

Improving HPLC Sample Throughput Using Ascentis™ Express Fused-Core Technology Columns

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Introduction

The demand for increased sample throughput and speed of results has driven HPLC users to search for breakthroughs in HPLC instruments and column technology. Although improvements have been realized, setbacks have been encountered. Reduction in column ruggedness, costly replacements of existing instrumentation, and difficulties in transferring methods to new systems have often made these past improvements unappealing to analysts.

Ascentis Express: Breakthrough HPLC Technology

The Fused-Core™ HPLC particle technology behind Ascentis Express permits 4- to 6-fold reduction in analysis time, with a subsequent increase in sample throughput compared to conventional HPLC columns, without sacrificing resolution or column ruggedness and without the need to change systems or sample prep procedures.

High Column Efficiency via the Kinetic Advantage

Highly efficient columns deliver more plates per meter, which means shorter columns can be used to generate the same number of plates as a longer, less efficient column. Compared to 5 µm totally porous particles, the 2.7 µm Ascentis Express provides about three times the efficiency. Therefore, a 10 cm Ascentis Express column

will provide the same efficiency as a 25 cm column packed with 5 µm particles.

Figure 1 compares the resolution of a five-component sample on 25 cm, 5 µm C18 and 10 cm Ascentis Express C18 columns. Each column has approximately the same number of theoretical plates and hence the same resolving power. However the shorter Ascentis Express column delivers this separation in a much shorter time, in this case less than one-fourth the time as the 25 cm column.

Therefore, a 10 cm Ascentis Express column will provide the same efficiency as a 25 cm column packed with 5 µm particles.

The improved kinetics from the physical structure of the Ascentis Express leads to efficiencies that are higher than predicted by particle size alone. Called "Fused-Core," the 2.7 µm Ascentis Express particle comprises a solid 1.7 µm silica core surrounded by a 0.5 µm porous silica layer (Figure 2). The solid core prevents solutes from diffusing as deeply into the Ascentis Express particle as they can in a totally porous particle. This reduced diffusion lessens band broadening and gives higher efficiency. The Fused-Core particle technology inside Ascentis Express columns provides efficiencies up to 240,000 N/m, which rivals that available from sub-2 µm particles.

Figure 1. Increase Sample Throughput by Using Ascentis Express

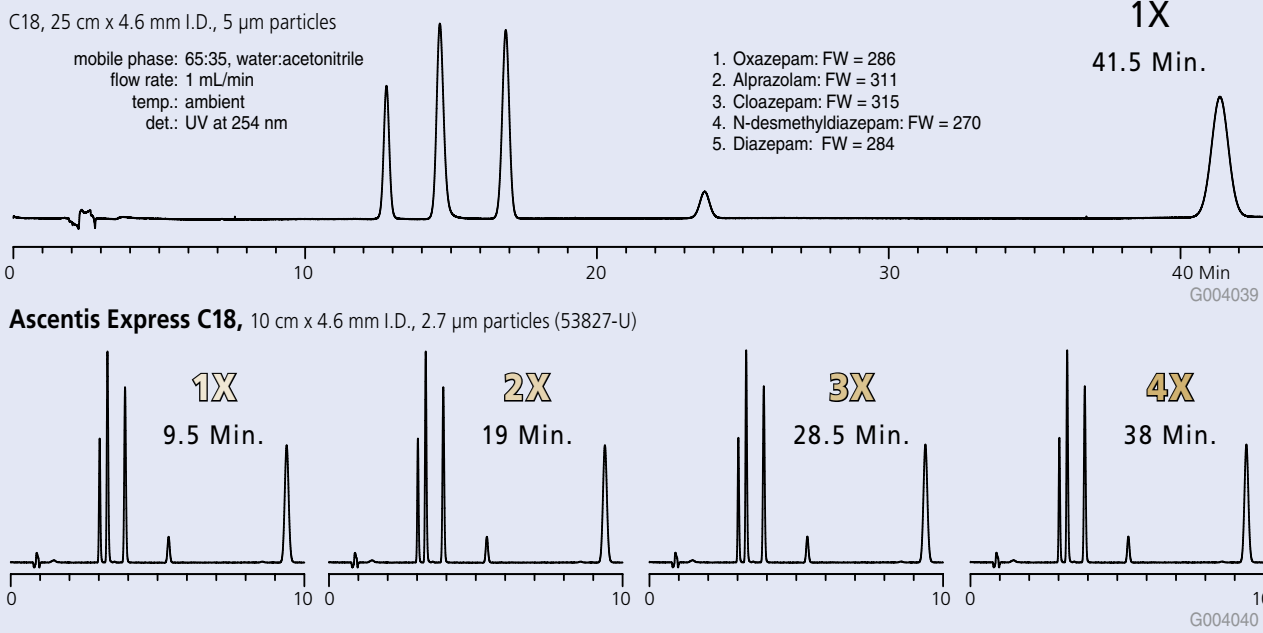
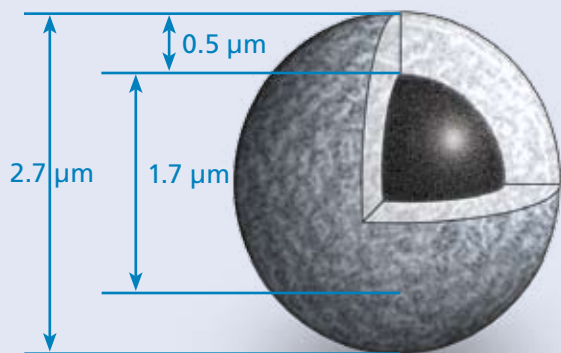


