✓✓	✓✓✓	✓✓	✓	✓✓	✓✓	✗
C18---HE	✓✓✓	✓✓✓	✓✓	✓	✓✓✓	✓✓✓	✗
C18---TNE	✓✓	✓✓	✓✓✓	✓✓✓	✓	✓	✓
C18---T	✓✓✓	✓✓✓	✓✓	✓✓	✓✓	✓✓	✗
C18---THE	✓✓✓	✓✓✓	✓	✓	✓✓✓	✓✓✓	✗
C18---A	✓	✓	✓✓✓	✓✓✓	✓	✓	✗
C18---A31	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✗
C8	✓✓	✓✓	✓✓	✓	✓	✓	✗
C8---HE	✓✓✓	✓✓✓	✓	✓	✓	✓✓	✗
C8---A/A31	✓	✓	✓✓✓	✓✓✓	✓	✓	✗
Phenyl	✓✓	✓✓	✓✓	✓	✓	✓	✗
C4	✓	✓	✓✓	✓	✓	✓	✗
C4---HE	✓✓	✓✓	✓	✓	✓	✓✓	✗
C4---A/A31	✓	✓	✓✓✓	✓	✓	✓	✗
Cyano	✓	✓	✓✓	✓	✓	✓	✗
DIOL	✓	✗	✓✓	✓	✓	✓	✗
Amino	✓	✗	✓✓✓	✓✓	✗	✓✓✓	✓
DNH	✓	✗	✓✓✓	✓✓	✗	✓✓✓	✓✓
PEI	✓	✓	✓✓✓	✓✓✓	✗	✓✓✓	✓✓✓
ARG	✓	✓	✓✓✓	✓✓✓	✓✓✓	✓	✓✓✓
COOH	✓	✗	✓	✓	✓	✗	✓
SO <sub>3</sub> H	✓	✗	✓	✓	✓✓	✗	✓✓

## PRODUCT RANGE

# HPLC ANALYTICAL GRADES

Super Pure Spherical (SPS) silica product line is dedicated to analytical **HPLC** and **UHPLC** where high efficiency and high mechanical strength is required.



## Features & Benefits

- › SPS purity of SiO<sub>2</sub> is higher than 99.99%
- › Selection of particle sizes to optimize efficiency
- › Tight distribution of particle sizes and spherical particle shape to reduce back-pressure
- › Lot-to-Lot consistency for reproducible performance
- › Superior pressure strength
- › Consistent and reproducible retention times to allow direct scale-up from laboratory through process applications
- › Large bulk quantities for all applications available, secured lots offered for process use

## PRODUCT RANGE

# HPLC SEMI-PREPARATIVE & FLASH GRADES

**Flash chromatography** is a quick and easy way to separate complex mixtures of compounds.

The silica packed in flash cartridges (or disposable columns) is specifically designed to increase cartridge efficiency while exhibiting moderate back-pressure; and therefore improving resolution.

