Uptisphere® CS Evolution™
Core Shell columns for fast & highly efficient identification & quantification of small molecules

www.interchim.com
www.blog.interchim.com
www.forum.interchim.com
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Uptisphere® CS Evolution™ consists of superficially porous & mono-dispersed 2,6μm particles of high purity silica.

They are formed by a solid core of 1.6 microns diameter and welded to its surface, a totally porous silica layer of 0.50 μm thickness.

**Benefit of its technology:**

- Thin diffusion zone which allows rapid mass transfer.
- Mono-dispersed and "heavy" particles ensure optimum columns packing. Efficiency & reproducibility are superior to equivalent totally porous columns, h <1.8.
- Low back pressure

Uptisphere® CS Evolution guarantee high efficiencies and very fast separations with lower back pressures for (U)HPLC applications.
Core-Shell technology boots productivity without compromising with resolution.
Particle size

- Superposition of three consecutive measurements: very good homogeneity
- One Gaussian, narrow, ranging from 1.7 to 3.1 microns

Analyzes done with Mastersizer 2000 wet process (suspended in acetonitrile)
Surface Area

- BET = 126 m\(^2\)/g
Maximum Operational Surface Technology (MOST)
Interchim technology advantages & benefits

Before bonding, Uptisphere® CS Evolution™ particles undergo a proprietary treatment similar to a re-condensation of the porous silica layer, which has the effect of maximizing the operational surface density.

- Enhance surface with selected silanol ready for bonding for both hILic & reverse phase mode
- High temperature stability
- Allows direct transfer from Uptisphere® CS Evolution™ to Interchim purification stationary phases
29Si RMN after ITM proprietary treatment & C18 bonding

Red = micro wave
Blue = reflux

φ 3 - no bonding detected (M)

φ 2 - reflux + MW

φ 1 - MW

φ 1 - reflux + MW

Laboratoire SMS - université de Rouen
### Elementary analysis after ITM proprietary treatment & C18 bonding

<table>
<thead>
<tr>
<th>Synthesis</th>
<th>Bonding type</th>
<th>( n_c )</th>
<th>( M_w ) (g. mol(^{-1}))</th>
<th>Treatment (°C)</th>
<th>%C</th>
<th>Grafting rate* (µmol/m(^2))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microwave</td>
<td>-Si(CH(<em>3))(<em>2)C(</em>{18})H(</em>{37})</td>
<td>20</td>
<td>311,65</td>
<td>Regular</td>
<td>9,54</td>
<td>3,60</td>
</tr>
<tr>
<td>Microwave</td>
<td>-Si(CH(<em>3))(<em>2)C(</em>{18})H(</em>{37})</td>
<td>20</td>
<td>311,65</td>
<td>( \phi ) 1</td>
<td>9,06</td>
<td>3,39</td>
</tr>
<tr>
<td>Microwave</td>
<td>-Si(CH(<em>3))(<em>2)C(</em>{18})H(</em>{37})</td>
<td>20</td>
<td>311,65</td>
<td>( \phi ) 2</td>
<td>7,68</td>
<td>2,82</td>
</tr>
<tr>
<td>Microwave</td>
<td>-Si(CH(<em>3))(<em>2)C(</em>{18})H(</em>{37})</td>
<td>20</td>
<td>311,65</td>
<td>( \phi ) 3</td>
<td>0,50</td>
<td>0,17</td>
</tr>
</tbody>
</table>

* Based on a surface area of 126 m\(^2\)/g

### Impact on chromatographic results

<table>
<thead>
<tr>
<th>Impact on chromatographic results</th>
<th>Regular</th>
<th>Step 1</th>
<th>Step 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qty of alkyl chains</td>
<td>5,24</td>
<td>4,53</td>
<td>5,34</td>
</tr>
<tr>
<td>Hydrophobicity</td>
<td>1,51</td>
<td>1,53</td>
<td>1,51</td>
</tr>
<tr>
<td>Steric Selectivity</td>
<td>1,50</td>
<td>1,74</td>
<td>1,55</td>
</tr>
<tr>
<td>Potential of hydrogen links</td>
<td>0,43</td>
<td>0,37</td>
<td>0,52</td>
</tr>
<tr>
<td>Exchange potential @ pH: 2.7</td>
<td>0,06</td>
<td>0,05</td>
<td>0,05</td>
</tr>
<tr>
<td>Exchange potential @ pH: 7.6</td>
<td>0,30</td>
<td>0,30</td>
<td>0,68</td>
</tr>
</tbody>
</table>

