INTRODUCTION

The use of sub 2µm fully porous particles in UHPLC is now well established, offering high efficiencies, good resolution and fast throughput. Much is now being made of the ability of core-shell particles to improve speed of analysis and sensitivity but without the high back pressures associated with UHPLC.

In this poster we look at the role that resolution plays when trying to improve speed of analysis, as we go faster and faster selectivity (alpha) plays a large role in the separation process. We look at the alternative phases that are available on core-shell technology and how these can impact how fast we can actually go.

We show that whether using UHPLC or Core-Shell technology it is important to consider the role of stationary phase selectivity when trying to maximise resolution and not rely on efficiency alone.

Improving Resolution

Approaches to improving resolution involve making changes to one or more of three variables; efficiency, retention and selectivity. The move towards using Core-Shell particles has been driven by the theory that the resulting jump in efficiency will lead to significant improvements in resolution. As can be seen in figure 1 efficiency (N) does play a significant part in improving resolution, however by far the greatest factor is stationary phase selectivity (α).

If we compare the performance of a fully porous particle with that of a superficially porous 2.6µm particle we can see that a resolution gain of >25% is possible just through the increase in efficiency of the Core-Shell product (see Table 1).

The dimensionless parameters for HETP (Height Equivalent of Theoretical Plate – H) and linear velocity allow for direct comparison of the efficiency of columns packed with different particle size packing materials. According to the theory a well packed column should have a reduced plate height (h) in the range of 2–3.

Contribution of Resolution

<FIGURE 1. Contributions to Resolution>

Selectivity (α) has the greatest impact on improving resolution.

<table>
<thead>
<tr>
<th>Particle Type</th>
<th>Particle Size</th>
<th>N/m</th>
<th>HETP</th>
<th>h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fully Porous 5µm</td>
<td>80,000</td>
<td>12.5</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>Fully Porous 3µm</td>
<td>120,000</td>
<td>8.3</td>
<td>2.8</td>
<td></td>
</tr>
<tr>
<td>Fully Porous 1.7µm</td>
<td>200,000</td>
<td>5.0</td>
<td>2.9</td>
<td></td>
</tr>
<tr>
<td>SpeedCore 2.6µm</td>
<td>200,000</td>
<td>5.0</td>
<td>1.9</td>
<td></td>
</tr>
</tbody>
</table>

As we run faster we now require selectivity of stationary phases to provide increased resolution, so that high resolution between critical pairs is still accomplished.

Speedcore provides an orthogonal selectivity range of hydrophobic, dipole and Hydrophilic stationary phases to ensure that maximum resolution can be combined with the high efficiency of the particle.

Conclusion

Even though the new core-shell SpeedCore column provides very high efficiency, it is paramount that selectivity as a variable in the separation is not forgotten, since this will provide a powerful method development tool. Having a wide variety of selectivity's available is essential as we run faster analysis whether for method development or redevelopment of older QC methods.