Direct Connect Liners: Improved Response for Active Compounds

Technique/Technology

Author

Mike Szelewski
Bill Wilson
Agilent Technologies, Inc.
2850 Centerville Road
Wilmington, DE 19808
USA

Harry Prest
Agilent Technologies, Inc.
1601 California Avenue
Palo Alto, California 94304-1111
USA

Introduction

The split/splitless GC inlet is the most commonly used inlet and for trace compound analysis and splitless injection is the most widely applied technique. This technique is rugged, robust and sensitive since a large portion of the sample is delivered to the column. Key to the technique is vaporization in the inlet. This vaporization is facilitated by the inlet liner. Liners have been developed in a variety of forms but the most commonly used liners are straight, deactivated borosilicate glass with a tapered bottom to prevent contact with the metal baseplate of the inlet. Liners with tapers at the bottom and the top are also popular since they provide better containment of the injected sample. This is important for difficult or active compounds which tend to be lost or irreversibly adsorbed in the inlet. These compounds tend to be highly polar and are often acidic or basic compounds.

In theory, the response factor should be constant and independent of the amount injected. Typically the response factor (detector signal per weight of compound injected) is smaller at lower concentrations than at higher concentrations.

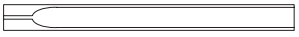
The lowered response is more apparent at small concentrations because the portion of the analyte that is lost in an injection is a larger and more distinguishable fraction of the total amount injected. To increase response and therefore sensitivity for these troublesome compounds, Agilent Technologies now offers Direct Connect Liners for the 6890 GC. These liners directly connect the capillary column to the liner to reduce possible losses during injection.

The nitrophenols, especially 2,4-dinitrophenol are known to demonstrate this behavior. This note illustrates the improvements in response that are possible for splitless injection by changing inlet liner type and demonstrates the performance of the Direct Connect Liner using 2,4-dinitrophenol as a model for active compounds.

Liner types

Several standard liner types were compared to the new Direct Connect Liners, Table 1.

Table 1. Inlet Liners

Part Number	Liner Type
5062-3587	Single Taper with glass wool 
5181-3316	Single Taper (open top) 
5181-3315	Double Taper (closed top) 
G1544-80730	Direct Connect Liner with single taper 
G1544-80700	Direct Connect Liner with double taper 

Splitless injection parameters were optimized for each liner type based on the FID response. The same column was used for all experiments. The 2,4-dinitrophenol response factors for 5 ng, 20 ng, 80 ng and 160 ng were calculated relative to a constant concentration of internal standard for each liner and for cool on-column injection. The results are summarized in Figure 1.

In a perfect world, the responses for each splitless liner would look like the on-column injection results (at the right in Figure 1). The cool on-column injection produces identical response factors regardless of whether 5, 20, 80 or 160 ng of the active compound are injected. The differences among the liners is most evident at the 5 ng level. The single taper with wool liner shows the lowest relative response for the 2,4-dinitrophenol. Removing the wool shows an improvement. Although adding deactivated wool is a standard practice for dirty samples, wool activity is difficult to reduce. The double taper liner provides a dramatic increase in relative response due to the enhanced confinement during injection. Both the Direct Connect single and double taper liners show the best responses for the active analyte with performance very close to that achieved by cool on-column injection. In fact, only a small fraction of the signal is lost at the 5 ng and 20 ng levels. However, as with on-column injection, these Direct Connect Liners do deposit more material into the capillary column. The Direct Connect Liners are best suited for relatively clean samples such as water extracts; nevertheless, these liners have worked successfully for solid waste methods and the user should evaluate them with respect to their specific operating protocols.

For More Information

For more information on our products and services, you can visit our site on the World Wide Web at: **http://www.agilent.com/chem.**

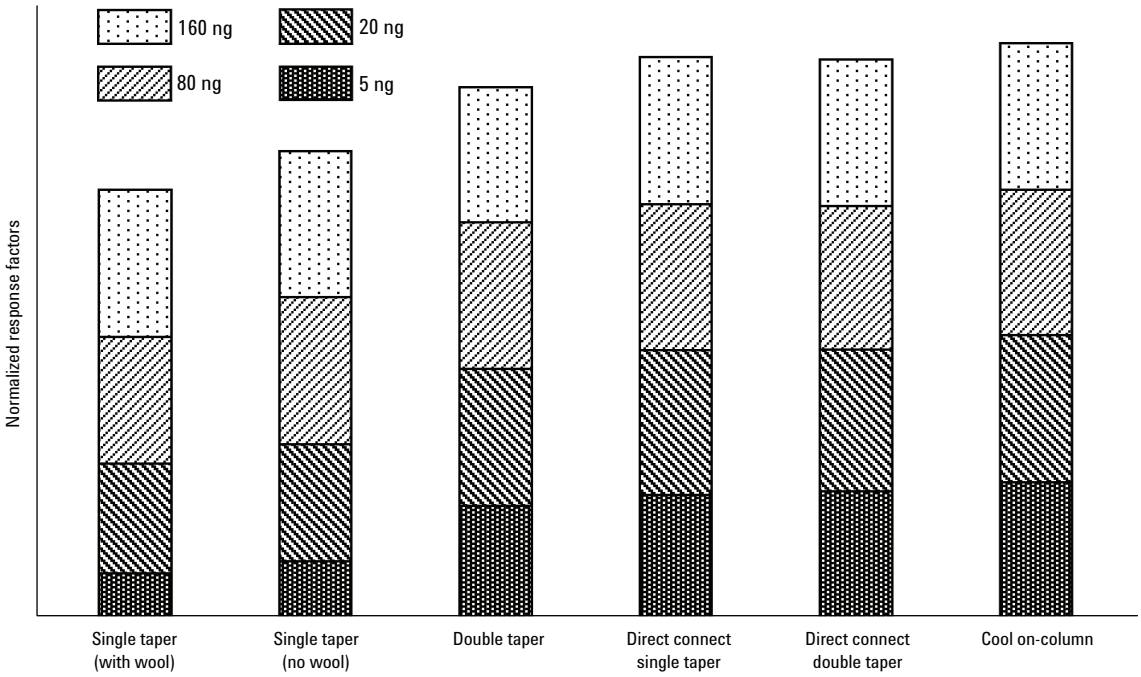


Figure 1. Normalized relative response factors for 5, 20, 80, and 160 ng of 2,4-dinitrophenol injected in each liner.

Agilent Technologies shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

Information, descriptions, and specifications in this publication are subject to change without notice.

Copyright© 2001
© Agilent Technologies, Inc.

www.agilent.com/chem

Printed in the USA
September 12, 2001
5988-3933EN

Agilent Technologies