

Comprehensive Dual-Column GC for Pharmaceutical Solvents

Analyze all EPA Method 1671 Analytes, Using a Stabilwax® / Stabilwax® DB Column Pair

By Rick Lake, Pharmaceutical Applications Chemist

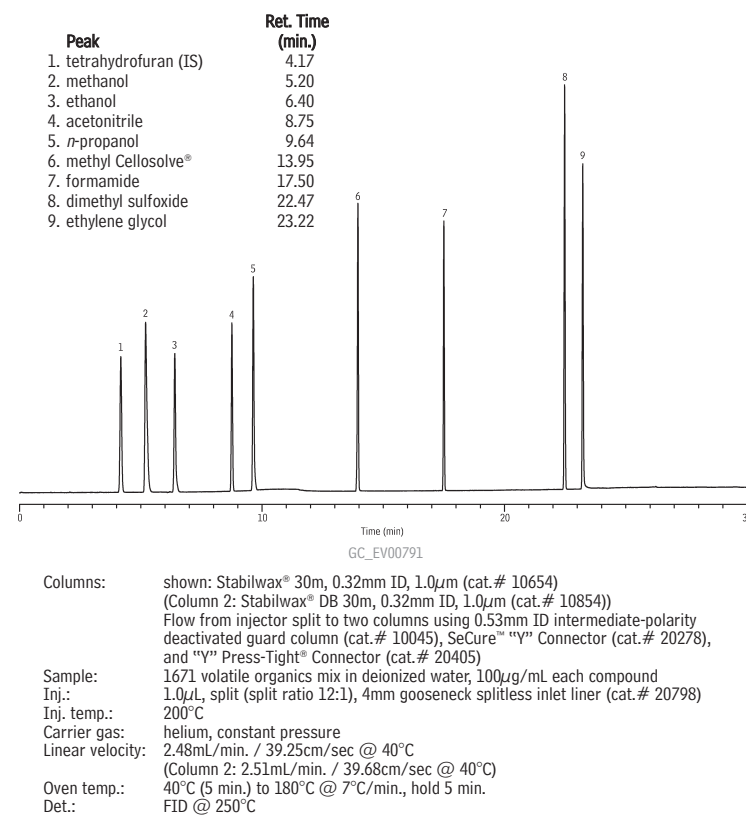
- Dual-column approach targets all listed potential pollutants with one injection.
- Excellent resolution and peak shapes from two polyethylene glycol (PEG) stationary phases.
- Superior analysis of the primary amines from a base-deactivated PEG.

The fate of solvents used in manufacturing pharmaceutical products is a worldwide concern. In the US, EPA Method 1671, *Volatile Organic Compounds Specific to the Pharmaceutical Manufacturing Industry by GC/FID* is used to monitor concentrations of non-purgeable pollutants in the aqueous discharge of pharmaceutical manufacturing facilities. Method 1671 is a performance-based method and, therefore, may be tailored to specific analytes and advantageous techniques, if all acceptance criteria are upheld. The target analytes—water-soluble organic solvents used in manufacturing pharmaceutical products—include primary amines (methyl amine, dimethylamine, diethylamine, triethylamine), which are basic in nature, and alcohols (methanol, ethanol, ethylene glycol), which are slightly acidic. When the diverse chemical properties of the target analytes are considered, column selection might be the most important aspect to developing a successful approach to this method.

The first step in developing any GC method is selection of the stationary phase. The diverse chemical nature of the analytes in Method 1671 is a major consideration. Polyethylene glycol (PEG) stationary phases are an excellent choice for analyzing organic solvents in a water matrix. PEG is a polar material with the capacity to resolve all applicable analytes, as well as to retain polar solvents, like water. Retention of polar solvents is advantageous here, because it enables the analyst to inject larger samples without the worry of extinguishing the FID. Yet, because both basic and acidic properties are represented by the analytes, no single analytical column may be capable of effectively analyzing all analytes: a column incorporating a base-deactivated functionality might act against the chromatography of the acidic alcohols and, likewise, a column without specific base deactivation might not provide acceptable chromatography for the basic primary amines. Therefore, we used a dual-column method comprising both base-deactivated and non-base-deactivated PEG stationary phases to analyze the entire Method 1671 target list.

