

Why use a Splitless Injection?

During a splitless injection the split valve is closed which minimizes the loss of sample and maximizes sensitivity. It is common to use a splitless injection for trace analysis.

Solvent Focusing

When injecting a liquid sample into the GC, it will vaporize within the splitless injector and then enter the head of the column. By having a low initial oven temperature the sample will recondense at the head of the column as a film. The recondensed solvent will trap the analytes and prevents them from moving through the column. As the oven temperature increases the solvent will evaporate and the analyte will be left at the head of the column. This is known as "solvent focusing".

This is beneficial as it will concentrate the sample at the head of the column which "focuses" the sample and will produce better peak shapes and sharpness in our analysis, especially in the early eluting analytes. This technique is valuable if your sample contains volatile compounds with boiling points close to your solvent.

To optimize solvent focusing, selection of injector and initial oven temperature is crucial. You will need to know the boiling point of the solvent and your analytes. As previously stated you want the injector temperature to be high enough to vaporize everything in the sample and the oven temperature below the boiling point of your solvent, usually 20 °C below is optimal. For some solvents 20 °C below boiling point of your solvent will not be practical without cryogenic cooling so in this case set your oven temperature as low as possible and if analysis results in poor peak shape then consider cryogenic cooling or changing your injection technique.

Analyte Focusing

If your sample contains compounds with a boiling point greatly above the solvent then a higher initial oven temperature can be used. This technique allows the solvent to pass through the column at the point of injection and then the analytes can be focused at the head of the column by selecting an initial oven temperature which is below the boiling point of your most volatile compound in your sample. This is referred to as "analyte focusing".

Solvent Polarity

For splitless injections your solvent choice is even more crucial as a greater amount of solvent will be injected onto the column. If using the technique of solvent focusing and the solvent choice

is not suitable for the column phase then this can lead to issues with peak shape and decrease in response of your analytes. This is due to something called the "reverse solvent effect".

The reverse solvent effect occurs when the polarity of the solvent and the polarity of the column phase are mismatched. This is said to lead to "beading" of the solvent on the stationary phase surface resulting in the sample recondensing at the column head unevenly. This increase can cause additional issues as depending on the analytes affinity towards the solvent compared to the column phase it could get "trapped" in the solvent. This can lead to split and tailing peaks.

To avoid issues with solvent polarity, you'll need to go back to the basic principle of "like dissolves like". Generally, if you have a low polarity column stationary phase then use a low polarity solvent e.g. SCION-5 column being used then hexane could be a good solvent choice. Another option is also to potentially use a guard column or a retention gap which can be placed before your analytical GC column and used to "focus" the sample before it reaches your analytical column.

A "guard column" or "retention gap" both usually refer to a length of uncoated but deactivated capillary column which is placed in front of the analytical GC column and connected through a union. The retention gap is mainly used as an extension of the liner and helps to focus the analytes at the head of the analytical column. A guard column is used primarily to protect the analytical GC column from problematic sample matrices but can also help to focus the sample.

It is important to always be mindful of your GC column maximum isothermal and programmed temperatures. See our technical note on [Column Care](#) for more information on the SCION Knowledge centre.

Splitless Liners

Liner choice is crucial to your analysis. Selecting the wrong liner can lead to poor sample transfer onto the column which will affect peak shape and response. Typically for a splitless injection you would select a liner with a taper at the column end of the liner to focus the sample onto the head of the column. Depending on your application, you may want to consider a specialised liner such as one containing quartz wool, that is base deactivated or chemically coated. See our [Liner Guide](#) for more information.