

# The Advantage

Innovators of  
High Resolution  
Chromatography  
Products

## CarboFrit™

# Inlet Liner Inserts

### An alternative to glass wool packings for split & splitless injection liners.

- Exhibits excellent inertness for highly active compounds.
- Allows unimpeded inlet flows.
- Provides low inlet liner pressure drop.
- Improves trapping of high molecular weight contaminants.
- Eliminates off gassing or bleed from deactivation.

Packing split/splitless inlet liners with glass or fused silica wool improves sample vaporization, traps non-volatile sample residue, and is necessary for proper operation of fast autosamplers. However, the benefits to analytical systems are sometimes overshadowed by problems such as adsorption of active compounds, variable packing densities, and off gassing or bleed from deactivation agents. Chromatographers have learned to live with these problems because there were no alternatives – until now.

Researchers at Restek developed an alternative material for packing inlet liners that overcomes many of the limitations of glass or fused silica wool. CarboFrit™ inlet liner inserts provide chromatographers with the same advantages as glass wool: improved vaporization and low pressure drop with superior inertness, higher temperature stability, and better trapping of high molecular weight contaminants. The uniform pore size of these frits guarantees consistent flow through the liner.

The CarboFrit™ inserts are available prepacked in 4mm ID split and splitless liners for HP and Varian GCs or individually as replacement packing. They are easy to install into any inlet liner with a 3.5mm or greater ID\* and can be easily replaced if contaminated by dirty sample residue or septum particles. Analysts no longer have to fumble with brittle wool or worry if active sites have been exposed.



*CarboFrit™ packing offers the advantages of glass wool but with superior inertness, higher temperature stability; improved retention of sample contaminants, and more consistent packing densities.*

The inertness of the CarboFrit™ inserts was evaluated with several active classes of compounds including pesticides and phenols. Endrin, a chlorinated pesticide, is a very good indicator of sleeve inertness. It will readily break down to endrin aldehyde and endrin ketone in an active injection system. A 50pg standard of endrin was injected into five different liners packed with CarboFrit™ inserts. Table I (on page 2) shows the endrin breakdown results for these five liners. The average breakdown was less than 3% which is well within the 20% breakdown guidelines required in most EPA protocols.

*\*Liners with IDs less than 3.5mm can be packed on a custom basis.*

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Table 1 Endrin Breakdown Results with CarboFrit™ Inserts

Sleeve#	% Endrin Breakdown
1	3.4
2	7.8
3	0.8
4	0.4
5	2.3
Average	2.9
Standard Dev.	2.7

The inertness of CarboFrit™ inserts and fused silica wool was compared by analyzing a mixture of EPA Method 604 phenols. Figure 1 shows the analysis of these phenols. The response of 2,4-dinitrophenol (peak 8) and 2-methyl-4,6-dinitrophenol (peak 10) is significantly higher with the CarboFrit™-packed liner. Even though the glass wool packed into the first liner was deactivated, some active sites were exposed from placing it into the sleeve. These exposed sites can adsorb low levels of active compounds such as 2,4-dinitrophenol and 2-methyl-4,6-dinitrophenol.

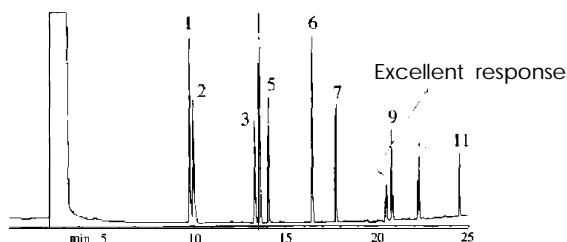
One limitation we discovered was that the CarboFrit™ inserts can retain low concentrations of hydrocarbons above C30 or 4- and 5-ring aromatic hydrocarbons at levels less than 20ng/pl in the splitless injection mode. However, at concentrations commonly used for split injections (>20ng/ul), no retention was observed. For all other classes of compounds and lower molecular weight hydrocarbons, no retention was observed. This is true even at levels below 50pg. Increased injection port temperatures will reduce retention of high molecular weight aromatic compounds at trace levels when using

CarboFrit™ inserts. Elevating injection port temperatures to as high as 400°C will ensure that these components completely elute from the injector. Unlike deactivated glass wool that can release siloxane deactivants at high injection port temperatures, CarboFrit™ inserts show no background contamination peaks even at injection port temperatures of 350°C. CarboFrit™-packed liners can be oxidized at high temperatures in the presence of room air. Therefore, the injector should be cooled before installing or replacing the CarboFrit™ insert. In addition, high-purity carrier gas and oxygen-removal traps should be used on carrier gas lines.

Restek has developed an alternative liner packing that offers all the positive features of wool without the adsorption problems. The CarboFrit™ insert is easy to install and replace and can be used for a wide range of applications including alcohols, amines, pesticides, esters, dioxins, triglycerides, fatty acid methyl esters, and hydrocarbons. Call Restek to discuss how these inserts can help with your analyses.

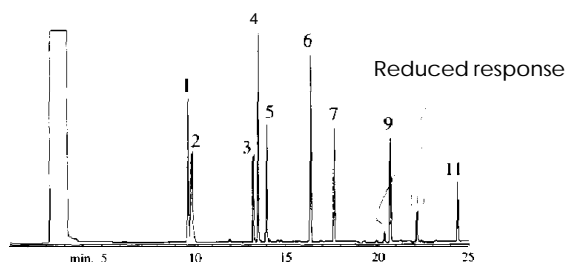
Figure 1: CarboFrit™ inserts show excellent response to active phenols including 2,4-dinitrophenol and pentachlorophenol compared to liners packed with deactivated glass wool.

liner packed with a Carbofrit™ insert



- |                   |                            |                                |
|-------------------|----------------------------|--------------------------------|
| 1. phenol         | 4. 2,4-dimethylphenol      | 8. 2,4-dinitrophenol           |
| 2. 2-chlorophenol | 5. 2,4-dichlorophenol      | 9. 4-nitrophenol               |
| 3. 2-nitrophenol  | 6. 4-chloro-3-methylphenol | 10. 2-methyl-4,6-dinitrophenol |
|                   | 7. 2,4,6-trichlorophenol   | 11. pentachlorophenol          |

liner packed with deactivated wool



30m, 0.25mm ID, 0.25u XTI™-5 (cat.# 12223). 1.0ul splitless injection of Method 604 phenols. **Oven temp.:** 50°C (hold 4 min.) to 250°C @ 8C/min.; **Inj. & det. temp.:** 275°C; **Carrier gas:** H2, **Linear velocity:** 24cm/sec. set @ 50°C; **Splitless hold time:** 1 min.; **Split vent flow:** 50mU/min.

Gob, K., "Sample Evaporation in Hot GC Injectors". The Restek Advantage, Winter 1996, pp. 12-13.



Prepacked Sleeves.

4mm Splitless		4mm Gooseneck
for HP	for Varian	for HP
20772-209.1	20904-209.1	20798-209.1
20773-209.5	20905-209.5	20799-209.5
20774-209.25	20906-209.25	20800-209.25

The catalog numbers above ending in ".1" are single packs, ".5" are 5-packs, ".25" are 25-packs, ".25" are 25-packs

To order other sleeves >3.5mm ID prepacked with CarboFrit™ inserts, add the appropriate suffix to the inlet sleeve catalog number.

Each	-209.1
5-pack	-209.5
25-pack	-209.25

<b>Replacement hits &amp; Accessories:</b>	<b>Cat #</b>
CarboFrit™ (10-Pack)	20295
Puller\ Packing tool	21642