Laboratoire SMS - université de Rouen
C18 bonded & end-capped material

<table>
<thead>
<tr>
<th>Temperature Range</th>
<th>Empty Crucible (%)</th>
<th>Normalized C18 Silica (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 to 300°C</td>
<td>0</td>
<td>-0.1</td>
</tr>
<tr>
<td>300 to 600°C</td>
<td>-0.5</td>
<td>-9.5</td>
</tr>
<tr>
<td>600 to 900°C</td>
<td>-1.75</td>
<td>-0.5</td>
</tr>
<tr>
<td>Total loss 20 to 1000°C</td>
<td>-3</td>
<td>-10.5</td>
</tr>
</tbody>
</table>
Application:
non-polar organic compounds

USP code: L1

Selectivity

C18-HB

Uptisphere® CS Evolution™

Capacity

Productivity

Maximum Operational Surface Technology

Uptisphere® CS Evolution™ C18-HB
85Å - 130m²/g
2.6 µm
Bonding: C18 monofonctionnal
%C: 8.0
End-capping: one-step
pH stability: 1.5 to 8.0

Suitable for non polar compounds separation. Exhibits a very hydrophobic surface. HB shows excellent mechanical stability under high temperature.
**Uptisphere® CS Evolution™ C18**

85Å - 130m²/g

2.6 µm

Bonding: C18 monofonctionnal

%C: 9.0

End-capping: one-step

pH stability: 1.5 to 7.5

*Serves a broad-ship of analytical & prep LC requirements for separating non polar compounds*
**USP code: L1**

**Application:**
mid-polar organic compounds

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**Uptisphere® CS Evolution™ C18-RP**

85Å - 130m²/g

2.6 µm

Bonding: C18 monofonctionnal

%C: 6.0

End-capping: multi step mixte

pH stability: 1.5 to 8.0

*Suitable for mid & non polar compounds separation. RP shows excellent mechanical stability that provides long-life & make it an excellent tool for analysis under acidic or basic conditions.*
Hydrophobic selectivity – (Tanaka Méthylène)

1) Uracil, 2) Ethylbenzene, 3) n-Propylebenzene, 4) n-Butylbenzene, 5) n-pentylbenzene

MeOH-H2O @ 1 ml/min - UV: 254 nm

Similar selectivity for Hydrophobic probes

<table>
<thead>
<tr>
<th></th>
<th>CS competitor C18 2.7µm 50 x 4.6mm</th>
<th>CS Evolution C18-RP 2.6µm 50 x 4.6mm</th>
<th>Uptisphere C18-RP 3µm 150 x 4.6mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>α butylbenzene/pentylbenzene</td>
<td>1.56</td>
<td>1.54</td>
<td>1.50</td>
</tr>
</tbody>
</table>
Polar selectivity

**Better selectivity & resolution for Polar probes**

<table>
<thead>
<tr>
<th></th>
<th>CS concurrente C18 2.7µm 50 x 4.6mm</th>
<th>CS Evolution C18-RP 2.6µm 50 x 4.6mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>α Ethylbenzoic /methyl benzoate</td>
<td>1.36</td>
<td>1.39</td>
</tr>
<tr>
<td>Rs Ethylbenzoic /methyl benzoate</td>
<td>6.63</td>
<td>7.19</td>
</tr>
</tbody>
</table>

1) Uracil, 2) Benzoic acid, 3) p-Toluic acid, 4) p-Ethylbenzoic acid, 5) Methyl benzoate
ACN-formic acid buffer pH: 2.8 @ 1 ml/min - UV: 254 nm
Basic compounds

CS competitor 2.7µm C18 - 50 x 4.6mm

Uptisphere CS Evolution 2.6µm C18-RP - 50 x 4.6mm

1) Uracil, 2) p-Hydroxybenzoic acid, 3) Pyridine, 4) Dimethylpyridine
ACN-buffer pH: 5.7 @ 1 ml/min - UV: 254 nm

