Selection Guide

Tubing

VertiBond™ offer an excellent flexibility and high degree of inertness. The apparent of **VertiBond™** has expands the advantage of capillary columns that can be used in many applications. **VertiBond™** can be durable of breakage at any operating temperature and resist to abrasion and scratches, and theses columns can be coiled into a smaller diameter to fit into portable equipment. When you need to identify non-volatile contamination inside the column and breakage is less of a concern (stationary bench-top equipment), **VertiBond™** is the best selection. Furthermore, these columns are much more suitable to the addition of a guard column too.

Stationary Phase

The stationary phase have many interactions that can occur between the analyses and the functional groups of the stationary phase which more provide affect to the results of analysis than any other factor in the column. This is the reason for the important to understand as much about your column and sample as possible.

Changing in selectivity can be observed by using a column with difference functional groups as well as increasing the percentage of substitution of those functional groups. The non-polar phase will preferentially retain non-polar compounds compared to polar compounds such as alcohols. As non-polar methyl units are substituted with polar functionalities such as phenyl and cyanopropyl units, the selectivity of the column shifts towards more polar compounds. In turn, non-polar compound are retained less as there are less overall methyl units for the non-polar compounds to interact with. The stationary phase contains trifluoropropyl units which provide high selectivity for analyses containing lone pair electrons, such as nitro and carbonyl groups. Polyethylene glycol columns are polar and highly selective towards polar compounds such as alcohols.

ID (Internal Diameter)

Sample concentration and instrumentation must be considered for selecting an ID (Internal Diameter). Because, ID has important relation with sample capacity and resolution, that is, when the ID increase, sample capacity will increase but the resolution power will decrease, on the other hand, when ID decrease or narrow ID, sample capacity will decrease but resolution will increase. Therefore, the complex sample should be choose a narrow column ID and for the large volume sample should be choose the larger one. If sample concentration is exceeds or mismatch the column's capacity, then will result in less resolution, poor reproducibility, and peak distortion.

The type of instrument has an important thing for choosing column ID too; therefore the inlet suggests the optimum column ID. Example for narrow bore columns (0.18 mm ID<50ng) versus high capacity of 0.53 mm ID columns (200ng), also 0.53 mm ID columns are recommended in high flow situations, such as with a purge-and-trap unit. Conversely, narrow bore columns can be installed directly into a mass spectrometry detector because of the limited flow at optimum linear velocity. Furthermore, in GC/MS system or MSD with direct source coupling may require a column with a lower flow rate (0.20-0.25 mm ID).

Length

The benefits of using longer columns differ depending on whether isothermal or temperature programmed analyses are being performed, and the requirement of speed, time and resolution. For an isothermal analysis, column's length is direct proportional analysis time, if the column length is doubled; the analysis time will double as too. However, resolution is proportional to square root of the length. Longer column provide more resolving power, increase analysis times, and cost more. Often an analyst must determine whether the amount of resolution increase is worth the extra time an expense.

For common column's length used, almost laboratory used 30 m columns, The 15 m columns are used for fast, simple mixtures or extremely high molecular weight compounds, and 50, 60 and 105 m are used for extremely complex mixture.

Length effects

Length affects resolution and speed of analysis

$$\text{Resolution} = \frac{1}{4}\sqrt{\frac{L}{H}} \times \frac{k}{k+1} \times \frac{\alpha}{\alpha+1}$$

L = lenght
h = HETP
k = capacity factor
α = selectivity

In the case of temperature-programmed analyses, retention times are more dependent on temperature than column length. The increase in resolution is the same as an isothermal run, but there is only a marginal increase in analysis time. When using temperature programming, 60-meter columns provide better resolution than 30-meter columns without a significant increase in analysis time.

Film Thickness

Film Thickness has a direct effect on the retention time and elution temperature. Thicker-film retains compounds longer and increase temperature required for elutes the compounds, in the other hand, thinner-films will quickly elute and require lower temperature. Therefore, extremely volatile compounds or low-boiling compounds (gases, solvents and purgeables) should be analyzed on thick-film columns to increase the time the compounds spend in the column and allow them to separate near the room temperature. For high molecular weight compounds, such as triglycerides, must be analyzed on thin film columns, this minimizes the amount of time the analytes stay in the column and provides low bleed at elevated temperature.

Film thickness directly effects phase ratio (β), which is an important consideration when changing internal diameter. When internal diameter increase, film thickness (df) must increase in order to provide similar resolution and retention.