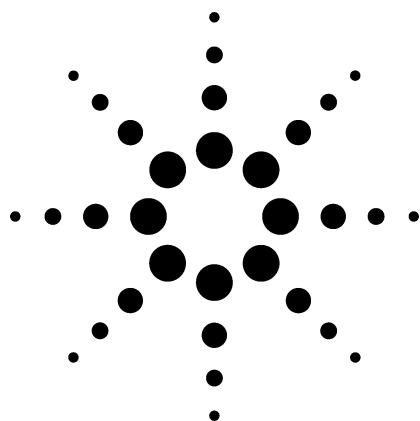


Fast GC: Comparison of the Agilent 6890 Plus GC with Oven Insert and the Agilent 6850 Series GC



Application

Gas Chromatography

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Abstract

Decreasing GC analysis time is of growing interest to many analysts. Shorter turnaround times mean quicker analytical results, lower operating costs, increased laboratory productivity and higher revenues. A technique commonly used to reduce analysis time is to increase the temperature program rate of the gas chromatograph (GC) oven. This application note discusses how the 6890 GC oven insert can increase the maximum obtainable oven program rate substantially by reducing the GC oven volume. Comparisons between the 6890 GC fast and standard ovens and the 6850 Series GC standard oven show a dramatic increase in oven program rate with the 6890 GC oven insert.

Introduction

Decreasing GC analysis time is of growing importance to chromatographers for several good reasons. As sample throughput is increased, for example, more billable samples can be run. Also, quicker analytical results allow tighter control of chemical processes, resulting in less waste and higher yields. In addition, lower operating cost (the cost per sample) results directly from less carrier gas, cryogenic fluid, power consumption and person-time per sample.

Decreasing a current GC analysis time requires changing one or more experimental parameters (temperature program rate, pressure or flow rates, column dimensions). Increasing the temperature program rate is probably the most common approach to reducing analysis time.

With the 6890 GC oven insert (part no. G2646-60500), chromatographers can increase oven temperature program rates beyond what is normally possible with the standard configuration. The insert, which fits inside the 6890 GC oven, reduces the overall volume so that the column

and sample heat more quickly, yielding faster chromatography. Reducing the oven volume achieves faster oven program rates, resulting in reduced analysis time. Reducing oven volume can also decrease cool-down times, significantly lowering overall GC cycle times. In addition, with less air and surface area to be heated, operating costs can be reduced as well.

The oven insert can be used with any inlet, column and detector as long as they are mounted in the back positions. Refer to *Installing the Agilent 6890 Oven Insert for Fast Chromatography* (part no. G2646-90400), for product specifications and installation procedure.

This application note illustrates how the 6890 GC oven insert can decrease GC analysis time and operating costs dramatically. Comparisons of the differences in oven program rates of the 6890 Plus GC (standard and fast oven options) with and without the use of the oven insert show how the 6890 GC oven insert can increase your 6890 GC oven program rate by as much as 50 percent.



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This application note also compares the 6850 Series GC standard oven program rate with those of the 6890 GC. Porting methods between the two instruments is easy with the enhanced oven ramps of the 6890 GC and the use of the Agilent GC method translation software (a freeware program that simplifies fast GC method development).

Experimental

These experiments were conducted on two 6890 Plus GCs (one with the fast oven option and the other with the standard oven option) and an 6850 Series GC. Each instrument was equipped with a split/splitless inlet and a flame ionization detector (FID). All gas flows and pressures were controlled electronically while sample injections were made with an Agilent 7683 automatic liquid sampler (ALS). A split liner, L (part no. 5183-4647) with glass wool near the top was installed in each of the inlets.

The sample used was an ASTM D 2887 standard test mix for boiling point distribution, (C6 – C44). An Agilent ChemStation (Revision A.06.01) was used for instrument control and data acquisition. See table 1 for a list of conditions used for these experiments.

