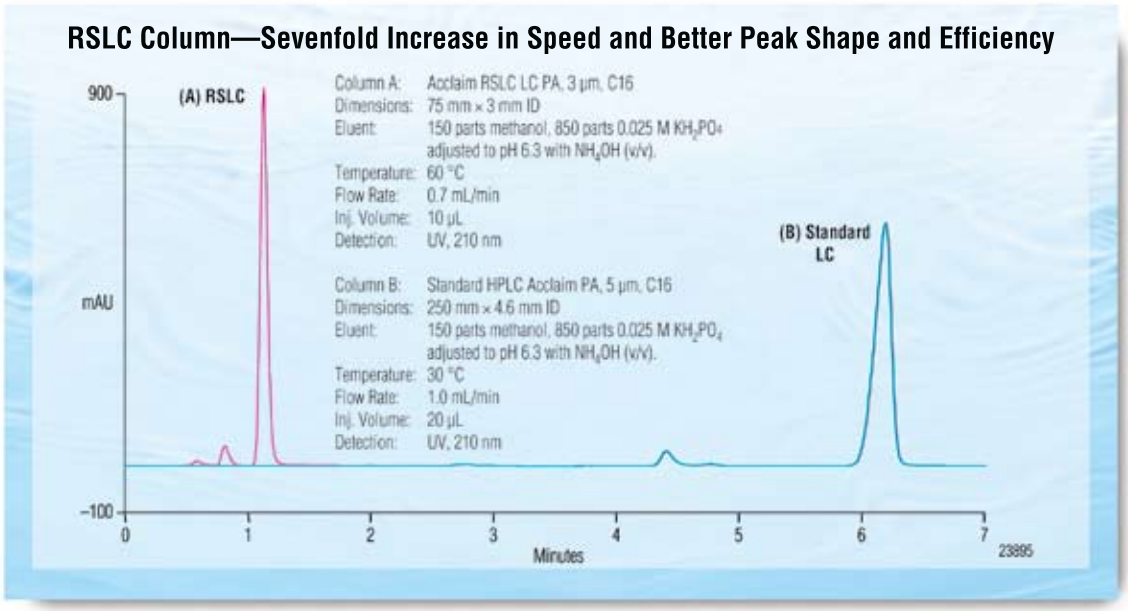
columns

Acclaim® Rapid Separation LC Columns



The Acclaim Rapid Separation LC (RSLC) column family increases throughput while maintaining robust methods and ease of use. RSLC columns are ideal for use with the Dionex UltiMate® 3000 Intelligent LC series. The RSLC columns are available with well-established Acclaim reversed-phase packing for proven separation power and efficiency. Three packing phases are available for the Acclaim RSLC: Acclaim 120 C18, Acclaim Polar-Advantage (PA), and Acclaim Polar-Advantage II (PA2).

Now sold under the Thermo Scientific brand

Thermo SCIENTIFIC

RSLC That Is Easy to Use

- Accelerate separations up to 15-fold compared to conventional LC.
- Accelerate throughput up to 30-fold compared to conventional LC, using the columns in combination with UltiMate Intelligent LC systems.
- Save up to 85% of solvent.
- Requires only 40% of sample volume traditionally required for LC in some cases.
- Compatible with standard HPLC equipment.
- Ease of operation ensures optimal, fast separations.
- Acclaim 120 C18, PA, and PA2 stationary phases available.

Intelligent Solutions for RSLC

The Dionex total solution for fast LC combines Acclaim column technology with UltiMate 3000 Intelligent LC systems, which provide up to 500 bar pressure, up to 85 °C column temperature, and a very short sample injection cycle of less than 15 s. The columns are available in 3 mm ID and 33 mm or 75 mm lengths, packed with 3-µm stationary phases. Acclaim RSLC columns integrate with Dionex UltiMate 3000 LC systems to provide superior performance, reliability, and ease of use. RSLC columns can increase sample throughput by an additional 100% when combined with Intelligent LC systems performing parallel LC, tandem LC, or other techniques. For a quick review of parallel LC and tandem LC, see Figures 4 and 5, respectively.

DIONEX

Passion. Power. Productivity.

