Increase Capabilities Using Batch Enabled Sample Preparation

Application Note

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Abstract

With the implementation of batch enabled sample preparation, additional time and resource savings are realized using the Agilent 7696A Sample Prep WorkBench. A common sample preparation task was performed using both non-batch and batch mode sample processing. The amount of wash solvent used and the time required to complete each sample was compared.

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Introduction

The Agilent 7696A Automated Sample Prep WorkBench can perform many sample preparation tasks for either gas chromatographic (GC) or liquid chromatographic (LC) analyses. WorkBench consists of two liquid dispensing modules, a single vial heater capable of reaching 80 °C, a single vial vortex mixer, and bar code reader (Figure 1). This enables dilutions/aliquoting, liquid addition, sample heating, liquid/liquid extractions, and sample mixing. Individual racks can also be heated or cooled. This sample preparation instrument can perform tasks with the same accuracy and precision as the 7693A Automatic Liquid Sampler [1] in an offline setting instead of on top of a GC.

Figure 1. Agilent 7696A Sample Prep WorkBench

The Agilent 7696A Sample Prep WorkBench uses the Easy SamplePrep paradigm to greatly simplify sample prep programming. Easy SamplePrep (ESP) features icon based programming and a resource manager. Using a drag-and-drop editor, users can create a sample prep method in a manner similar to following a protocol or instructions in a laboratory notebook. ESP also gives a textual display of the sample prep steps. There are two modes of operation for ESP, batch and non-batch mode. Non-batch mode processes each sample singularly and in series, that is all steps are performed for one sample, thus completing the sample preparation before moving on to the next sample. Conversely, batch mode processes samples in parallel, that is each step is performed on all samples before moving to the next sample preparation step, thus completing all the samples at approximately the same time.

An automated method for the esterification of fatty acids [2] was performed using both non-batch and batch mode processing. The amount of wash solvent used was determined for each operative mode as well as the time required to complete sample preparation.

Results and Discussion

Batch mode processing allows significant time and resource savings (Table 1). To complete six samples using the method outlined in [2], non-batch mode processing required 45 minutes per sample (270 minutes to complete all six samples). When using the batch mode available in the software, all six samples were completed in 138 minutes, averaging to 23 minutes per sample. A large time saver was the ability to move all samples to the heated rack, wait for the 20 minute reaction time, then return all samples to the original location. With batch mode, all samples can be reacted (heated) at the same time compared to non-batch mode which took advantage of the single vial heater, but reacted/heated each sample separately for 20 minutes.

Table 1. Time and Resource Savings

Batch size n = 6	Non-batch	Batch	Improvement
Number of programming steps	12	12	n/a
Wash steps	9	9	n/a
Total number of washes	54	9	1/n (n times)
Total time	4.5 h	2.3 h	~50%
Time per sample	45 min	23 min	~50%
Wash volume	15.3 mL	2.55 mL	1/n (n times)

Likewise, when comparing the amount of wash solvent used, the advantages of batch mode were clear. Using batch mode to process the samples, only nine wash steps totaling 2.6 mL were used. To process the six sample using non-batch, nine wash steps were again employed, but for six samples, totaling 54 wash steps and using 15.3 mL. By using batch mode to process the samples, the amount of wash solvent used was reduced six-fold for this particular comparison.

Conclusions

Comparing batch and non-batch mode processing of a sample preparation method developed for the Agilent 7696A Sample Prep WorkBench demonstrated the benefits of using the batch feature to process samples. Batch processing reduces the time per sample. For the example given here, batch mode allowed the sample to be processed twice as fast. Additionally, significant wash solvent can be saved using batch processing. Using the batch feature, the wash steps are reduced n-fold (where n is the number of samples) and the amount of wash solvent used is also reduced n-fold. For six samples, this equates to a six-fold savings in wash solvent usage, 2.6 mL versus 15.3 mL for non-batch mode operation. This will result in significant savings, especially as the throughput of the instrument is increased.

References

1. Susanne Moyer, Dale Synder, Rebecca Veeneman, and Bill Wilson, "Typical Injection Performance for the Agilent 7693A Autoinjector," Agilent Technologies Publication 5990-4606EN

2. Rebecca Veeneman, "Improving the Analysis of Fatty Acid Methyl Esters Using Automated Sample Preparation Techniques," Agilent Technologies Publication 5990-6873EN

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