

Application Note

Increase Performance with 1.7µm Fortis

Introduction

Discussions have suggested that performance can be improved with Core-Shell particles and/or by the use of UHPLC (Ultra High Pressure Liquid Chromatography), but that both of these technologies are mutually exclusive due to the instrumentation that is required.

In this application note we suggest that with the use of careful thought and use of a high surface area porous silica material you can achieve this performance with a simple short, small particle column.

“Why choose between high performance and high pressure? Utilise both in the same particle”

Porous particles

Fortis™ particles are based upon a traditional porous silica template. They have a high surface area of 380m²/g which allows good retention of non-polar analyte species. They are also fully scalable to analytical and prep scale scale. Particles that have been relied upon so far in UHPLC tend to have a surface area of ~185m²/g and the newer core-shell particles possess a surface area somewhere between 150-200m²/g. This can lead to a serious compromise in the peak capacity and therefore resolution of the separation, as well as potential overload issues.

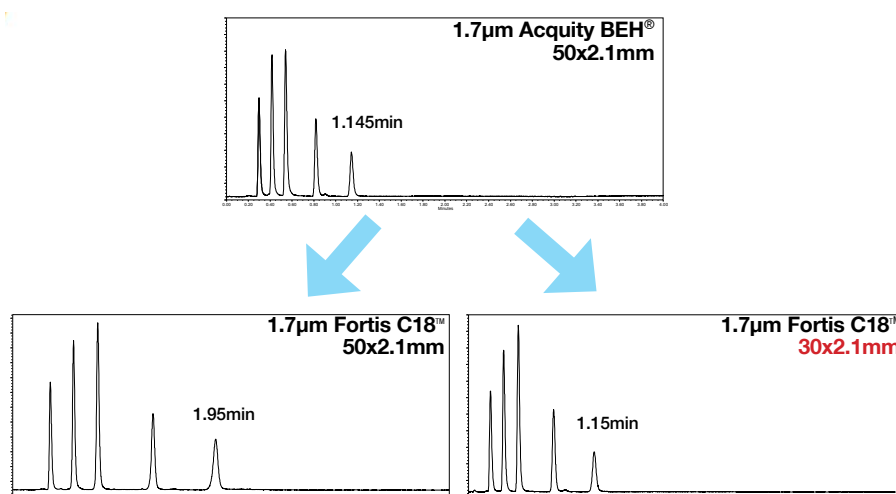
Methodology

Small particle porous materials have reduced the slope of the van deemter curve, Core-Shell particles work on the principle of reducing the A term (Eddy Diffusion) in the Knox equation, both can be effective in reducing analysis time. If we look at the 1.7µm Fortis™ particle, it combines this reduced

van deemter curve with the high retention/high selectivity that the resolution equation (Carr equation) suggests is appropriate.

Method Development

pect due to the higher surface area. This leads to a higher resolution/peak capacity being available for the same column length. If we then move to the shorter Fortis column the retention profile achievable is very simi-

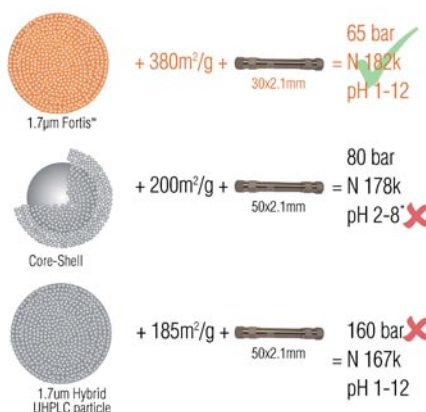


Having a high surface area particle allows the analyst to choose a shorter column than usable in either the traditional UHPLC column technology or the Core-Shell particles. This then results in the same retention profile and efficiency range but a lower back pressure than either of the other particle options. In example 1. we see the retention profile of five peaks run on an Acquity® BEH 1.7µm C18 column and the same length 1.7µm Fortis™ C18 column. Retention for the Fortis column is much longer as we would expect

lar to that of the Acquity® BEH but now the pressure has been significantly decreased.

In a similar manner core-shell particles are claimed as being similar efficiency to sub 2µm particles but with a lower backpressure. Both of these statements are true. However just as we saw with the UHPLC column with a low surface area, the same chromatographic comparisons can be achieved against core-shell particles due to their surface area, they possess between 150-200m²/g. This surface area range means that there is a similar compromise in peak capacity, loadability and scalability as there was before.

In example 2. we see how this works in practise. Given a specific core-shell column dimension used typically for high-throughput screening (HTS) we achieve a run time of 0.95minutes. A comparative 1.7µm Fortis™ C18 50x3.0mm length column achieves 1.14minutes. The higher surface area of the porous Fortis particle again leading to higher retention as we would expect.

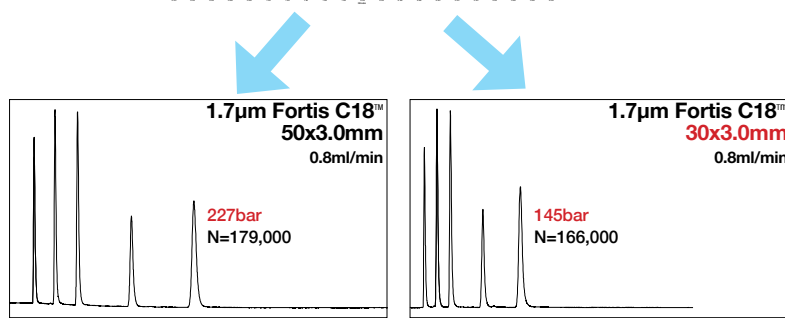
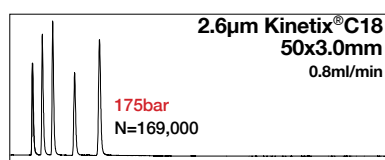


This now gives us the same choice as before, do we want this extra peak capacity? or do we want to perform in a

capable of being scaled to both analytical as well as prep particle size, maintaining the same selectivity and separation so that meth-

pressure column with good peak shapes and high resolution, or as a alternative to core-shell particles, high efficiency, lower pressure than traditional UHPLC performance. Combined with this option comes the other advantages that Fortis C18 can offer:

- pH range 1-12
- Scaleability for method transfer to 3µm, 5µm and 10µm particles.
- Method scaling for prep
- High loadability due to high surface area
- High peak capacity



similar fashion to the core-shell particle? If the answer is high selectivity/capacity then retain the same column dimension, if the answer is similar retention then we can do this with the shorter column and reduce the back pressure of the overall system, whilst maintaining the efficiency of the system.

Choices

Several other factors can also define our choice of stationary phase. Porous particles can provide advantages in loadability over core-shell particles since the higher surface area provides the interaction points needed for column loading. 1.7µm Fortis C18 is also

od transfer is simplified and less complex. A further advantage of using 1.7µm Fortis C18 in method development is that the pH range is 1-12, allowing the option for retention of acids, bases and neutral's at various pH values to be tested. Thus utilising just one C18 column instead of the need for silica (low & neutral pH) and hybrid (high pH) stationary phases to be validated.

Conclusion

In this application note we have shown how the correct use of UHPLC particles with a high surface area can allow the analyst to use the column as a UHPLC high

Both traditional 400bar and newer 1000bar UHPLC systems can be utilised to the best of their ability.

Flexibility, robustness and reliability can all be achieved with one scaleable stationary phase.

* Acquity® BEH is a registered trademark of Waters corporation. Kinetix® is a registered trademark of Phenomenex. 1.7µm Fortis™ is a trademark of Fortis Technologies. All columns are original manufacturers own.