LC Technical Note
LT183
GL Sciences Inc.

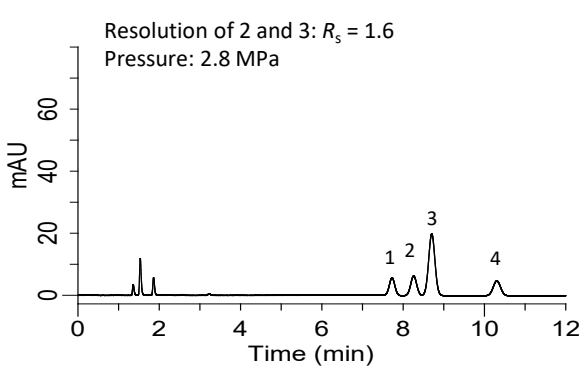
Reduction of Solvent Consumption in HPLC (2020 #1) –Tips for Isocratic Mode

GL Sciences has been suggesting reduction of solvent consumption in HPLC for more than 15 years. This technical note focuses again on how to reduce solvent consumption in HPLC by changing the column I.D. A reduction of more than 25% can be easily achieved in isocratic mode. This technical note is suitable for those who are using 4.6 mm I.D. columns.

(K. Suzuki)

For 4.6 mm I.D. column users

The example below shows reduction of solvent consumption from a 4.6 mm I.D. column. First, select the column I.D. depending on your reduction target; 4.0 mm I.D. and 3.0 mm I.D. enable ca. 25% and 60% reduction, respectively. Do not change the particle diameter, column length or packing material. When the narrower column is installed on the HPLC system, adjust the flow rate according to the ratio of the cross-sectional areas of the columns (i.e., 1:0.75:0.4 for 4.6 mm I.D. : 4.0mm I.D. : 3.0mm I.D.).



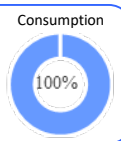
Conditions

System : GL7700
Column : InertSustain C18 (5µm, 150 mm long)
Mobile Phase : A) CH_3CN
B) H_2O
A/B = 75/25, v/v
Column Temp. : 40 ℃
Detection : UV 254 nm
Inj. Vol. : 1 µL

Note: other values are shown in the figures.

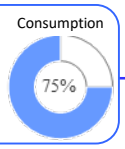
1. *n*-Butylbenzene
2. *o*-Terphenyl
3. Triphenylene
4. *n*-Amylbenzene

Column : InertSustain C18
5 µm, 150 x 4.6 mm I.D.
Flow rate : 1.0 mL/min

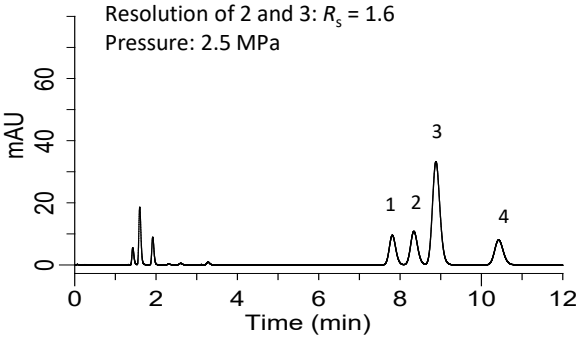


Only by changing the column I.D. and flow rate

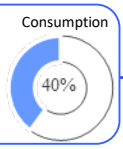
Column : InertSustain C18
5 µm, 150 x **4.0 mmI.D.**
Flow rate : **0.75 mL/min**



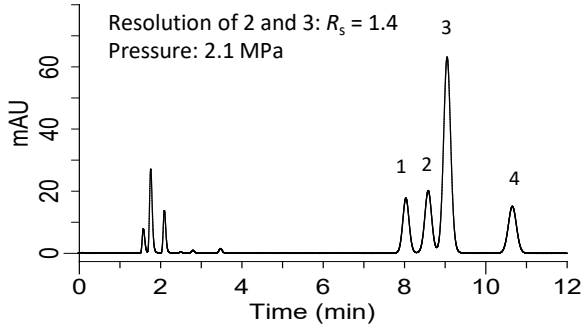
25 % Reduction!



