

GC Inlet Liner Deactivations for Basic Drug Analysis

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- Base-deactivated inlet liners are inert to basic drugs, for greater responses.
- Inertness of Rtx®-5 Amine column is enhanced for basic compounds.
- Use this liner / column combination for the lowest %RSDs for basic drugs.

Clinical and forensic toxicologists are required to detect low levels of abused drugs in body fluids and confirm their presence by GC/MS. Typical limits of detection are 1-15ng/mL, depending on the sample matrix. For basic drugs (e.g., Figure 1), selecting the proper surface treatment for the GC inlet liner is important, because this parameter can affect responses. The surface of a glass inlet liner contains active silanol groups (Si-OH) that can act as electron pair acceptors, and react with nitrogen or oxygen electron pair donors in basic drug molecules (Figure 2).¹ These reactions usually are rapid and reversible, but they are expressed chromatographically as broad, tailing peaks and/or reduced responses. To eliminate these acid-base reactions, make chromatographic peaks sharp, Gaussian, and easy to integrate, and thereby help ensure reproducible and accurate responses, the -OH groups on the glass surface must be deactivated.

We evaluated several alternatives for deactivating inlet liners to determine the best deactivation chemistry for the analysis of basic drugs. Standards composed of the free base forms of the drugs shown in Figure 1 were prepared at concentrations of 5, 10, 25, 50, and 100 ng/mL for analysis on a 15m, 0.25mm ID, 0.25µm Rtx®-5 Amine column (5% diphenyl/95% dimethyl polysiloxane stationary phase). The analysis of these drug standards was repeated on a series of 4mm ID single gooseneck liners that had been treated with different deactivation techniques, as well as an untreated liner. Three replicate analyses were performed on each liner to determine which deactivation treatment offered the highest and most consistent response for these basic drugs.

We used these results to generate box plots that display the range of data distribution, or variation – an indication of the reproducibility of the performance. We chose phencyclidine (PCP) and cocaine plots to represent the nitrogen-containing and nitrogen/oxygen-containing drugs, respectively (Figure 2). The line in each box indicates the mean response.

The data show that undeactivated liners and liners that received intermediate polarity treatment provided poorer responses or reproducibility, com-

Figure 1 Basic compounds can react with silanol groups on glass inlet liner surfaces, causing poor chromatography.

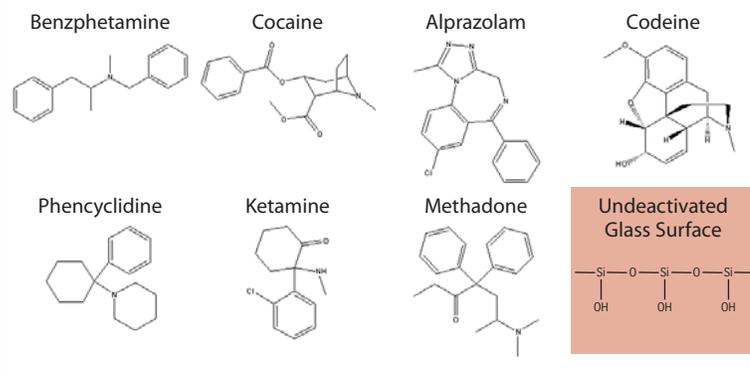


Figure 2 A base-deactivated inlet liner provides highest mean responses for PCP.

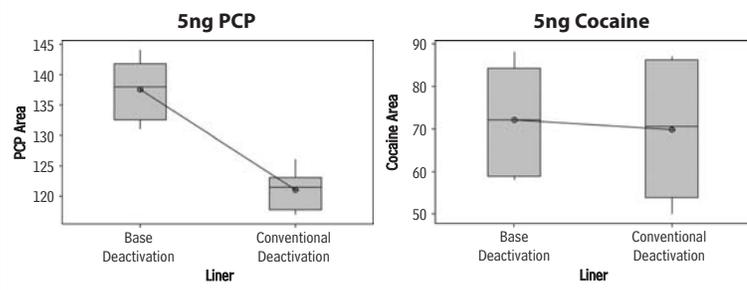
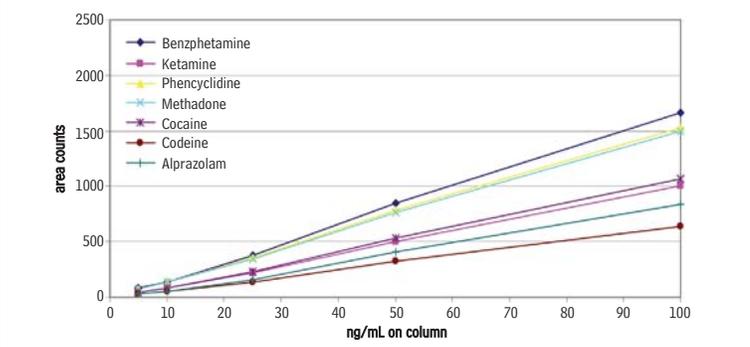