Advantages of Acclaim RSLC

Acclaim RSLC columns provide the ideal compromise between separation performance and required column pressure. This compromise is achieved using the 3-µm particle based stationary phase. A column inner diameter of 3 mm makes RSLC columns fully compatible with standard analytical LC instrumentation, and saves up to 60% solvent compared to a 4.6-mm column of otherwise identical features. The use of column IDs of 2.1 mm or smaller require dedicated micro LC instruments and cannot easily be operated in a standard analytical system.

RSLC achieves its optimal performance, comparable to sub-2-µm particle-based fast separations, using the following parameters:

A) Chromatographic conditions

- 3-µm stationary phase (instead of sub 2 µm packings)
- 75-mm column length (instead of 50 mm)
- 2-mL/min flow rate (instead of the Van Deemter optimum at 1 mL/min)

B) Chromatographic conditions

- 3-µm stationary phase
- 33-mm column length
- 3-mL/min flow rate

Advantages of Using Conditions A

Comparing these conditions to the operation of a 1.7-µm packing in a 50-mm column operated at the optimum Van Deemter flow rate, conditions A generates:

- 75% of the 1.7-µm method separation speed
- 80% of the 1.7-µm method resolution
- Only 46% of the 1.7-µm method operating pressure

Advantages of Using Conditions B

When these conditions are compared to the operation of 1.7-µm packing in a 50-mm column run at the optimum Van Deemter flow rate, conditions B generates:

- 30% of the 1.7-µm resolution (still sufficient in distinct applications)
- 250% of the 1.7-µm method separation speed
- Only 65% of the 1.7-µm operating pressure

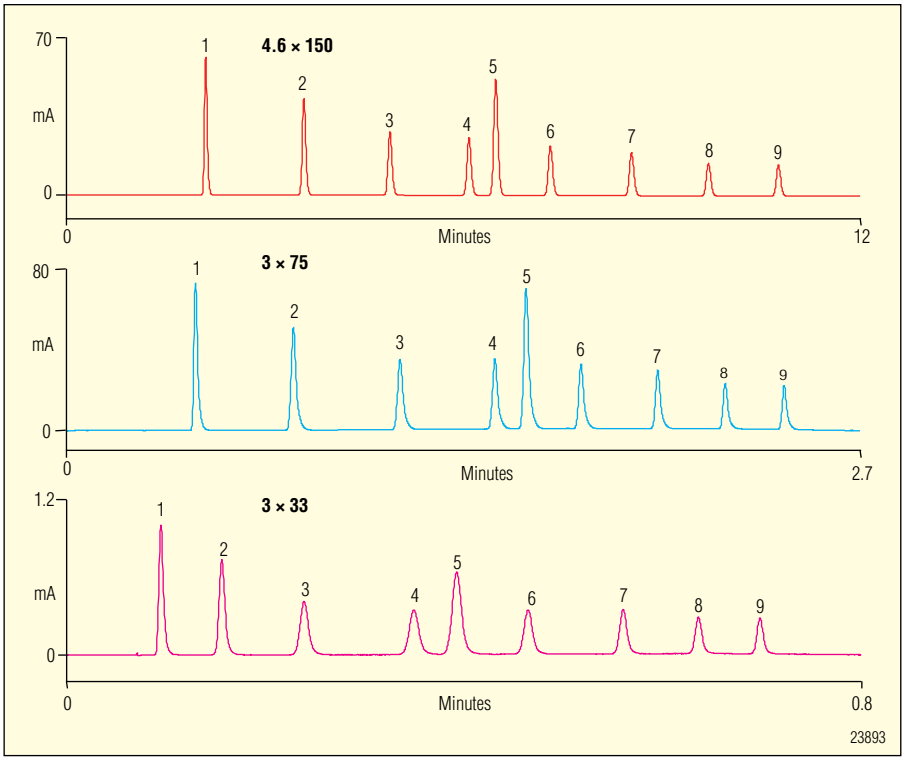


Figure 1. Alkyl phenone separation acceleration comparison. Standard column dimensions (top) compared with optimized RSLC column dimensions (center and lower) shows a 15-fold increase in separation speed. See Table 1 for chromatographic conditions and features.