Using a SeCure™ “Y” Connector (cat.# 20278), we divided the flow leaving the inlet of the GC system into two 30m, 0.32mm, 1.0µm columns: a Stabilwax® column and a Stabilwax® DB column

Figure 1 Excellent resolution and peak symmetry for non-basic pharmaceutical solvents, using a Stabilwax® column.



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Universal “Y” Press-Tight® Connectors

An alternative method of performing dual-column confirmation analyses!

- Split sample flow onto two columns.
- Split a single column flow to two detectors.
- Deactivated Press-Tight® connectors assure better recovery of polar and non-polar compounds.
- Siltek® treated connectors are ideal for chlorinated pesticides analysis.
- Fit column ODs from 0.33–0.74mm (Restek 0.1mm–0.53mm ID).

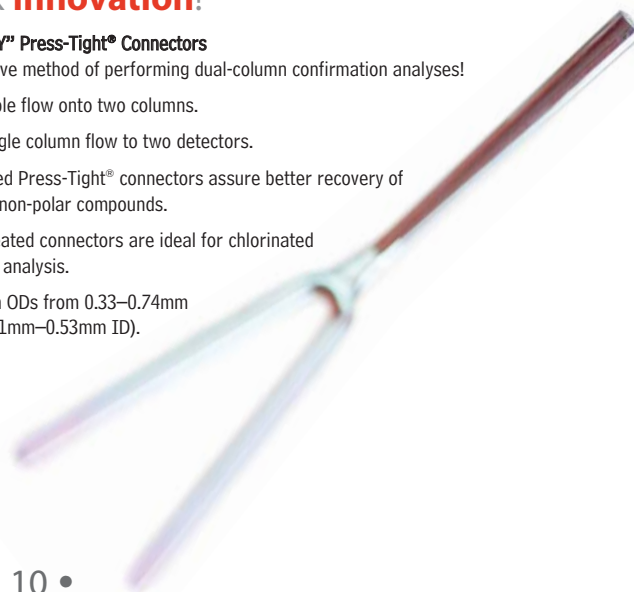
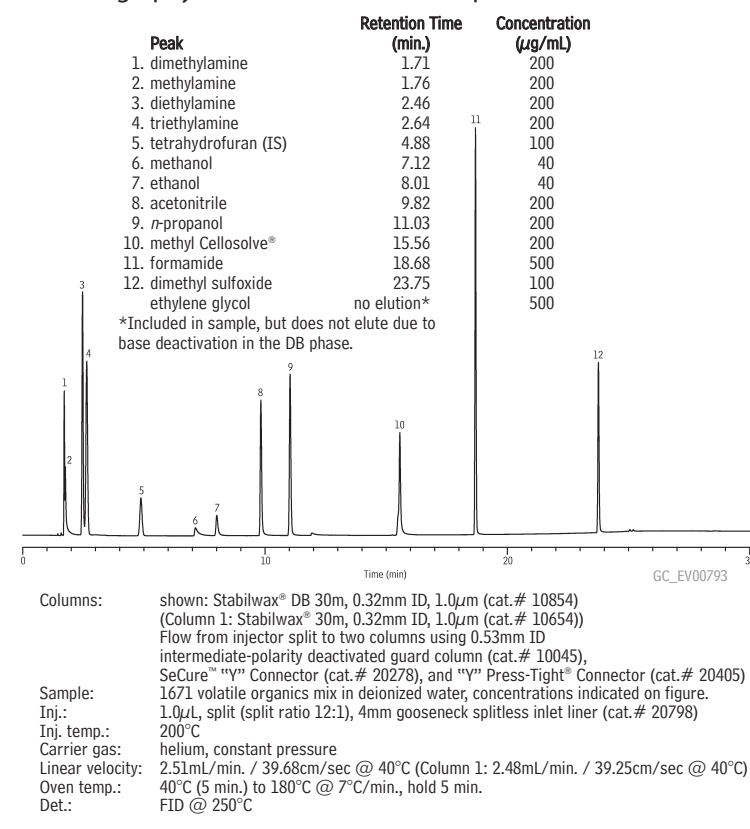


Figure 2 A Stabilwax® DB column provides excellent chromatography for basic and non-acidic pharmaceutical solvents.