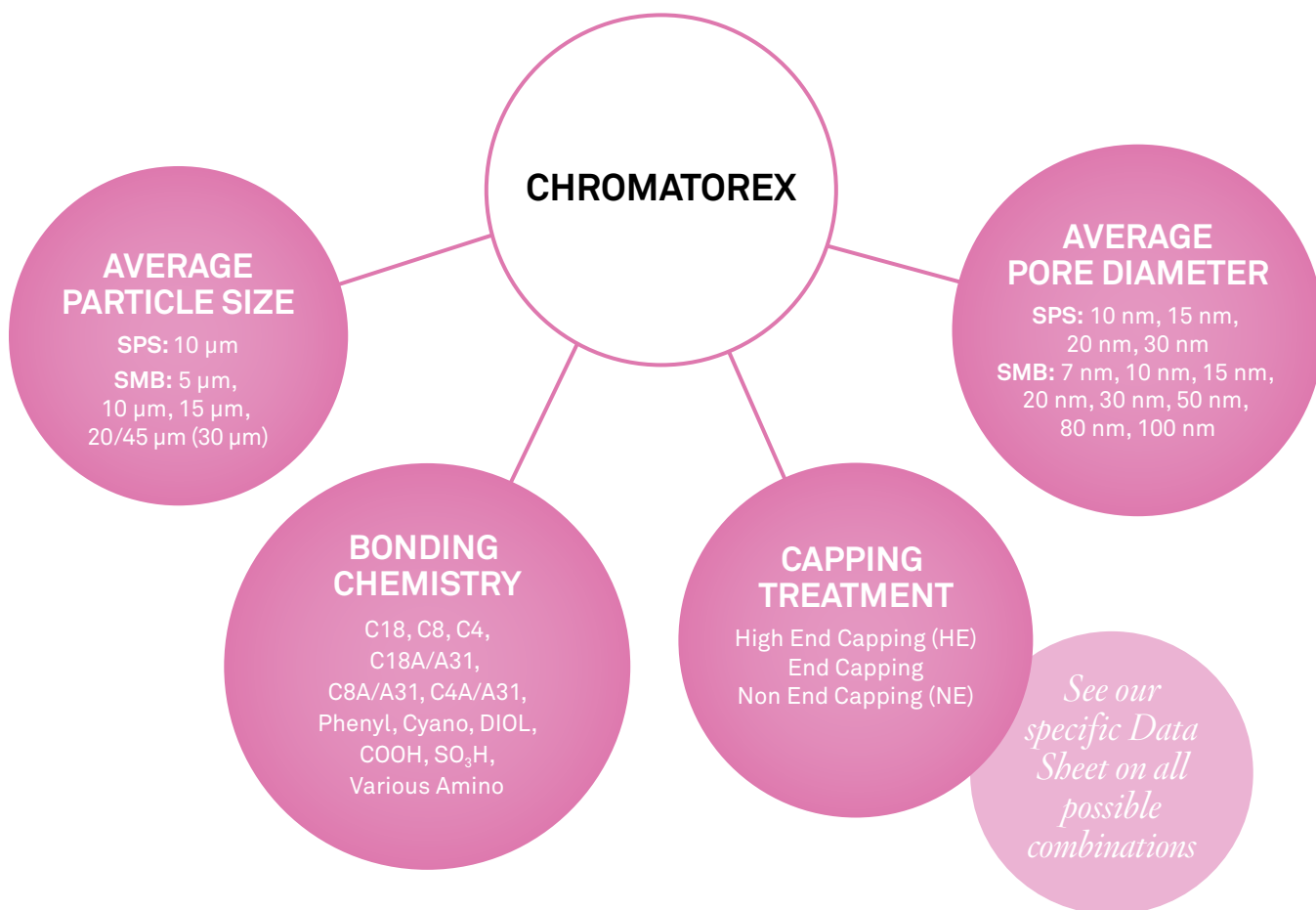
Fuji Silysia Chemical Ltd. developed silica for highly efficient flash chromatography using 20/45  $\mu\text{m}$  and 15  $\mu\text{m}$  particles.

For HPLC semi-preparative chromatography, we offer key products such as SPS 10  $\mu\text{m}$  and SMB 10  $\mu\text{m}$ .

In some case, where the separation is extremely difficult, a SMB 5  $\mu\text{m}$  will be the preferable choice.

All these bare silicas can be provided with a large range of bonding chemistries as mentioned here below.

Other bonding on request.