Table 1. Systematic Acceleration of Alkyl Phenone Separation Using RSLC with the UltiMate Intelligent LC

Column dimension (mm)	Particle size (µm)	Flow rate (mL/min)	Pressure (bar)	Temp. (°C)	Solvent consumption (mL/run)	Last peak time (min)	Speed up factor
4.6 × 150	5	1.2	119	30	17	10.8	1.0×
3 × 75	3	1.2	167	50	4.2	2.44	4.4×
3 × 33	3	2.4	169	65	2.6	0.7	15×

Accelerate an Alkyl Phenone Separation

The gradient separation of alkyl phenones is an ideal example to demonstrate the speed potential of Acclaim RSLC columns. Figure 1 shows the chromatograms of the initial separation with conventional LC, the transfer to the corresponding 75-mm RSLC column and eventually the highest separation speed on a 33-mm RSLC column with increased flow rate, adopted gradient time, and slightly increased column temperature. The column pressure remains below 170 bar, but a 15-fold advantage in separation speed, compared to the initial method, is easily achieved. In addition, 85% of solvent is saved, as the consumption per run is reduced from 17 mL to 2.4 mL (see Table 1).

Accelerate a Curcuminoid Separation: Systematic Improvements

An important advantage of RSLC is optimizing separations that require maximum resolution between peaks. For example, the separations of curcuminoids in Figure 2 shows the systematic improvements in chromatographic resolution using the RSLC columns.

- Run 1 shows a separation using a conventional column: Acclaim PA2, 5 µm, 4.6 × 250 mm.
- If the column is switched to the Acclaim RSLC with half the flow rate, resolution remains essentially the same, but the separation takes approximately half the time (run 2).
- If a shorter Acclaim RSLC column is substituted, optimal resolution is maintained and the separation (run 3) is completed in half the time compared to the previous run.
- The resolution and separation time are optimized by increasing the flow rate (run 4). Increasing the temperature and adjusting the mobile phase further improves resolution (run 5).
- Finally, optimizing the instrument tubing and preheater improves the resolution compared to the resolution observed using the conventional 5-µm column (run 6).

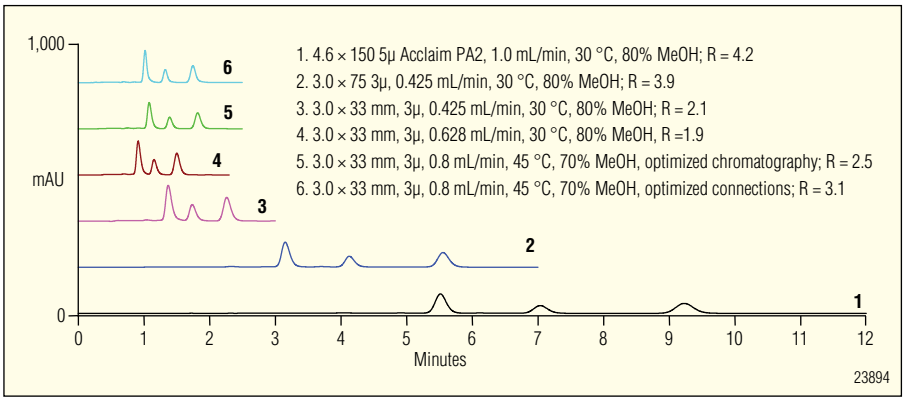


Figure 2. Standard column dimensions (run 1) compared with the Acclaim RSLC column dimensions (runs 2–6) show accelerated curcuminoid analysis using optimized chromatographic conditions (column size, particle size, flow rates, temperature).

