Professional GC & GC/MS Method Development Objectives & Benefits Guide

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Knowledge When You Need It

This GC & GC/MS guide offers practical advice which we hope will assist users to understand how the optimisation aspects of method development can benefit their organisation. This can range from more accurate results to significant increase in instrument uptime and lower maintenance costs. The objective being to develop reliable, automated sample introduction, separation, identification and quantitative results that are fit for purpose.

Application vs Method

In a majority of cases it is fairly simple to separate and detect a majority of compounds by GC and GC/MS as there are lots of application notes from the instrument and consumables manufacturers. However an application note is not a full documented method. To create a robust analytical method that is fit for purpose will require a great deal of thought and experience. The separation will only be a small part of this process. However investing time and effort to optimize a method creates huge benefits through the lifetime of the application and instrument.
One of the secrets of a robust method is working within the boundaries of the instrumentation, consumables and software and making sure the instrument is installed and maintained correctly. Additionally a good understanding of the physical and organic chemistry of your target analytes and matrix will play a significant role. If you can reduce steps and simplify things particularly at the start of the process the end results become much more reliable.

Method Parts	Feature	Benefits
1. Sample Preparation 2. Sample Introduction 3. Injectors 4. Chromatography 5. Detectors 6. Software	Minimise maintenance costs Minimise instrument downtime Lower consumable use Lower preventative maintenance frequency Minimised data review process (identification, reprocessing and manual integration)	More accurate results Saves time Saves money

Elements of a Robust Method

1. Sample Preparation - The objective is to efficiently extract/dilute/concentrate all targeted analytes and eliminate compounds that degrade the sample path and also interfere with the target analytes. Generally sample preparation causes the biggest errors. However as sample preparation becomes more available or integrated the speed and accuracy of analysis increases. The benefits of a good sample preparation are: increased instrument uptime, lower maintenance/ service and consumables costs. Along with fewer false positive/negative results. This also minimises the time spent on the data review process (identification, reprocessing and manual integration).

2. Sample Introduction/Automation - The objective is to provide a consistent representative sample onto the front end of the column enabling analyte detection without overloading. With syringe injections to fully optimise the method and robustness the following factors can be critical. Syringe point style, sample placement, sample transfer into injector, syringe speed and pre and post injection times. With gas injections other parameters such as eliminating air ingress are more critical.

3. Injectors and Injection technique - The objective is to maintain/enhance the integrity of the analyte and to ensure the target analytes/matrix remain within the limits and constraints of the chromatographic system and detector. Making sure your instrument is installed and maintained correctly will enable your method to have the broadest analysis range. Also, optimising the amount of sample and injector temperatures reduces carrier gas consumption and extends the lifetime, stability of consumables and service parts.

4. Chromatography - The objective is to provide optimal simple separation of target analytes in a time commensurate to the number of analytes, detection limit requirements and matrix complexity. Also minimising non targeted compounds reaching the detector. For split injections some methods can have isothermal oven temperatures for most other a temperature program is required in combination with injector vent openings.

5. Detectors - The objective is to provide robust detection levels within the linear dynamic range for the proposed analysis. In some instances detectors with high specificity are used to enhance detection and/or eliminate possible interreferences. Dependent on the detector they may have temperatures, gas flow rates or tunable operational and acquisition parameters. In addition data collection rates need to be considered for the accuracy required for the measurement and optimal data storage.

6. Software - The objective is ideally to have a control, data collection and data handling method in one location. The data handling method should have minimal integration steps and time programmed events, if necessary, enabling automatic integration of standards and samples. Manual integration and separate integration events for different chromatograms should be a last resort to provide automated reliable data collection and method parameter storage with ideally simple programmed events. The more time spent optimising the previous method parameters the less time will be spent on data review process (identification, reprocessing and manual integration).

Conclusion

If these guidelines are adhered to you will obtain more accurate results, save time and money. You will avoid undesirable outcomes and have a fully utilized robust method providing accurate and reliable results fit for purpose.

ChromSolutions Ltd

What we offer at ChromSolutions is our wealth of experience in analytical instrument sales and support (over 110 years distributed through the members of our company). We can help you from defining your requirements to the implementation of a robust analytical method fit for purpose.

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