Column : InertSustain C18
5 µm, 150 x **3.0 mmI.D.**
Flow rate : **0.4 mL/min**



60% Reduction!

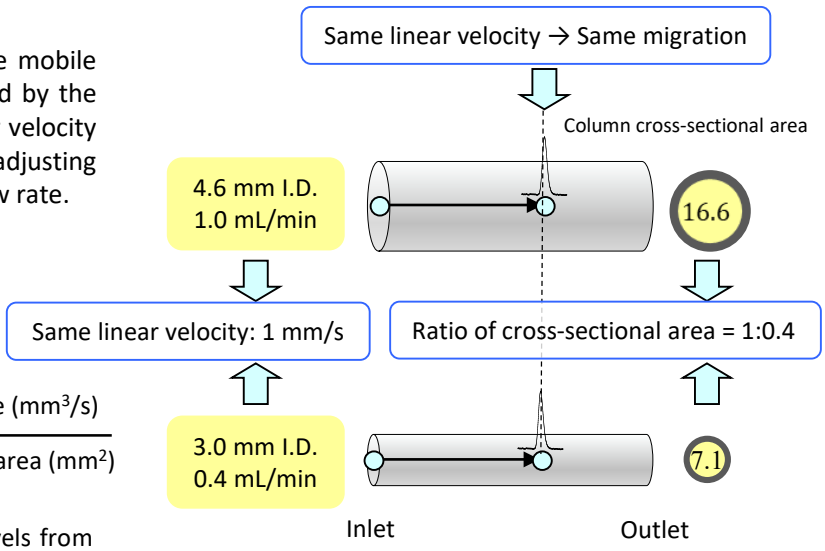


Similar chromatograms are obtained in the same analysis time when the I.D. and flow rate are adjusted to keep the linear velocity constant!

The linear velocity represents a distance the mobile phase travels per unit time, and is expressed by the below equation. In isocratic mode, the linear velocity and analysis time can remain constant by adjusting the column I.D. (cross-sectional area) and flow rate.

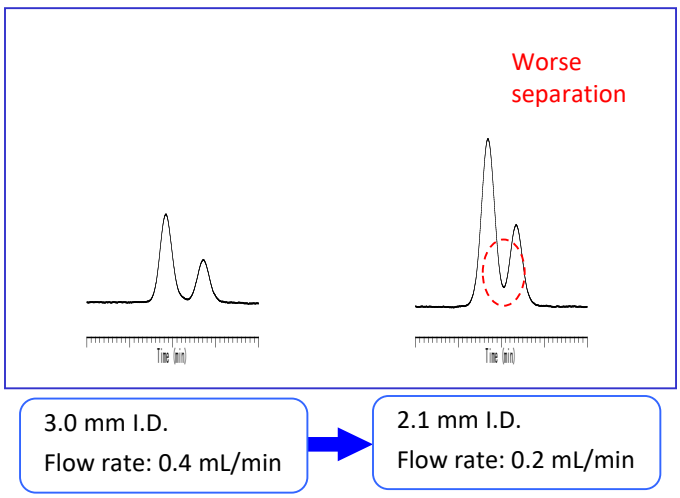
$$\text{Linear velocity (mm/s)} = \frac{\text{Mobile phase flow rate (mm}^3\text{/s)}}{\text{Column cross-sectional area (mm}^2\text{)}}$$

Linear velocity: a distance the mobile phase travels from inlet to outlet per unit time.



I.D. below 2.1 mm is difficult to use on conventional HPLC systems.

The figure on the right shows an I.D. reduction from 3.0 mm to 2.1 mm. As can be seen in the figure, the separation got worse by reducing the column I.D. This is because of the larger contribution of extra-column dispersion to total dispersion with 2.1 mm I.D. Therefore, a system with a low dead volume such as semi-micro LC, micro LC or UHPLC is necessary.



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