Results and Discussion

Based on the ASTM D 2887 test sample, results of these experiments show how the 6890 GC oven insert can substantially increase the oven program rate. Without the oven insert, the 6890 GC standard oven had a maximum program ramp of 25 °C/minute in the range of 40 °C to 350 °C while the 6890 GC fast oven and the 6850 Series GC had maximum oven program ramps of 40 °C/minute. With the oven insert installed in the 6890 GC, the standard oven ramp rate increased 40 percent to 35 °C/minute while the 6890 GC fast oven ramp rate increased 50 percent to 60 °C/minute (as shown in figure 1).

Table 1. Chromatographic Conditions

Parameters	Setpoint
Inlet Split/splitless	
● Mode	Split (10:1)
● Temperature	325 °C
● Gas type	He
Oven	
● Initial temperature	40 °C
● Initial time (min.)	0.00
● Ramp	
- Rate (without insert)	See figure 1
- Rate (with insert)	See figure 1
- Final temperature	350 °C
- Final time (min.)	4.00
Column (5-in. column basket)	
● Model No.	19095Z-121E
● Phase	HP-1
● Nominal length	10 M
● Nominal diameter	530 µm
● Nominal film thickness	2.65 µm
● Mode	Constant flow
● Initial flow (mL/min.)	12.0
Detector	FID
● Temperature	350 °C
● H ₂ flow (mL/min.)	40
● Air flow (mL/min.)	450
● Mode	Constant makeup flow
● Makeup flow (mL/min.)	45
● Makeup gas	Nitrogen

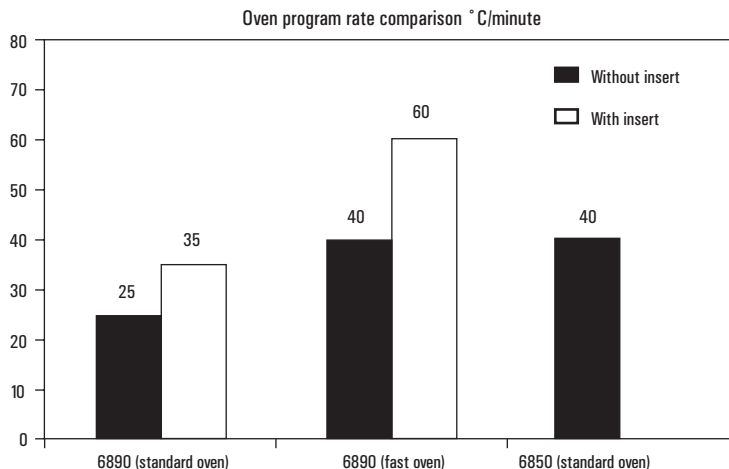


Figure 1. Oven program rate comparisons with and without the 6890 GC oven insert. The conditions are listed in table 1.

The following chromatograms (figures 2 and 3) illustrate that using the 6890 GC oven insert with the standard oven (120 V power) produces an oven program rate nearly identical to that of the 6890 GC fast oven (240 V power). This increase in oven program rate allows portability of methods between the two instruments and with the 6850 Series GC (120 V power).

Figure 4 illustrates the speed gained by installing the oven insert into the 6890 GC fast oven. With an increase of 50 percent oven program capability, nearly 2.5 minutes were reduced from the analysis time.

Retention time reproducibility of peaks C10, C20 and C32 was determined for ten consecutive runs. Results show relative standard deviation (RSD) below 0.05 percent for all instruments with and without the oven insert installed (as shown in table 2).

Conclusion

With the Agilent 6890 GC oven insert, users can decrease turnaround time and lower operating costs simultaneously and for a very small investment. The oven insert is designed to reduce the oven volume of the 6890 GC for faster oven programming capabilities without sacrificing chromatographic performance. Experimental results show how the oven insert can increase oven program capability by as much as 50 percent while maintaining retention time reproducibility below 0.05 percent RSD.

Additional benefits include rapid sample screening, decreased method development time, lower operating costs and the ability to port methods between the 6890 GC fast and standard ovens and the Agilent 6850 Series GC.