Figure 2. Ascentis Express Particle



Another advantage of Ascentis Express HPLC columns is the very narrow particle size distribution. This allows for 2 μm pore size frits to be used in Ascentis Express columns. These larger pore size frits do not foul as easily as the 0.5 μm frits that are necessary to retain the sub-2 μm and conventional 3 μm particles.

Do More Work in Less Time Without Changing Your Method

The current high resolution column for traditional HPLC methods is a 25 cm column packed with 5 μm particles. Until now, this dimension provided the most efficiency within the pressure limit of a conventional HPLC system. With the high efficiency Ascentis Express, one can now achieve the same number of plates as a 25 cm column packed with 5 μm particles with a 10 cm column or even more efficiency and resolution with a 15 cm Ascentis Express

column. Therefore, by simply changing columns and keeping all other conditions the same, you can reduce the runtime and increase the resolution of your method.

Conclusion

Ascentis Express is the ideal choice for HPLC analysts interested in increasing sample throughput while maintaining or even improving resolution. By reducing solute dispersion, the unique Fused-Core technology gives Ascentis Express a kinetic advantage over conventional particles. Its higher column permeability compared to sub-2 μm particles means that Ascentis Express can achieve UHPLC-like performance on conventional HPLC systems. Under UHPLC conditions, Ascentis Express can exceed the efficiency possible on sub-2 μm columns because longer columns can be used. There are several strategies for improving LC performance by using Ascentis Express. Table 1 outlines the strategies.

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ID (mm)	Length (cm)	Ascentis Express C18	Ascentis Express C8
2.1	3	53802-U	53839-U
2.1	5	53822-U	53831-U
2.1	7.5	53804-U	53843-U
2.1	10	53823-U	53832-U
2.1	15	53825-U	53834-U
3	3	53805-U	53844-U
3	5	53811-U	53848-U
3	7.5	53812-U	53849-U
3	10	53814-U	53852-U
3	15	53816-U	53853-U
4.6	3	53818-U	53857-U
4.6	5	53826-U	53836-U
4.6	7.5	53819-U	53858-U
4.6	10	53827-U	53837-U
4.6	15	53829-U	53838-U

Table 1. Strategies for Improving LC Performance by Using Ascentis Express

Desired Improvement	Current Particle	Change in Column Dimension with Ascentis Express	Change in Flow Rate with Ascentis Express	Resulting Improvement
Speed	Sub-2 μm	None	Double	Double the speed with equivalent plates
Efficiency	Sub-2 μm	Double the length	None	Double the plates
Efficiency	3 μm	None	None	Double the plates
Speed & Efficiency	5 μm	Half the length	None	4 times the speed & 1.3 times the plates

TRADEMARKS: Ascentis, ATIS, Carbo-pack, Carbotrap, Carboxen, CHIROBIOTIC, CHROMASOLV, CYCLOBOND, Fluka, MiniTips, P-CAP, P-CAP-DP, Riedel-de Haën, SGT, Sigma-Aldrich, SLB, SPB, Supelco, SupelMIP, Thermogreen, TraceCERT - Sigma-Aldrich Biotechnology LP; CombiPAL - CTC Analytics; Fused-Core - Advanced Materials Technology, Inc.; Mininert - Valco Instruments Co., Inc.; Q-TRAP - Applied Biosystems; Radiello - Fondazione Salvatore Maugeri; Super Clean - Scientific Glass Technology (SGT); Tenax - Enka Research Institute Arnhem

SPME - Technology licensed exclusively to Supelco. US patent #5,691,206, European patent #523,092.

P-CAP and P-CAP-DP are patent pending and manufactured under license from La Sapienza, Università degli Studi di Roma.