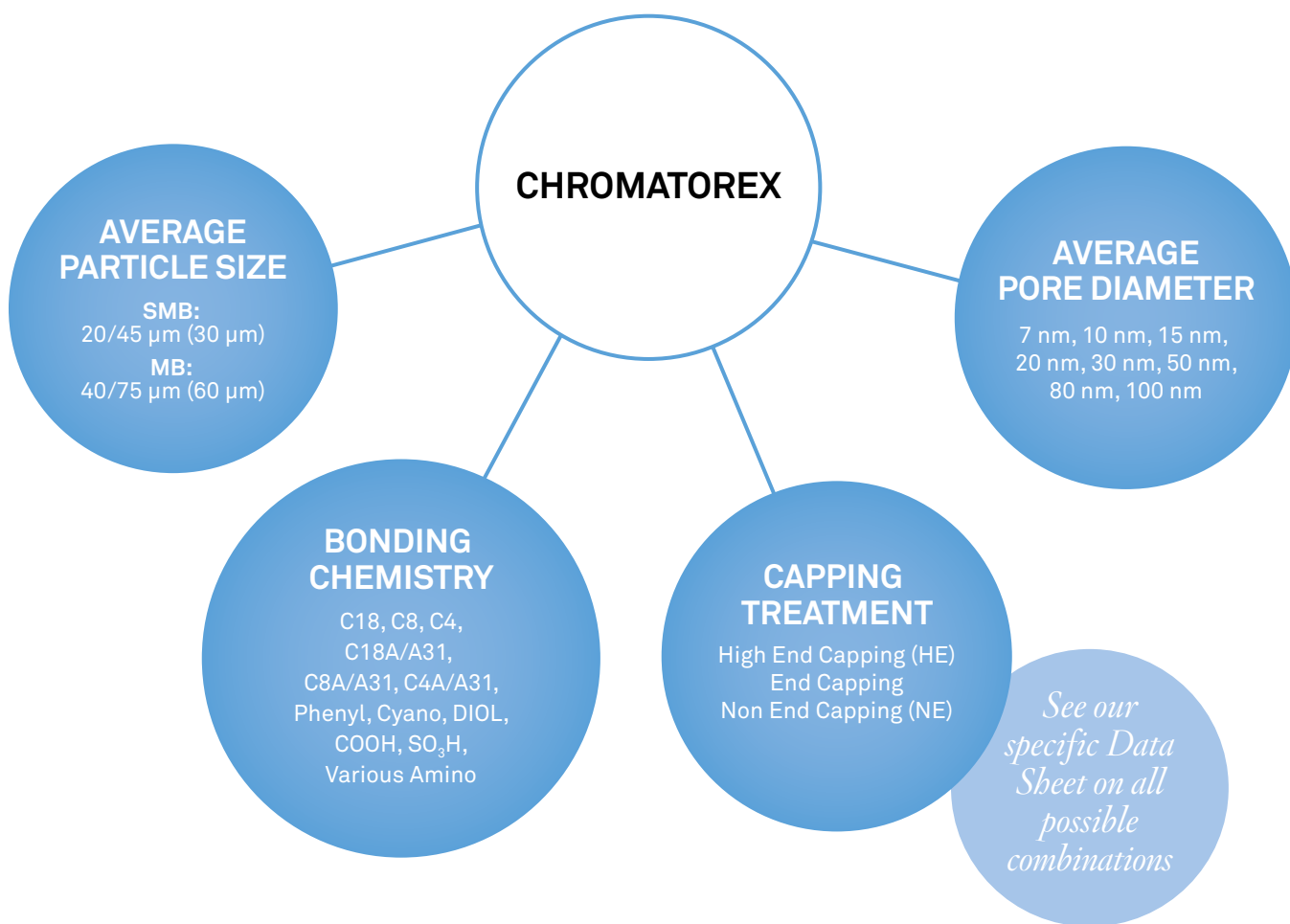
## PRODUCT RANGE

# PREPARATIVE & FLASH GRADES

The Super Micro-Beads (SMB) range, the backbone of our spherical product line for many years, is fully dedicated to preparative HPLC, in particular for DAC columns. The SMB line offers significant advantages including **easy packing**, **high efficiency**, and

**high capacity**, thus offering **economic advantages for large-scale processes**.

This product range is also used in great scale for simple and easy flash chromatography.