Good resolution & symmetry with Basic probes

<table>
<thead>
<tr>
<th></th>
<th>CS concurrente C18 2.7µm 50 x 4.6mm</th>
<th>CS Evolution C18-RP 2.6µm 50 x 4.6mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>α pyridine/diMepyridine</td>
<td>-</td>
<td>1.19</td>
</tr>
<tr>
<td>Rs pyridine/diMepyridine</td>
<td>-</td>
<td>2.39</td>
</tr>
</tbody>
</table>
**C18-AQ**

**Selectivity**

**Uptisphere® CS Evolution™**

**Capacity**

**Productivity**

**Uptisphere® CS Evolution™ C18-AQ**

85Å - 130m²/g

2.6 µm

Bonding: C18 monofonctionnal

%C: 6.5%

End-capping: Mixte

pH stability: 1.5 to 7.0

Suitable for mid & non polar compounds separation.

RP shows excellent mechanical stability under 100% aqueous mobile phase conditions.

**USP code: L1**

**Application:**

mid-polar organic compounds

100% water compatible
**RP/SCX**  

**Uptisphere® CS Evolution™**

**Selectivity**  

**Capacity**  

**Productivity**

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**Uptisphere® CS Evolution™ RP/SCX**

85Å - 130m²/g

2.6 μm

Bonding: mixed mode – RP/SCX monofonctionnal

%C: 8.5

End-capping: one step

pH stability: 2.0 to 7.0

*Ion exchange & hydrophobic chains are bonded onto the surface of silica providing unique selectivity. Compounds that possess basic functionality are retained by ion exchange functionality.*

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**USP code: L44**

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**Application:**

Mid-polar & non polar organic compounds under cationic form

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**Formula:**

\[
\text{O} \quad \text{Si} \quad \text{C}_n\text{H}_{2n+1} \\
\text{CH}_3
\]

\[
\text{O} \quad \text{Si} \quad (\text{CH}_2)_3 \quad \text{SO}\text{O}^{-}\text{H}^+ \\
\text{CH}_3
\]

---

**Interchim**
USP code: MVP

Selectivity

Uptisphere® CS Evolution™ Capacity

Productivity

Bonding: monofunctionnal
%C: 7.0
End-capping: propriétaire

pH stability: 2.0 to 7.5

Suitable for Alkylbenznes, PAHs applications

Application:
Planar & PI compounds. Peptides

Uptisphere® CS Evolution™ MVP
85Å - 130m²/g
2.6 μm

Interchim
Linear regressions of log k in function of log P_{o/w} for an homologous serie of (●) Alkylbenzenes & (●) PAHs

**competitor C18**

- CH₃CN-H₂O 85:15, v/v
- \( R^2 = 0.9966 \)
- \( R^2 = 0.9863 \)

**CS Evolution™ MVP**

- CH₃CN-H₂O 60:40, v/v
- \( R^2 = 0.9968 \)
- \( R^2 = 0.9884 \)

**competitor Amide**

- CH₃CN-H₂O 60:40, v/v
- \( R^2 = 0.994 \)
- \( R^2 = 0.9985 \)

**competitor Phenyl-Hexyl**

- CH₃CN-H₂O 60:40, v/v
- \( R^2 = 0.9966 \)
- \( R^2 = 0.9916 \)
**Uptisphere® CS Evolution™**

**Hilic-HIT**

**Selectivity**

**Capacity**

**Productivity**

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**Application:**

water-soluble compounds

**USP code:** L3

**Uptisphere® CS Evolution™ Hilic-HIT**

85Å - 130m²/g

2.6 µm

Bonding: proprietary

End-capping: proprietary

pH stability: 1.5 to 7.0

Aqueous normal phase separation (ANP) of water-soluble compounds.

Typical mobile phase: water / ACN (> 70%)

ANP is an excellent alternative to RP purification for highly polar compounds.

