Why Inertness Matters in Gas Phase Analyses

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Abstract

In gas chromatography inert surfaces in the flow path from the inlet through the column to the detector are essential for achieving good peak shapes, low level detection and accurate results for active analytes. Active analytes that stick to exposed silanols and other chemically active sites in the flow path include: organic acids and bases, sulfur species, alcohols, amines, aldehydes, phenols, and pesticides. Accurate and reproducible measurements of these analytes play important roles in international commerce, product quality, environmental preservation, and human health risks assessment for consumer products and foodstuffs.

Modern GC and GC/MS instruments are capable of routinely monitoring single digit part per billion (ppb) levels of analytes provided the analytes survive the trip from sample injection, vaporization in the inlet, separation on the column and delivery to the detector. Assuring that analytes survive the trip depends in large part on the quality of the consumable products in the flow path that come in contact with the sample.

A flow path diagram is a very useful tool in understanding where and how a lack of inertness can negatively impact chromatography. Some example chromatograms of active analytes using inert flow path consumables compared with less inert consumables show visually why inertness matters. Remedies for avoiding potential pitfalls in the various sections of the flow path are displayed along with the flow path diagram.

An Inert Flow Path is Critical

When an active analyte is introduced, it must travel a flow path through the injector and the column to the detector. Active sites along a non-inert GC flow path (injector, column, and detector) can latch onto active analytes and degrade peak shapes, or can absorb trace analytes completely.

Flow path inertness is essential for lower detection limits and quantification of active analytes, so it is critical to improve inertness through better surface deactivation strategies. Manufacturing improvements enable analyses of difficult, active compounds present in trace amounts. Now lower limits of detection, less tailing, and more reliable results are available even for difficult analytes.

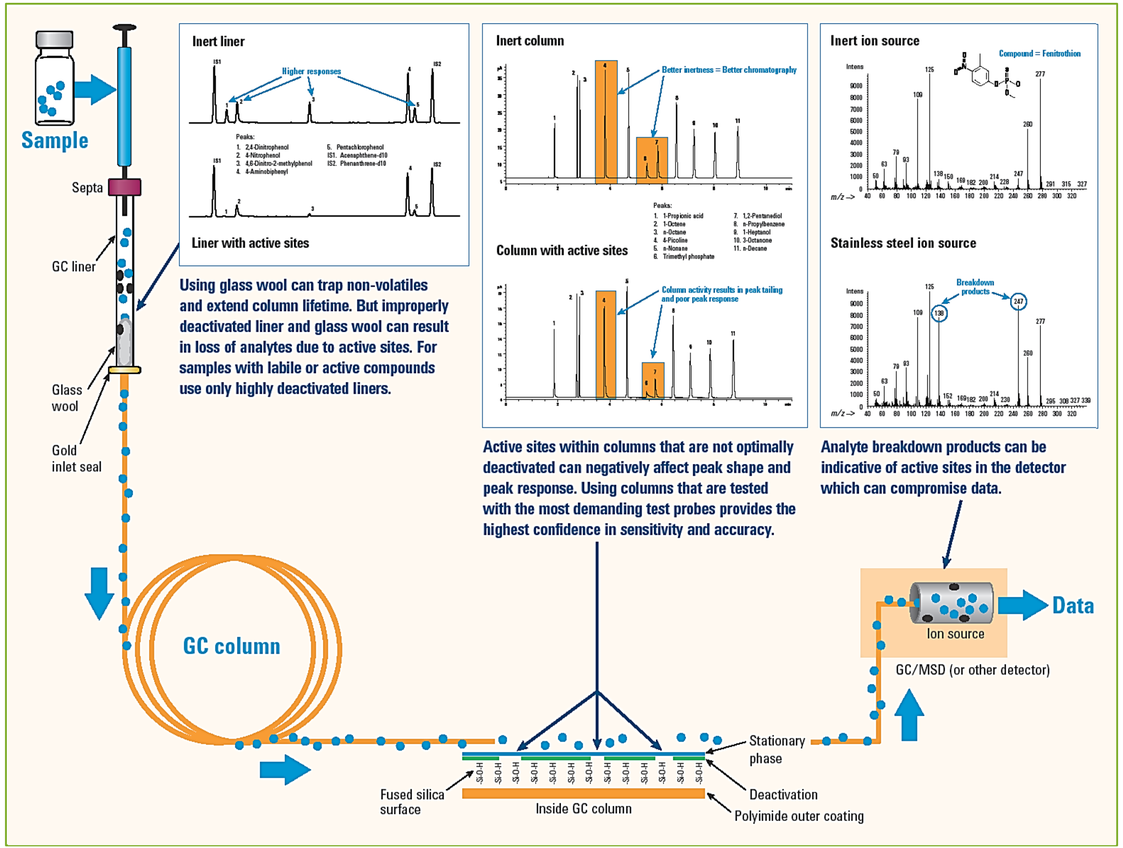
Active sites in an improperly deactivated liner or glass wool, such as silanol groups present on the glass surface, can cause the degradation or adsorption of sensitive compounds. This can result in loss of analytes before even reaching the GC column.

The importance of an inert GC column is crucial in the overall sample path inertness because it accounts for the majority of surface area the analyte is exposed to during the sample path. Traditional deactivation methods can leave gaps in surface coverage resulting in active sites within the column. Column activity can cause peak tailing and a decrease in peak response.

A non-inert detector can result in surface activity interactions which can compromise data. GC/MS is frequently used for trace level analyses in various industries. An inert MS source can result in improved peak symmetry and response, and minimize degradation ions for more reliable library matches.

To ensure accurate quantification and high sensitivity, flow path inertness is essential *so what you inject you detect.*

Optimizing Your GC Flow Path for Inertness



Top 5 TIPS for GC Flow Path Inertness

1 Maintain the inlet

Preventative maintenance helps ensure peak instrument performance and productivity. Inspect and replace worn or dirty flow path supplies - such as syringe needle, septa, ferrules, and inlet seals - to eliminate leaks and minimize downtime. Using certified vials, caps, septa, ferrules, and gold inlet seals also extends the flow path maintenance interval.

2 Prevent sample loss at injection

Inlet liners are a critical link in the sample flow path, and can be a source of activity and analyte loss. Liner design and chemistry impact the transfer of compounds into the column, so you should always use a reliably deactivated liner suited to your injection technique. Change the liner when there is visible discoloration indicating non-volatile residue buildup from samples. This can be challenging to detect; so when in doubt, change the liner. This will maximize sample transfer and minimize sample loss.

3 Select a column with optimized inertness

Optimized column inertness minimizes compound loss and degradation for more accurate quantitation of active analytes, especially at trace levels. To ensure consistent column inertness, choose a column that has been tested with a rigorous test probe mixture for in-depth evaluation and certification of inertness. When installing the column, start with high quality ferrules and examine column ends for chips or burrs under magnification. Make sure the column is positioned the recommended depth into the inlet and detector.

4 Remember your detector

To ensure accurate quantitation and high sensitivity, the flow path must be highly inert, including detector surfaces. This is especially true of mass spectrometers, where an inert ion source is necessary to prevent active compounds from attaching to metal surfaces. The best inert sources are constructed of a solid inert material, as opposed to an inert coating which can wear away over time.

5 Use a gas purifier

A clean, high quality gas supply that is free of oxygen and contaminants reduces the risk of column damage, sensitivity loss, and downtime, improving performance and increasing productivity.

For More Information

To learn more about creating the most inert flow path, and to download your FREE Ultra Inert Brochure, visit www.agilent.com/chem/ultrainert

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