## Features & Benefits

- › Wide selection of pore sizes to optimize capacity
- › Selection of particle sizes to optimize efficiency
- › Narrow particle size distribution to reduce pressure
- › Lot-to-lot consistency for reproducible performance
- › Bulk quantities for large-scale applications, no scale-up limitation, secured lots offered for process use





## PRODUCT RANGE

# INDUSTRIAL LC GRADES

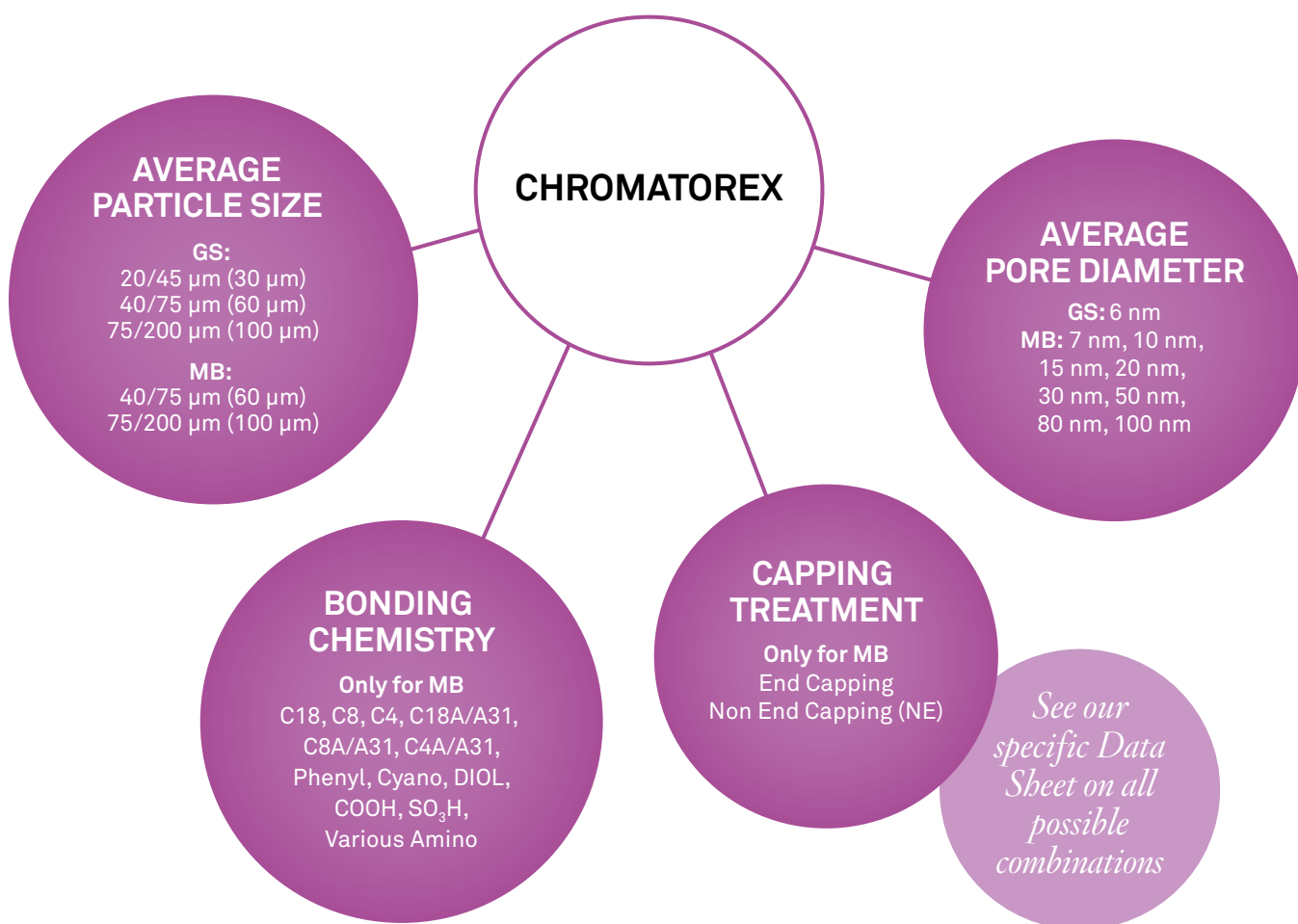
**Industrial Liquid Chromatography** plays an essential role in many industrial sectors, this technique is used in the chemical, agrochemical, cosmetic, veterinary, pharmaceutical, etc., to purify natural extracts, organic intermediates, drug substances, etc...