(cat.# 10654 and cat.# 10854, respectively). Rather than using a splitless injection, as listed in the method, we used a split injection at a 12:1 ratio to enhance peak shape for the analytes. By retaining the water solvent, as described above, the polar PEG stationary phases enabled us to increase the injection volume to 1.0µL. As a result, we achieved the detection limits specified in the method, using a split injection.

The Stabilwax® column demonstrated excellent separation and peak shape for the non-basic analytes (Figure 1). Had the target compounds not included primary amines, this column alone would be a good choice. The amines broke down almost totally on the Stabilwax® column, however. Conversely, the Stabilwax® DB column, which is designed for analyses of basic compounds, exhibited excellent resolution and peak shape for the amines and non-acidic analytes, but produced excessive tailing of the methanol and ethanol peaks, and nearly complete breakdown of ethylene glycol (Figure 2). By selecting the appropriate information from this Stabilwax®/Stabilwax® DB dual-column GC/FID analysis, a comprehensive picture for all Method 1671 analytes, both acidic and basic, can be obtained.

Stabilwax® Column (fused silica)

(Crossbond® Carbowax® polyethylene glycol)

ID	df (µm)	temp. limits	length	cat. #
0.32mm	1.00	40 to 240/250°C	30-Meter	10654

Stabilwax®-DB Column (fused silica)

(Crossbond® Carbowax® polyethylene glycol for amines and basic compounds)

ID	df (µm)	temp. limits	length	cat. #
0.32mm	1.00	40 to 210/220°C	30-Meter	10854

Universal “Y” Press-Tight® Connectors

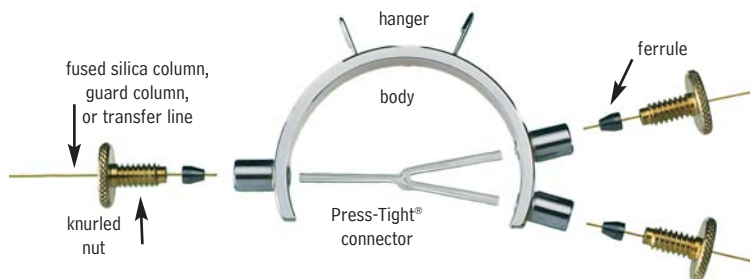
Description	cat. #
Universal “Y” Press-Tight® Connector	20405
Deactivated Universal “Y” Press-Tight® Connector	20405-261
Siltek® treated Universal “Y” Press-Tight® Connector	20485

SeCure™ “Y” Connector Kits

Description	Ferrules Fit Column		
	ID	qty.	cat.#
SeCure™ “Y” Connector	0.25/0.28mm	kit	20276
SeCure™ “Y” Connector	0.32mm	kit	20277
SeCure™ “Y” Connector	0.45/0.53mm	kit	20278
Knurled nut		3-pk.	20279

Kits include: SeCure™ “Y” connector body, 3 knurled nuts, “Y” Universal Press-Tight® union, 3 ferrules.

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The SeCure™ “Y” connector’s open design allows visual confirmation of the seal; secondary seals ensure a leak-tight connection.

- Connect two analytical columns to a transfer line or guard column.
- Use standard “Y” Press-Tight® connectors and 1/16" graphite ferrules.
- Reliable seal integrity, will not unexpectedly disconnect during temperature-programmed analyses.
- Open design allows visual confirmation of the seal for added confidence in the connection.

Combine the simplicity of a “Y” Press-Tight® connector with the strength of a metal union. The ferrules and knurled nuts hold the fused silica tubing in place, which prevents the tubing from unexpectedly disconnecting, even at temperatures as high as 400°C.