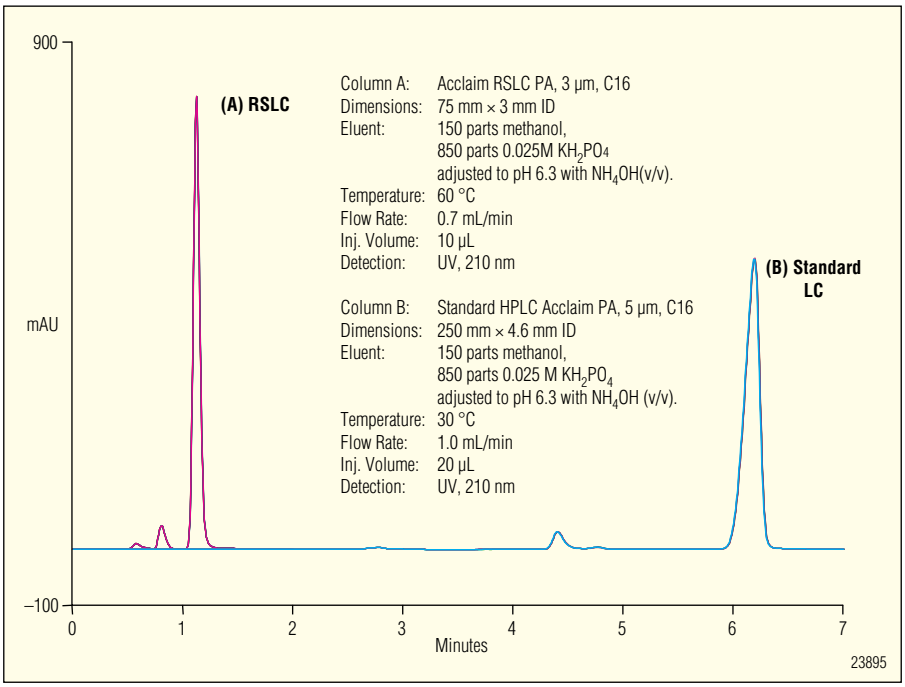


Figure 3. Comparison of standard LC and RSLC of the same compound (anticonvulsive drug), using Chromeleon Virtual Sequence. Note a sevenfold increase in speed and better peak shape and efficiency with the RSLC column.

Accelerate Pharmaceutical Applications

Chromatographic analysis at a major pharmaceutical company shows that standard LC separations using a 5-µm, 4.6 × 250 mm column is accelerated sevenfold using the Acclaim RSLC column. Figure 3 shows the advantages of RSLC over a standard Acclaim column.

Value of Acclaim RSLC

- Sevenfold increase in speed
- Improved peak shape and efficiency
- Better reproducibility
- Less injection volume (10 µL)
- Reduced mobile phase use (90%)
- Reduced wear on standard parts (e.g., the quaternary analytical pump) and consumables

The RSLC column did not require high pressure or special equipment (special binary pump, special gold coated connectors, special high pressure materials including columns) to achieve fast runs.

Increased Throughput, Eluent Savings Compared to Conventional LC

The separation efficiency in chromatography is controlled by the band broadening of the analyte zone moving along the separation column. The phenomena that influence band broadening in chromatography are described in the Van Deemter equation. This equation shows the dependence of the height equivalent of a theoretical plate (HETP) on the linear velocity of the mobile phase along the column. The linear velocity is controlled by the selected column diameter and the programmed flow rate. As a matter of fact, the chromatographic peak width and thus the resolution between two peaks are strictly related to HETP. The peak width is at minimum and the resolution at maximum when the HEPT adopts the smallest possible value (a low HETP is synonymous with a high separation efficiency). This flow rate, also referred to as the Van Deemter minimum, provides the highest resolution under otherwise given chromatographic conditions. Moreover, the loss of resolution when increasing the linear velocity beyond the optimal value, in order to speed up a separation, can be predicted with this equation.

Figure 6 shows the Van Deemter curves for four columns packed with 1.7 µm, 3 µm, 5 µm and 10 µm particles respectively. Three important conclusions can be drawn from these observations:

- The smaller the particle diameter, the better the resolution at optimal linear velocity.
- The smaller the particle diameter, the higher the optimal linear velocity, which translates into a faster separation.
- The smaller the particle diameter, the less severe the impact on resolution if the column is operated beyond the optimal flow rate to

