Monodisperse Fully Porous Particles (MFPP) for Use in Increasing Resolution in Liquid Chromatography

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PURPOSE

- In this poster we discuss the development of a new particle morphology manufactured to be monodisperse as compared to traditional polydisperse fully porous particles for the application use of high abd ultra-high performance liquid chromatography (HPLC and UHPLC)
- By reducing the dispersity of the manufactured fully porous media, the efficiency (N) of the packed bed increases by a 40 – 60%

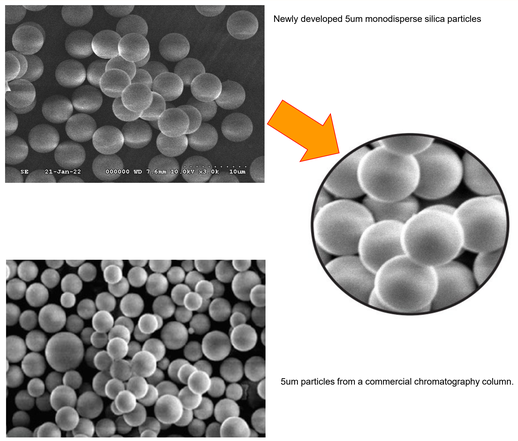
METHOD(S)

1) **Modified Stöber Process**: Using a modified Stöber manufacturing process we have produced silica particles that have an extremely high degree of monodispersity with a uniform smooth surface. **(Figure 1)**
2) **Particle Size Measurement - D90/D10:** The Evosphere® monodisperse silica particles (MFPP) size distribution were measured using a Coulter Multisizer 3 along with samples from two different commercial 3 µm silicas. Both commercial silicas have a much broader size distribution than the new monodisperse material with the mean shifting smaller and larger. When assigning a measurement to characterize a particle size distribution the ratio of D90/10 was used. **(Figure 2)**
3) **Column Backpressure:** Backpressures were measured at varied flow rates for the 3 µm Evosphere® monodisperse material and 2 commercial 3 µm materials. **(Figure 3)**
4) **Chromatographic Measurement:** The efficiency of columns packed with the new Evosphere® monodisperse particles were then compared against a number of existing commercial (non-monodisperse) columns. **(Figures 4)**. Further measurements were made at similar loading amounts comparing polydisperse fully porous particles, monodisperse Evosphere® fully porous particles and SPP (superficially porous particles. Further measurements were made by increasing loading capacity of SPP vs. MFPP to show comparable plates (N) to SPP without overloading MFPP particle morphology. **(Figures 5 and 6)**

RESULTS

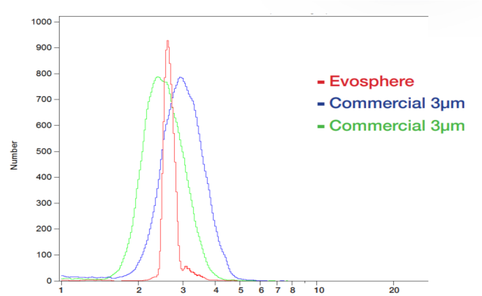
1. MODIFIED STÖBER PROCESS

FIGURE 1. SEM Imaging of HPLC Particles



2. PARTICLE SIZE MEASUREMENT – D90/D10

FIGURE 2. Particle Size Distribution

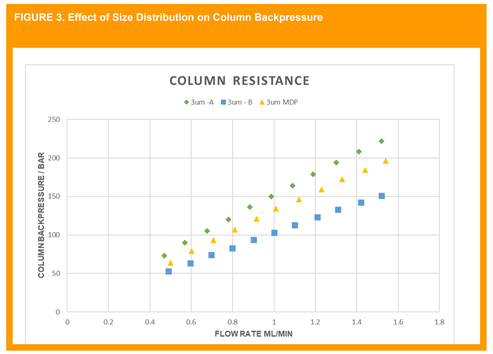


	Monodisperse Silica	Commercial 3µ Silica-A	Commercial 3µ Silica-B
Mean Particle size (d50)*	2.66µm *	2.48µm	2.97µm
SEM Particle Size	3.0µm	2.8µm	3.2µm
D90/10	**1.12**	**1.58**	**1.61**
Pore Volume	0.89	0.88	0.89

* Measured by Coulter Counter

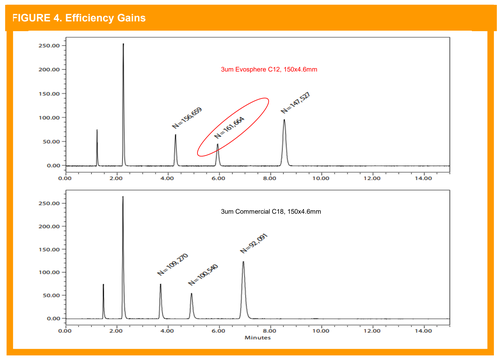
3. COLUMN BACKPRESSURES

FIGURE 3. Effect of Size Distribution on Column Backpressure



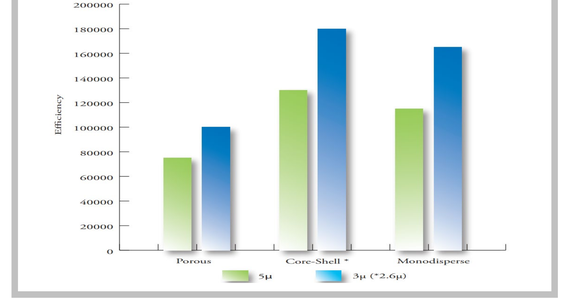
4A. CHROMATOGRAPHIC MEASUREMENTS

FIGURE 4. Efficiency Gains



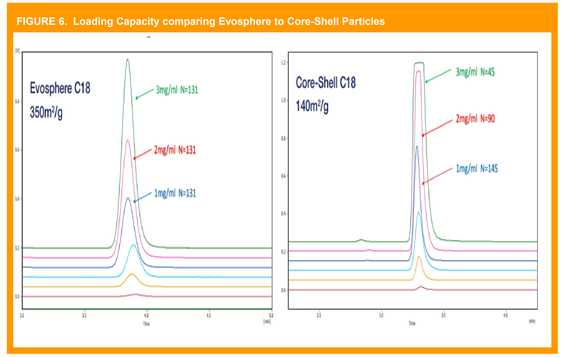
4B. CHROMATOGRAPHIC MEASUREMENTS – CONTINUED

FIGURE 5. Efficiency Values of Different Particle Types



4C. CHROMATOGRAPHIC MEASUREMENTS – CONTINUED

FIGURE 6. Loading Capacity comparing Evosphere to Core-Shell Particles



CONCLUSION(S)

- New silica manufactured to miniaturize D90/10 creating monodisperse silica platform
- Monodispersity generates high efficiency U/HPLC columns due to the reduced flow path dispersion (Eddy diffusion).
- Chromatographic measurements confirms benefits of monodisperity with respect to increased N compared to commercially available FPP and similar N but improved loading capacity compared to Core-Shell particles

TRADEMARKS

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