Protecting a GC Capillary Column from Matrix

If your chromatography degrades quickly after injecting samples (or standards) that contain matrix, the following suggestions may help increase the numbers of injections before routine maintenance (trimming the column, replacing the injection port liner, cleaning the injection port, etc.) is needed.

Dilute the sample

Assuming detection limits permit, if given the option to inject using split mode, or to dilute and inject using splitless mode, I suggest diluting the sample into a clean solvent and inject using splitless mode. Why? Although split injections will help to keep some matrix out of the capillary column, the injection port liner will likely become contaminated much quicker than if you dilute the sample into clean solvent and inject using splitless mode (assuming the solvent is not problematic, like with water injections).

In other words, diluting the sample into a clean solvent, even if injecting in splitless mode, should help keep the GC column, injection port, and injection port liner cleaner for more injections than not diluting the sample, even if the sample is injected using split mode.

Use wool in the liner

Using wool in the injection port liner is very common, as most of you know, to capture/trap unwanted material from getting into your GC column. In addition to simply using a liner packed with wool, I also suggest decreasing the injection port temperature to at least 25°C lower than the maximum GC oven temperature (of the GC method/program used for sample analysis). Using this trick should help trap/keep most non-volatile and semi-volatile residue in the injection port liner and out of the capillary column. The matrix that does get into the column should burn off at the higher (final maximum) programmed oven temperature.

Use a guard column

Using a guard column can trap non-volatile and semi-volatile residue, keeping much of it from entering the capillary column. When used in conjunction with wool in the injection port liner, most (if not all) of the non-volatile residue and semi-volatile residue should be trapped before it enters the analytical

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(phase-containing) GC column. Do not forget to trim/remove the contaminated section of guard column when you notice a degradation in chromatography (poor peak shapes, missing peaks, unstable or high baseline, etc.).

Use a pre-column

Instead of using a regular/traditional guard column which has no liquid phase inside of it, use a short piece (2-meter to 5-meter) of the same column/phase as the analytical column. Why? Unlike traditional guard columns, these pre-columns can usually capture/trap more non-volatile and semi-volatile residue in the sticky polymer. Trim this pre-column as needed and replace when the length is 1-meter.

Clean the Sample/Extract

Cleaning the sample, or sample extract, before injection may dramatically reduce the amount of matrix that gets into the injection port, injection port liner, and GC column. Consider SPE (Solid Phase Extraction), GPC (Gel Permeation Chromatography), QuEChERS dSPE (dispersive Solid Phase Extraction), and/or filtration by searching for a well-established published method that offers sample clean-up advice/procedure(s) for a similar analysis (compound list and matrix).

Consider an Alternative Sample Introduction Technique

Instead of simply injecting a liquid sample (or sample extract) for your application, there may be an alternative sample introduction technique available. If the compounds of interest have low boiling points (generally speaking, less than 125°C), you may want to try purge & trap, SPME (Solid Phase MicroExtraction - vapor extraction technique) and/or traditional headspace analysis. By only injecting the compounds that are able to enter the vapor phase at room temperature (or slightly above room temperature), all non-volatile residue and most semi-volatile residue should remain in the sparge vessel or headspace vial.