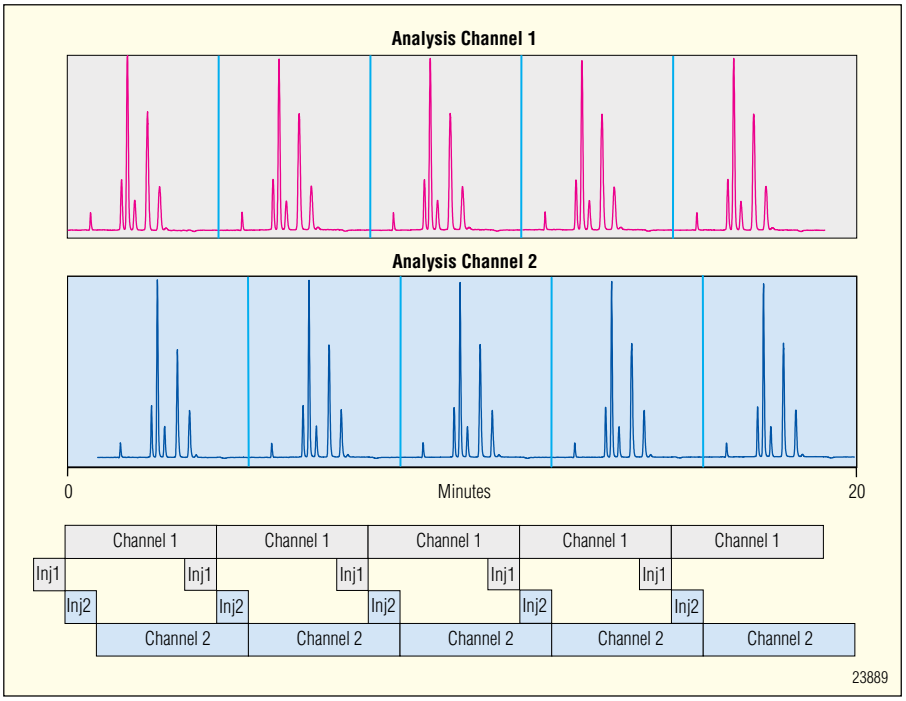


Figure 4. Parallel LC is a Dionex Intelligent LC solution that doubles sample throughput without any change to the initial method. Sharing dual gradient pumps (two ternary gradient pumps in one enclosure), the autosampler and column compartment between two different flow paths and detectors enable two separations in one system at the same time.

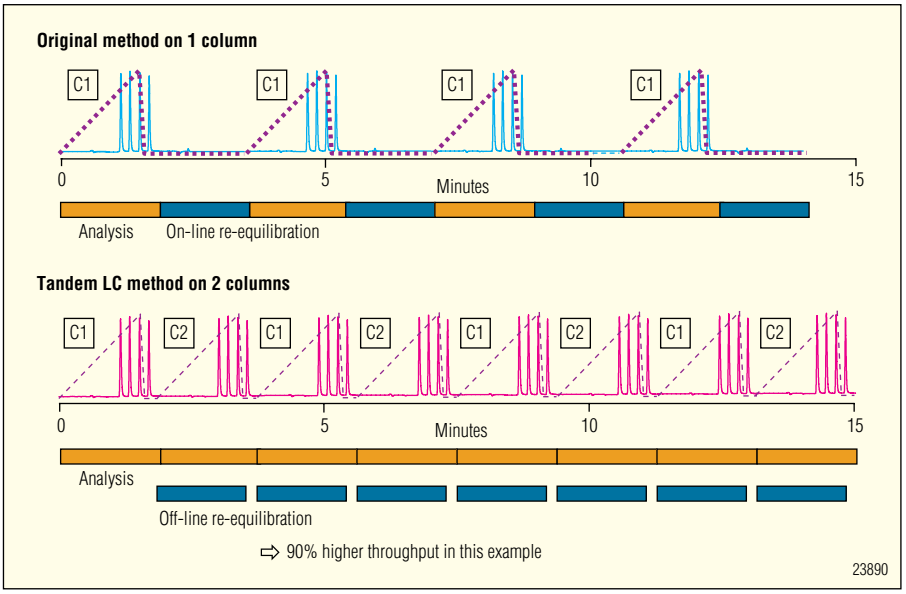


Figure 5. Tandem LC, another Dionex Intelligent LC solution, enables off-line column regeneration to significantly increase analysis throughput with selected gradient applications. This technique is accomplished using the UltiMate 3000 Intelligent LC series with Chromeleon® single-point software control and a wizard for easy method transfer from a one-column to a two-column method.

increase the separation speed.