Maximum Operational Surface Technology

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Selectivity, Efficiency & Resolution

<table>
<thead>
<tr>
<th>#</th>
<th>Peak Name</th>
<th>Rt.</th>
<th>Tailling</th>
<th>Plates (USP)</th>
<th>Resolution (USP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tri-tert-butylbenzene</td>
<td>0.94</td>
<td>1.19</td>
<td>21285,62</td>
<td>0.00</td>
</tr>
<tr>
<td>2</td>
<td>Diethylphthalate</td>
<td>1.43</td>
<td>1.02</td>
<td>21584,83</td>
<td>14.96</td>
</tr>
<tr>
<td>3</td>
<td>Dimethylphthalate</td>
<td>1.78</td>
<td>1.02</td>
<td>20426,69</td>
<td>8.01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#</th>
<th>Peak Name</th>
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<th>Resolution (USP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tri-tert-butylbenzene</td>
<td>0.97</td>
<td>1.03</td>
<td>22714,51</td>
<td>0.00</td>
</tr>
<tr>
<td>2</td>
<td>Diethylphthalate</td>
<td>1.61</td>
<td>1.05</td>
<td>22918,27</td>
<td>10.75</td>
</tr>
<tr>
<td>3</td>
<td>Dimethylphthalate</td>
<td>2.10</td>
<td>1.13</td>
<td>20861,99</td>
<td>9.79</td>
</tr>
</tbody>
</table>

CS competitor 2.7µm Hilic - 50 x 4.6mm

Uptisphere CS Evolution 2.6µm HIT - 50 x 4.6mm
Symmetry for basic compounds

<table>
<thead>
<tr>
<th>#</th>
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<th>Plates (USP)</th>
<th>Resolution (USP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>p-hydroxybenzoic acid</td>
<td>1.01</td>
<td>1.25</td>
<td>21412,79</td>
<td>0.00</td>
</tr>
<tr>
<td>2</td>
<td>Uracil</td>
<td>1.09</td>
<td>1.17</td>
<td>19577,18</td>
<td>2.66</td>
</tr>
<tr>
<td>3</td>
<td>pyridine</td>
<td>1.61</td>
<td>1.86</td>
<td>14456,86</td>
<td>12.18</td>
</tr>
<tr>
<td>4</td>
<td>2.6-dimethylpyridine</td>
<td>2.09</td>
<td>3.43</td>
<td>8827,32</td>
<td>6.81</td>
</tr>
</tbody>
</table>

**As pyridine**: 1.86
**As 2.6-dimethylpyridine**: 3.43

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<tr>
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<th>Plates (USP)</th>
<th>Resolution (USP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>p-hydroxybenzoic acid</td>
<td>1.05</td>
<td>1.19</td>
<td>19886,54</td>
<td>0.00</td>
</tr>
<tr>
<td>2</td>
<td>uracil</td>
<td>1.13</td>
<td>1.17</td>
<td>15643,32</td>
<td>2.42</td>
</tr>
<tr>
<td>3</td>
<td>pyridine</td>
<td>1.69</td>
<td>1.70</td>
<td>13526,09</td>
<td>11.74</td>
</tr>
<tr>
<td>4</td>
<td>2.6-dimethylpyridine</td>
<td>2.20</td>
<td>2.82</td>
<td>8415,31</td>
<td>6.65</td>
</tr>
</tbody>
</table>

**As pyridine**: 1.70
**As 2.6-dimethylpyridine**: 2.82

CS competitor 2.7µm Hilic - 50 x 4.6mm
Uptisphere CS Evolution 2.6µm HIT - 50 x 4.6mm
Stimulant compounds

(90/10) - ACN/Acétate d’ammonium 40 mM
Flow rate = 1,5 mL/min
T = 35°C
UV : 254 nm
Sample: 1 - norephedrin
   2 - ephedrin
   3 - hydroxyephedrin
   4 - synephrin
Aromatic Amino-acids

(85/15) - ACN/Acétate d’ammonium 100 mM pH: 4
Flow rate = 0.5 mL/min
T = 25°C
UV : 254 nm
Samples : 1 - tryptophan
          2 - phenylalanin
          3 - tyrosin

Uptisphere CS Evolution 2.6µm HIT
**Application:**
Non-ionic, polar organic compounds

**Uptisphere® CS Evolution™ Silica**
85Å - 130m²/g

2.6 µm

Bonding: none

End-capping: none

pH stability: 1.5 to 7.0

*Specific of non-ionic, polar organic compounds analysis*