MICROSOLV

How much higher is the pressure generated on the Cogent 2.0 columns than 4um phases – FAQ

The column pressure under any conditions can be predicted using the following equation:

$$P = (150\ \eta\ L\ F) / (d_{particle}^2\ d_{column}^2)$$

where P is the pressure, η is the solvent viscosity, L is the column length, F is the flow rate, $d_{particle}$ is the particle diameter, and d_{column} is the column inner diameter. If only the particle size is varied *(same method, same column dimensions)*, then the factor $(150\ \eta\ L\ F)\ /\ d_{column}^2$ becomes a constant k:

$$P_{2\mu m} = k\ /\ d_{2\mu m}^2$$

$$P_{4\mu m} = k\ /\ d_{4\mu m}^2$$

The constant will be the same for 4μm and 2μm columns so we can solve each equation for k...

$$P_{2\mu m}\ d_{2\mu m}^2 = k$$

$$P_{4\mu m}\ d_{4\mu m}^2 = k$$

...and then set the two expressions equal to each other:

$$P_{2\mu m}\ d_{2\mu m}^2 = P_{4\mu m}\ d_{4\mu m}^2 = k$$

Note that we don't need to know the actual numerical value of k. Now we want to know how the pressures compare, so we will rearrange the equation to show the pressure ratio of 2μm vs. 4μm columns as a function of particle size:

$$(P_{2\mu m}\ /\ P_{4\mu m}) = d_{4\mu m}^2\ /\ d_{2\mu m}^2$$

$$(P_{2\mu m}\ /\ P_{4\mu m}) = 4^2\ /\ 2^2 = 16\ /\ 4 = 4$$

The equation shows the pressure will be theoretically **4 times higher** on the 2μm column than the 4μm column using equivalent conditions. In practice you may not use the exact same method conditions when transferring a 4μm method to a 2μm column. A lower flow rate or shorter column may be warranted, for example. You can still predict the pressure difference using different conditions but the comparison becomes more complicated if more than one variable is changed because k is no longer the same between the two methods.

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