Figure 3 Linearity plots for all drugs, analyzed using a base-deactivated inlet liner and an Rtx®-5 Amine column.



Base Deactivated Inlet Liners for Basic Drug Analysis

For Agilent GCs	ea.	cat.#	5-pk.	25-pk.
Gooseneck Splitless, Base Deactivated (4.0mm ID* x 6.5mm OD x 78.5mm)	20798-210.1	20799-210.5	20800-210.25	
Gooseneck Splitless, Base Deactivated w/ Base Deactivated Wool (4.0mm ID* x 6.5mm OD x 78.5mm)	20781-211.1	20799-211.5	20800-211.25	
Split Straight, Base Deactivated w/ Base Deactivated Wool (4.0mm ID* x 6.3mm OD x 78.5mm)	20781-211.1	20782-211.5	20783-211.25	
Cycloplitter®, Base Deactivated (4.0mm ID* x 6.3mm OD x 78.5mm)	20706-210.1	20707-210.5	20708-210.25	

*Nominal ID at syringe needle expulsion point.

For liners for other instruments, refer to our catalog or website.

Base-Deactivated Inlet Liners

qty.	Base-Deactivated Liner	Base-Deactivated Liner w/ Base-Deactivated Wool
each	-210.1 addl. cost	-211.1 addl. cost
5-pk.	-210.5 addl. cost	-211.5 addl. cost
25-pk.	-210.25 addl. cost	-211.25 addl. cost

For base-deactivated inlet liners, add the corresponding suffix number to the liner catalog number.

Base-Deactivated Wool

Ideal for amines and other basic compounds.

Description	qty.	cat.#
Base-Deactivated Wool	10 grams	20999



Mini Wool Puller/Inserter

Insert and remove wool plugs easily.

Description	qty.	cat.#
Mini Wool Puller/Inserter	2-pk.	20114



Inlet Liner Removal Tool

- Easily remove liner from injector—no more burned fingers.
- Made from high-temperature silicone.
- Won't chip or crack the liner.



Description	qty.	cat.#
Inlet Liner Removal Tool	3-pk.	20181

Rtx®-5 Amine Columns (fused silica)

(Crossbond® 5% diphenyl/95% dimethyl polysiloxane)

ID	df (µm)	temp. limits	length	cat. #
0.25mm	0.25	-60 to 300/315°C	15-Meter	12320
0.25mm	0.25	-60 to 300/315°C	30-Meter	12323



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pared to base-deactivated or Siltek® treated liners, due to the acidic nature of the undeactivated glass surface or to a small but influential number of residual acidic sites remaining on the intermediate polarity deactivated surface.

Because the undeactivated liners and intermediate polarity treated liners exhibited either low mean response or high variation, we reanalyzed the data, excluding these treatments and comparing the remaining data (for base-deactivated liners and Siltek® treated liners) for responses and reproducibility. As shown by the examples in Figure 2, base-deactivated liners and Siltek® treated liners performed equally well for cocaine, but the base-deactivated liners yielded the best responses and reproducibility for PCP. Ultimately, a base-deactivated liner would give the best overall performance. Figure 3 shows the linearity plots for all analyzed drugs, obtained using a base-deactivated liner and an Rtx®-5Amine column. Low %RSD values for ketamine (3%), phencyclidine (2%), methadone (2%), cocaine (3%), codeine (5%), and alprazolam (12%) confirm the reproducibility of data obtained from this combination.

Because nitrogen- and oxygen-containing drugs react with silanol groups on glass surfaces, it is important to use properly deactivated glass inlet liners when analyzing these compounds by GC. This work demonstrates that a base-deactivated inlet liner, used in combination with a base-deactivated column, produces high and reproducible responses for basic drugs.

Reference

1. Seyhan N. and D.C. Ege, *Organic Chemistry Health and Company*, 1984, pp.124-136.

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