When processing chemicals, purification steps are crucial passages in the production, for example, active principles leading to commercial drugs that must contain less than 1% total impurities.

In many applications, the quantities to be purified are very important and this has led to the development of large industrial chromatography columns that can contain

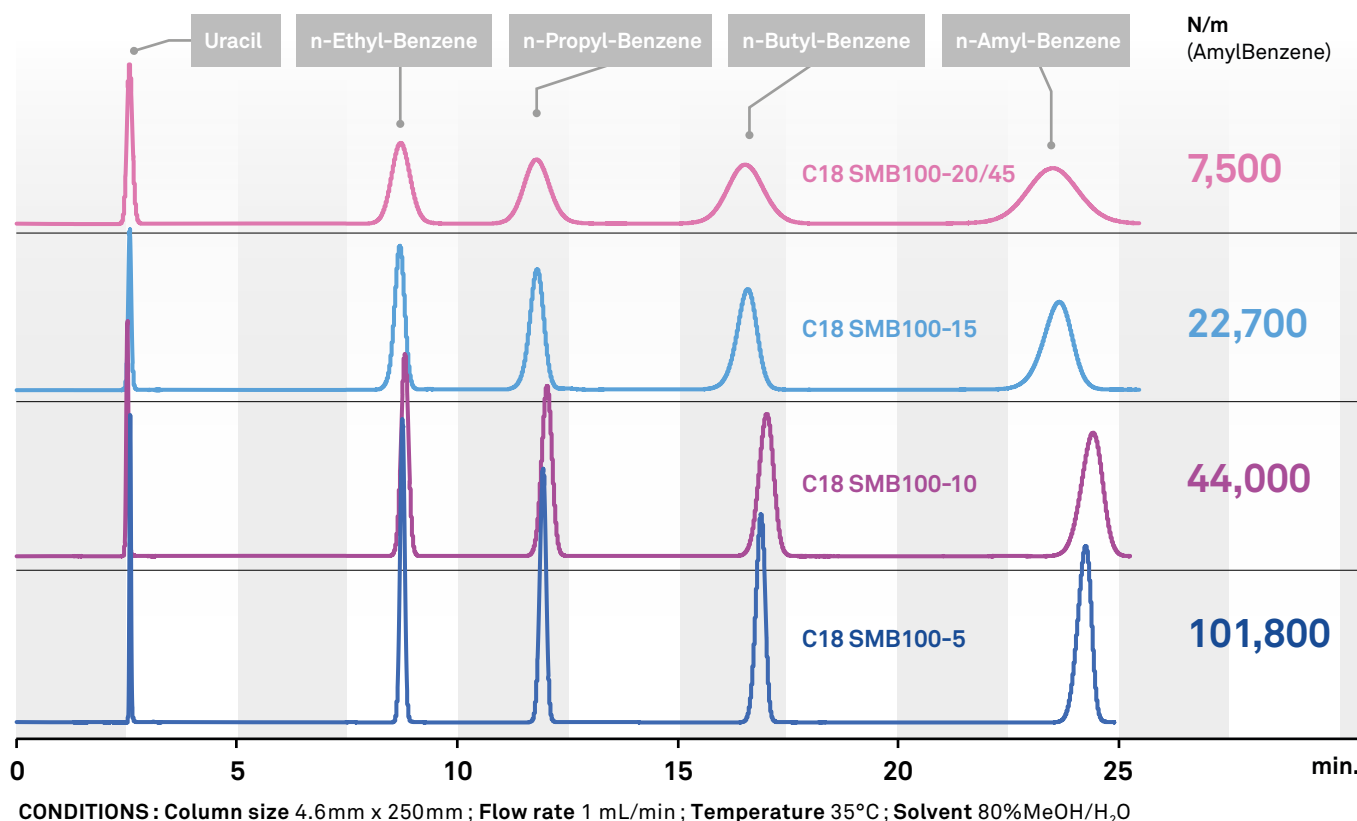
several tens to hundreds of kilograms of stationary phases whose physical and chemical characteristics must be particularly well suited to the purification of the target.