Conventional LC uses particle diameters of 5 µm or higher, while Intelligent LC—using 3 µm or smaller particles—has obvious advantages. Separations are accelerated by 66% with improved chromatographic resolution by switching from 5-µm to 3-µm particles, keeping the column length constant, and adhering to the Van Deemter curve minimum. To maintain optimal resolution, the column length with 3-µm particles can be reduced to 60% of the original length. Combining the effect of a shorter column and a faster mobile phase movement (linear velocity), the speed of the 3-µm method is equal to more than 250% of the initial 5-µm method.

To further increase speed, the column can be operated beyond the optimal linear velocity. This speed up, however, will have more adverse effects with the 5 µm particles than with the 3 µm, as can be deduced from the slope of the Van Deemter curves at higher linear velocities.

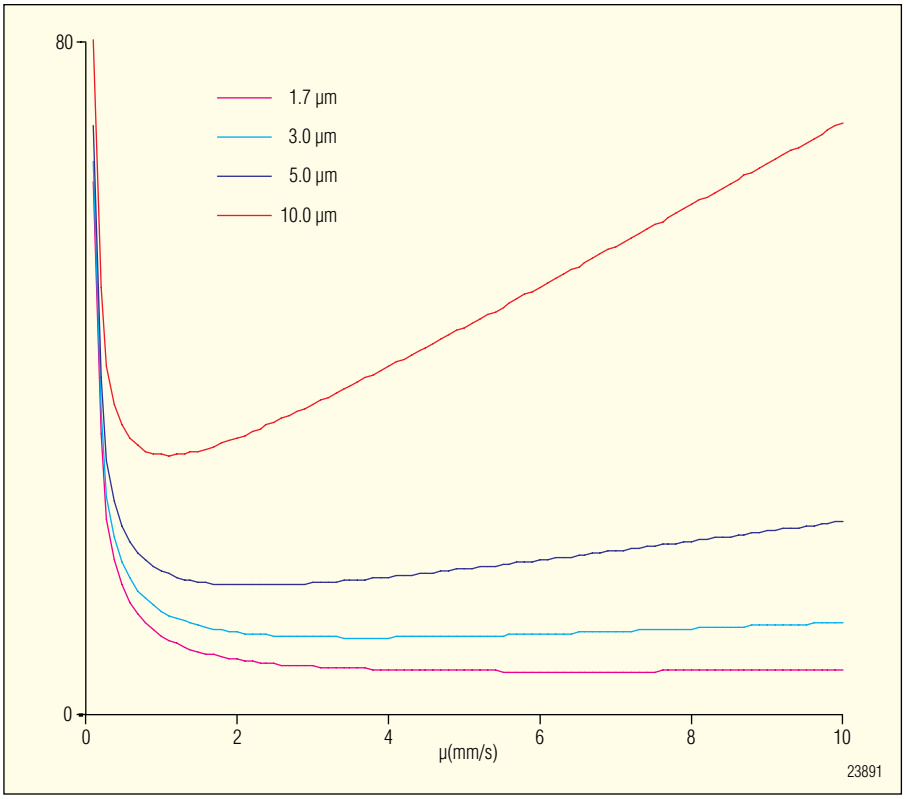


Figure 6. Van Deemter curves for columns packed with stationary phases of different particle diameters.

