

KORY'S GC TECK-TIPS

How does Fast GC work?

Fast GC is using smaller diameter columns to help reduce run times for gas chromatography. The reason that this works is all due to the increased efficiency of smaller ID columns which allow the use of shorter columns. A smaller ID column has much greater efficiency due to increased mass transfer (there is less gas to travel through before interacting with the other side of the column). Because the smaller ID columns have greater efficiency, the total length of the column can be decreased to achieve the same efficiency as a longer but less efficient and wider ID column. So, a 30x0.25x0.25 column and a 20x0.018x0.18 column will have similar efficiency though the 0.18mm ID column has only 20 meters of length.

The table below compares the efficiencies of different dimensions of columns though for your reference. Use the 0.25mm ID column as a starting point. Notice that the 0.18mm ID column has 39% increased efficiency allowing us to remove 33% of the column length (from 15 meters to 10 meters) and still retaining efficiency and therefore resolution!

Column ID (mm)	Theoretical Plates/Meter	Experimental Plates/Meter	% Increase N	% Increase R
0.10	12,500	7,500	83%	62%
0.18	6,600	5,700	39%	18%
0.20	5,940	5,000	25%	12%
0.25	4,750	4,100	0%	0%
0.32	3,710	3,350	-22%	-12%
0.53	2,240*	1,500**		

The use of shorter columns is important because it is that loss in length of the column that shortens the run times. A 30x0.18x0.18 column would actually have longer retention than a 30x0.25x0.25 column because there would be a greater number of interactions with the phase and therefore more retention. So, by simply reducing the internal diameter will not shorten the run times. If initially using a 15x0.25x0.25 column, we would suggest going down to a 10x0.18x0.18 column to reduce run times.

When using smaller ID columns, notice that the film thickness decreased with the diameter. This is to keep the phase ratio (β) the same since this term has an effect on selectivity. Decreasing the film thickness will decrease sample capacity though. To compensate for this, a higher split ratio can be employed (most often used method) or a thicker film can be used. A higher split ratio will reduce the amount of analyte onto the column, but that is somewhat offset because the analytes will elute from the column in a shorter amount of time resulting in more narrow and higher peaks.

If a thicker film is used, this will affect the phase ratio and can impact selectivity and possibly elution orders. This will add extra retention for compounds which may offset some of the advantages of going to a shorter column. Another effect is that a thicker film will also cause lower efficiency because there will be increased diffusion within the phase as well as slowing mass transfer (small but not insignificant).