For this Fuji Silysia Chemical Ltd., a global producer of silica and bonded silica has a large number of stationary phases available from kilogram to multi-ton production. This allows us to offer a range of stationary phases optimized and suitable in terms of type and bonding density, particle size, pore diameter and pore volume.

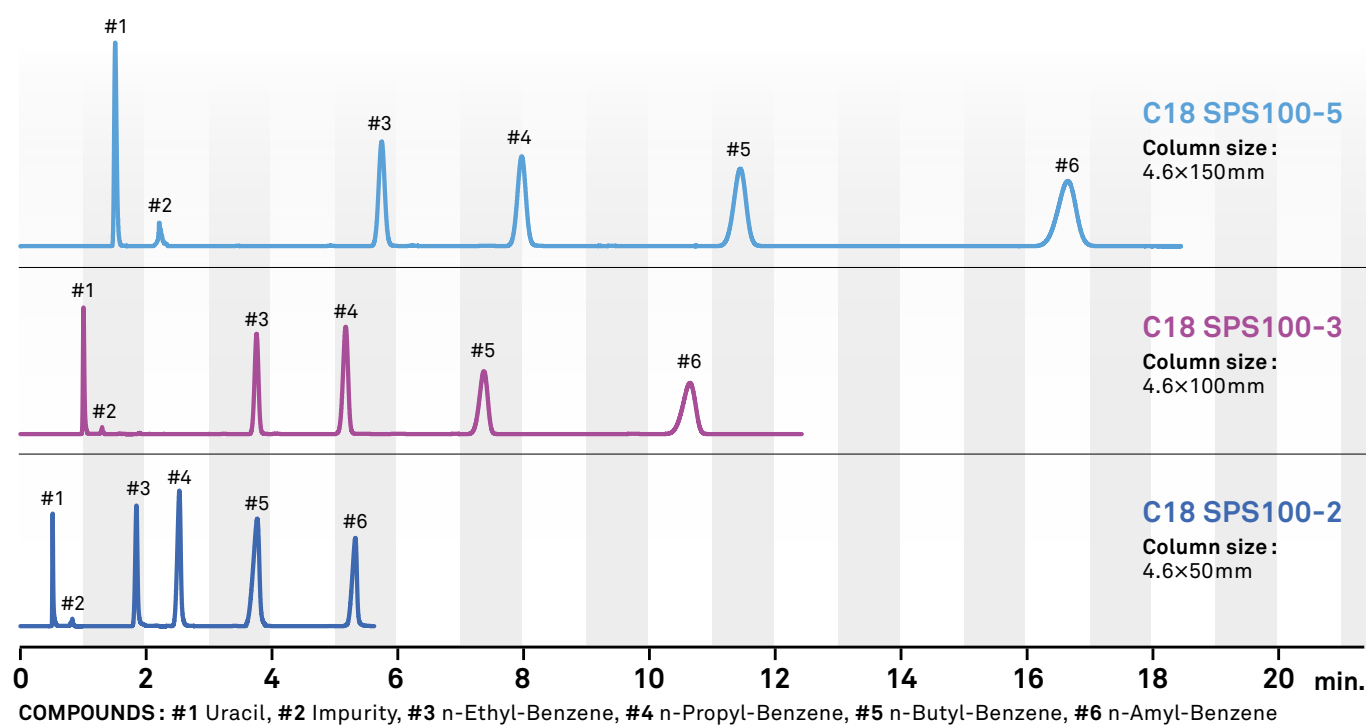


# LC TIPS FOR SCALE UP & SCALE DOWN

## Scale up



## Scale down



# CHROMATOREX SILICA GEL

## For Metal Scavenger

Organic synthesis methods using transition metal catalysts have been applied in many applications, such as the Suzuki-Miyaura reaction. At the same time of the study of this synthesis method, the removal of used metals from the reaction system was a major issue.

After these processes, removing the residual heavy metals is just as important as the development of catalyst reaction process.

One of the removal methods is to introduce a functional group that specifically binds metal to the solid surface and use it as a scavenger.

However :

**First objective** of the transitional metal removal is to get an API with high purity and feasible economy.

**Second objective** is to improve the environmental sustainability with waste recycling and/or potential precious metal recovery, key factors in the pharmaceutical industry.

*Removing the residual heavy metals is just as important as the development of catalyst reaction process.*