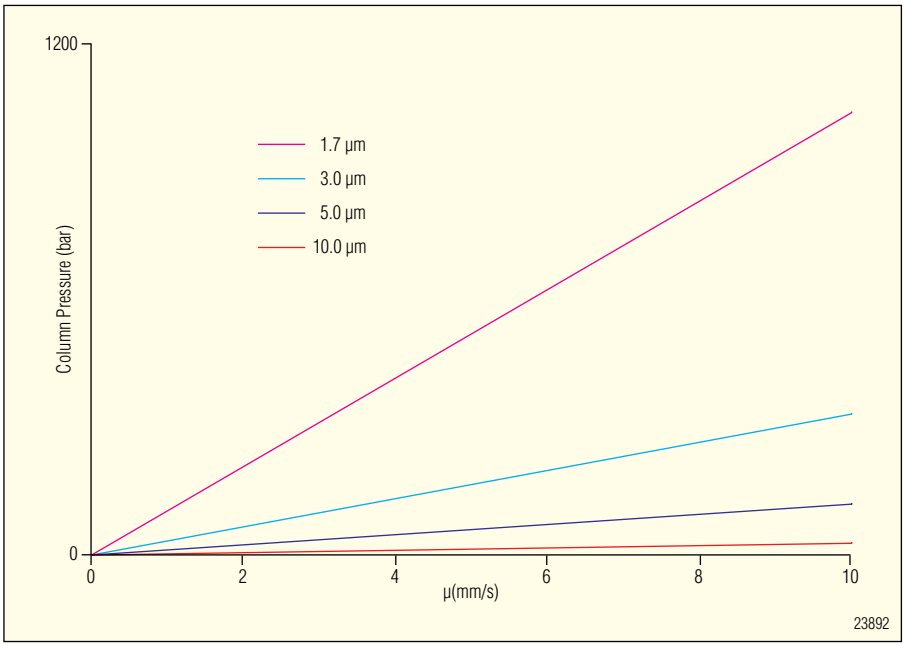


Figure 7. Theoretical pressure generated at 150 mm. Column pressure is shown as a function of the linear eluent velocity for columns packed with stationary phases of different particle size.

Advantages Over Sub-2-µm-Based LC

Acclaim RSLC columns help reduce stress on wear parts and reduce instrument demands, such as operating pressure. Due to the viscous friction of the eluent and the particles of the stationary phase, column backpressure is inversely proportional to the particle diameter squared. Figure 7 shows the column head pressure versus the linear velocity for a 150 mm long column packed with 1.7-µm, 3-µm, 5-µm and 10-µm particles respectively under typical eluent conditions. Clearly, the use of particles smaller than 2 µm, though they are advantageous with respect to their Van Deemter behavior, requires significantly higher pressure. If a method generates 80 bar on a column packed with 5 µm particles, a transfer to 3-µm particles would result in 220 bar, a transfer to 1.7 µm particles in 700 bar. Column length and linear velocity are adopted in that consideration. This shows that 3-µm particles are conveniently manipulated with standard LC equipment, while 1.7-µm columns require highly dedicated instrumentation. Such instruments are more challenging to operate and maintain, and show significantly higher wear on parts.

SPECIFICATIONS

	Acclaim 120 C18	Acclaim PA	Acclaim PA 2
Bonded Phase	C18	Sulfamido C16	Amide C18
Endcapped	Yes	Yes	Yes
Substrate	Ultrapure Silica	Ultrapure Silica	Ultrapure Silica
Particle Shape	Spherical	Spherical	Spherical
Particle size	3 µm	3 µm	3 µm
Metal impurity (ppm) Na, Fe, Al	<10 ppm	<10 ppm	<10 ppm
Average pore diameter	120 Å	120 Å	120 Å
Surface area (m^2/g)	300	300	300
Total carbon content	18%	17%	17%
pH range	2.0–8.0	2.0–8.0	1.5–10
Pressure limit (psi)	4500	4500	4500
Temperature	80	65	80
Organic solvents	20–100%	0–100%	0–100%

ORDERING INFORMATION

To order, using the following part numbers, contact your local Dionex office or distributor nearest you. In the U.S., call (800) 346-6390. In other regions, refer to the phone numbers below.

Acclaim RSLC Columns

Acclaim RSLC 120 C18, 3 µm, 3.0 × 33 mm.....066272
Acclaim RSLC 120 C18, 3 µm, 3.0 × 75 mm.....066273
Acclaim RSLC PolarAdvantage (PA) 3 µm, 3.0 × 33 mm 066274
Acclaim RSLC PolarAdvantage (PA) 3 µm, 3.0 × 75 mm 066275
Acclaim RSLC PolarAdvantage II, (PA2) 3 µm, 3.0 × 33 mm.....066276
Acclaim RSLC PolarAdvantage II, (PA2) 3 µm, 3.0 × 75 mm.....066277

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