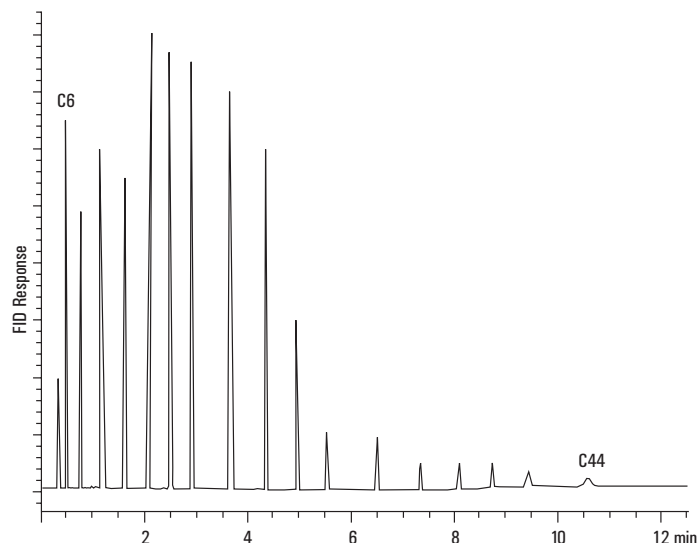


Figure 2. 6890 GC standard oven with 6890 oven insert (ramp 35 °C/min.)

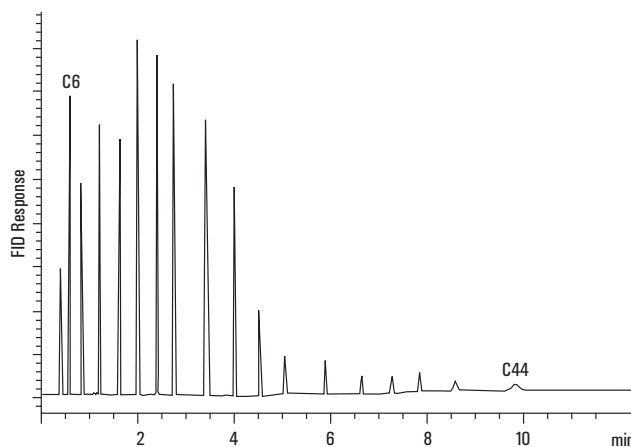


Figure 3. 6890 GC fast oven without oven insert (ramp 40 °C/min.)

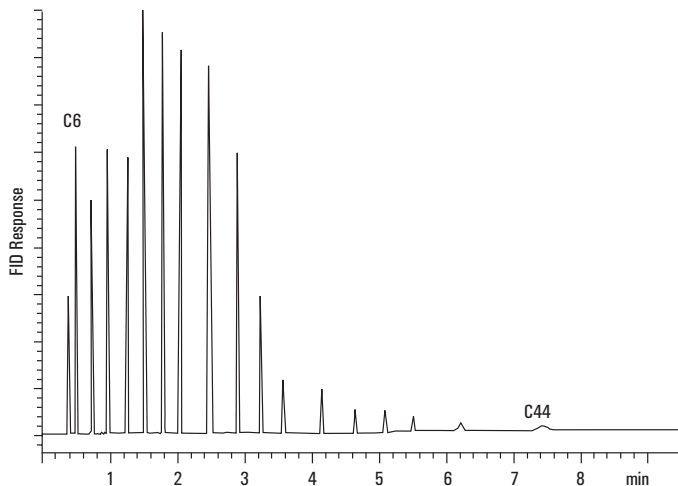


Figure 4. 6890 GC fast oven with 6890 oven insert (60 °C/min.)

To Obtain Method Translation Software

The Agilent method translation software can be downloaded from the Agilent web site at <http://chem.agilent.com/cag/servsup/usersoft/main.html>.

Reference

M. Klee and V. Giarrocco.
"Predictable Translation of Capillary Gas Chromatography Methods for Fast GC," Agilent Technologies, Application Note 228-373, Publication No. (23) 5965-7673E, March 1997.

Table 2. Retention Time Reproducibility (% RSD)

6890 Plus GC	C10	C20	C32
Fast oven with insert	0.046	0.009	0.009
Fast oven without insert	0.022	0.014	0.013
Standard oven with insert	0.047	0.024	0.022

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