Grade	Adsorbed species
Diamine Silica	Ni, Cu, Zn, Ru, Pd, Cd, Pb
NH Silica	Ni, Cu, Pd(II)
SH Silica	Ru, Pd, Pt, Hg
SO <sub>3</sub> H Silica	Fe, Co, Ru

Solvent	Adsorption capacity (mmol/g)								
	Pd (II) / Pd (OAc) <sub>2</sub>			Pd (0) / Pd (dba) <sub>2</sub>			Ni (II) / Ni (acac) <sub>2</sub>		
	CHCl <sub>3</sub>	THF	Toluene	CHCl <sub>3</sub>	THF	Toluene	THF	DMF	DMSO
Diamine Silica	0.64	0.82	0.74	0.18	0.27	0.31	0.41	0.41	0.61
NH Silica	0.42	0.63	0.55	0.09	0.21	0.15	0.24	0.10	0.08
SH Silica	0.60	0.74	0.64	0.23	0.27	0.31	0.09	0.06	0.04

Solvent	Adsorption capacity (mmol/g)								
	Cu (II) / Cu (OAc) <sub>2</sub>			Cu (I) / CuCl			Fe (III) / Fe (acac) <sub>3</sub>		
	MeCN	THF	DMF	DMF	DMSO	–	MeCN	THF	Toluene
Diamine Silica	0.50	0.51	0.40	0.15	0.13	–	0.05	0.03	0.03
NH Silica	0.41	0.47	0.35	0.15	0.15	–	0.08	0.02	0.09
SH Silica	0.24	0.24	0.19	0.05	0.10	–	0.06	0.04	0.09
SO <sub>3</sub> H Silica	–	–	–	–	–	–	0.19	0.18	0.20

	Solvent Effect					
	Pd (II) / Pd (OAc) <sub>2</sub>			Pd (0) / Pd (dba) <sub>2</sub>		
Solvent	CHCl <sub>3</sub>	THF	Toluene	CHCl <sub>3</sub>	THF	Toluene
Diamine Silica	>97.5%			>85.0%	>97.5%	
NH Silica	>85.0%			<85.0%	>85.0%	
SH Silica	>97.5%			>97.5%		

### PRODUCT INFORMATION

**Base silica Diamine, NH, SH :**  
Spherical, 100 Å, 100 µm

**Base silica SO<sub>3</sub>H :**  
Spherical, 70 Å, 100 µm

**Packaging :** 100 g, 1 kg, 20 kg

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