

Case Study I: Improving Lab Productivity with Fast GC Accessories for DRO and BNA Analysis

Technical Note 003
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Introduction

GC test methods and equipment play an integral part of nearly every field of chemical testing. A scientist might view GC as a very mature field because both theory and practice are well understood. On the other hand, a lab manager views his fleet of GCs as a financial resource because test results and sample analysis generate revenue. As a result, managers are always on the lookout for faster and more cost-effective ways to streamline operations and maximize the earning potential of their equipment. Fast GCs, new methods, techniques and accessories that can achieve higher sample throughputs are important tools for attaining higher profitability.

Fast GC Accessories

Thermal agility is a term that describes the ability of an oven to heat up and cool down fast. Both steps comprise the complete cycle time and together they determine sample throughput. Lab managers recognize that cost effective fast GC accessories provide an attractive alternative to buying new equipment because they require little or no bench space and do not eat up extra costs for consumables and support equipment.

Zip Scientific manufactures two Fast GC accessories that improve thermal agility. The GC Racer, shown in Figure 1, is a fast temperature programming device. The GC Chaser, shown in Figure 2 can dramatically reduce the oven cool-down step. They can be used individually or together on old or new GCs to reduce cycle time and increase productivity. The pros and cons of Fast GC and both of these accessories are described in more detail in *Zip Scientific Technical Note 001*.

Case Study

TestAmerica Laboratories, Inc. (www.testamericainc.com) is a U.S. leader in environmental testing. They have a large network of environmental testing facilities located throughout the United States. The TestAmerica facility in Edison, NJ was selected

as the test site for this case study. Both the GC Racer and GC Chaser are used for Diesel Range Organics (DRO) and the GC Chaser is used for semi-volatile Base Neutral Acid (BNA) analysis. Table I summarizes the data demonstrating the productivity gains achieved with these two fast GC accessories.



Figure 1. GC Racer Heater installed on an Agilent 5890 GC

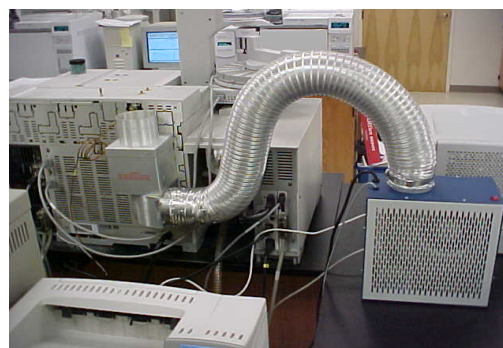


Figure 2. GC Chaser installed on an Agilent 6890 GC/MSD.

Two GCs are dedicated to DRO testing. Each is a dual column Agilent 6890 with both the GC Racer and the GC Chaser installed. Initially the run time was 21 minutes. After installing the GC Racer and adjusting conditions the run time was reduced to 7.25 minutes. This represents almost 3 fold improvement or a time savings of 13.75 min. The chromatogram is shown in Figure 3. The DRO region for integration starts at 0.50 min and extends to 6.25 min. The remainder of the run serves to bake out the column for the next injection. The surrogate o-terphenyl is seen to elute just after 3.3 min. The rise in baseline is not unusual for these types of analysis whether

or not fast temperature programming is used. Separate experiments have demonstrated that the GC Racer and fast temperature programming do not cause additional column bleed. See *Zip Scientific Technical Note 002* for detailed information on column bleed.

Table I. Increased Productivity Data		
Application	DRO	BNA
GC Model	Agilent 6890 FID	Agilent 5890 5971 MSD
GC Racer	Yes	No
GC Chaser	Yes	Yes
Previous Run Time (min)	21	18
New Run Time (min)	7.25	N/A (GC Racer not used)
Previous Cycle Time (min)	31.0	28.0
New Cycle Time (min)	10.5	21.5
Productivity Increase	2.95	1.30

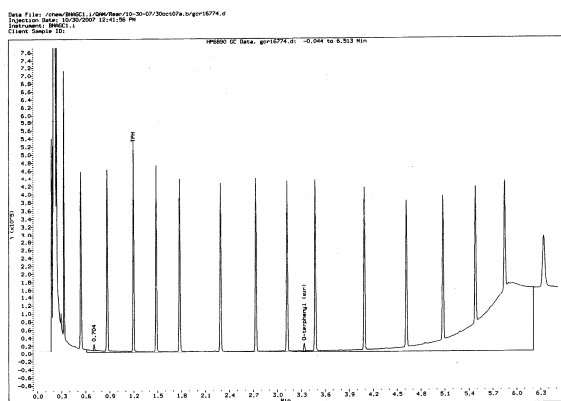


Figure 3. Fast Temperature Programmed DRO

Adding the GC Chaser reduced the oven cool-down step from 10 min to 3.25 min. The final tally was that the entire cycle time from one injection to the next was reduced from 31 min to 10.5 min, essentially a 3 fold increase in productivity. **For these dual column GCs that resulted in 8 extra samples per hour per GC for a total of 16 extra samples per hour.**

Base Neutral Acids

BNAs were analyzed on an Agilent 5890 GC with a 5971 MSD. Three systems are dedicated to BNAs, each has a GC Chaser. The

chromatogram is shown in Figure 4. Fast temperature programming is not a good approach for this application due to the large number of peaks and the limitations of the MSD scan rate. Therefore, the GC Racer is not used and the run times remain the same. On the other hand productivity is very important because GC-MS systems are expensive and these samples generate higher profits. The GC Chaser is a valuable addition in this case. The total cycle time was reduced from 28.0 min to 21.5 min just by cooling the oven down faster between runs. Productivity was increased 1.3 times. Lab Manager Mark Acierno states, **“We get in about 5 more samples per instrument/per clock. We run 2 clocks a day on three instruments. So 10 extra samples a day X 3 instruments (30 more a day/150 a week). This really helps with rush work.”**

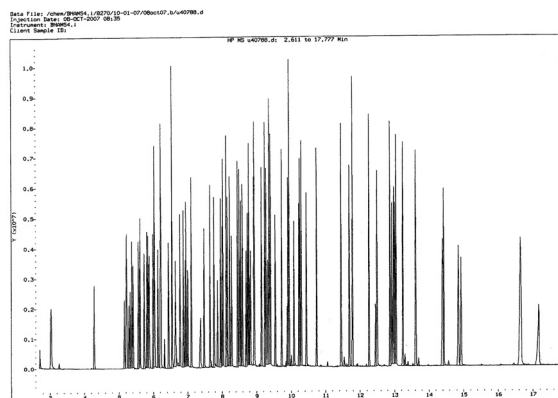


Figure 4. BNA Run with Fast Oven Cool-Down

Conclusion

This case study demonstrates the advantages of using Fast GC accessories to increase lab productivity. The equipment is simple to install, requires no operator training and is rugged enough to stand up to the rigorous requirements of 24/7 test lab schedules. In addition to savings gained from not purchasing new GCs these accessories eliminate the need for all of the associated support equipment including additional bench space, columns, autosamplers, computers and syringes. Even the added cost of carrier gas is eliminated by maximizing the potential of the single GC. The GC Racer and the GC Chaser offer an attractive option to lab managers for streamlining operations, reducing costs and maximizing profits.

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