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Technical Report

Maximizing Analytical Efficiency with Real-time Measurement of Mobile Phase Consumption

- Analytical Intelligence Part 2 -

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Abstract:

Management of the mobile phase is of great importance in high-performance liquid chromatograph analysis. Depletion of the mobile phase during analysis not only results in failure of the analysis, but also risks damaging expensive analytical columns. To prevent these problems, it is necessary to estimate the amount of mobile phase required for analysis before starting, but such an estimate is laborious to calculate, especially with regards to gradient elution. There is also the possibility that the mobile phase may nonetheless be depleted during analysis due to a calculation error. While, it is time-consuming for the user to visit the laboratory frequently to check the quantity of mobile phase remaining. In this report we describe the effectiveness of the Mobile Phase Monitor Module (MPM-40) for real-time measurement of mobile phase quantity and automated estimate of consumption of mobile phase with LabSolutions™.

Keywords: Mobile phase monitoring, Real-time gravimetric measurement

1. The MPM-40 Module

The MPM-40 is a Shimadzu module that includes sensors to accurately weight mobile phase. This technology enables real-time display of the actual amount of mobile phase remaining, not the amount calculated indirectly from forecast consumption.

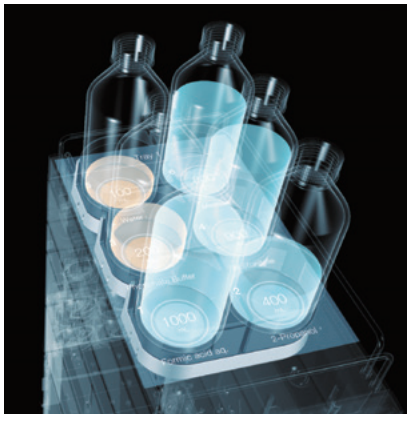

Fig. 1 A Nexera™ system equipped with an MPM-40 module

The module continuously records the weight of mobile phase and exchanges real time data with connected workstations, and smart devices. And, before starting the analysis, the quantity of mobile phase required for the series of analysis is automatically calculated and compared with the current quantity of mobile phase. A warning is displayed if there is insufficient mobile phase for the analysis. The mobile phase volume can be checked on a PC or smart device through a dedicated application. It is possible to receive warnings about the lack of mobile phase and perform automatic actions such as stopping analysis. This prevents data loss due to mobile phase depletion during continuous analysis and enables more efficient overall analysis.

The MPM-40 can also be used with LC systems other than the Nexera series. (If LabSolutions is not used, some functions such as predicting and confirming the consumption of mobile phase will not be available.)

2. Improvement of Analytical Efficiency

Monitoring functions can always be accessed directly through LabSolutions, or remotely through a dedicated mobile application on a smart device.

Up to 12 solvents can be simultaneously monitored through an MPM-40 module connected to one LC system. Mobile phase monitoring modules are connected to workstations via a LAN network. It is possible to use the dedicated software MPMChecker™ for monitoring and customizing parameters (calibration, warning levels, alarm levels).

In addition, by linking this mobile phase monitoring technology with Shimadzu LabTotal™ Smart Service Net Asset Agent, it is possible to track the operation status of devices from their mobile phase consumption. This supports the efficient allocation of resources in the lab.

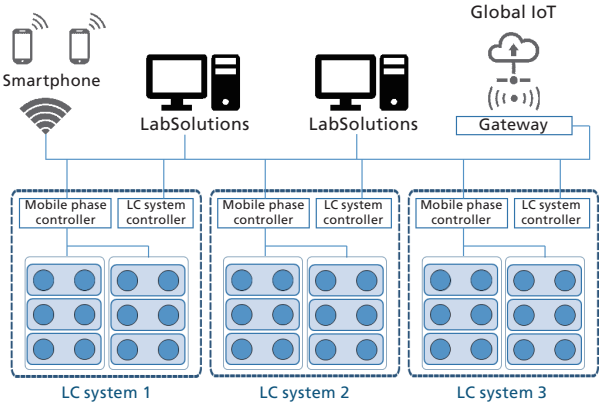

Fig. 2 Mobile phase monitoring technology integrated into laboratory workflow (representative system configuration)

1 Analytical & Measuring Instrument Division

3. Using the Mobile Phase Monitor

Operators can easily calibrate the sensors by following the step-by-step procedure included in the software. Calibration consists of measuring the weight of the empty bottle and then that of the filled bottle (Fig. 3).

During this phase it is also possible to customize information about the composition of the mobile phases, warning levels and line connections (Fig. 4).

The Mobile Phase Monitor is automatically turned on, and warning levels and alarm levels will be activated according to user settings. Each time an analysis is started (either single or multiple analysis), the volume of mobile phase needed is estimated and a warning will appear if the current volume of mobile phase is insufficient (Fig. 5).

Since all bottles are connected to the system, the total amount of mobile phase consumption is estimated, including all rinse steps, giving an accurate consumption prediction regardless of the differences in analytical methods used.

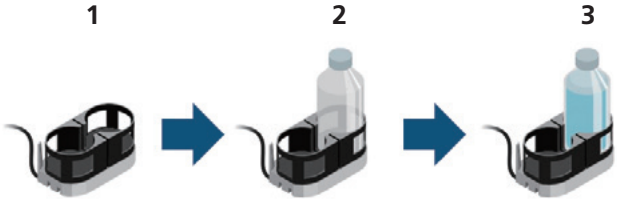

Fig. 3 Sensor calibration procedure

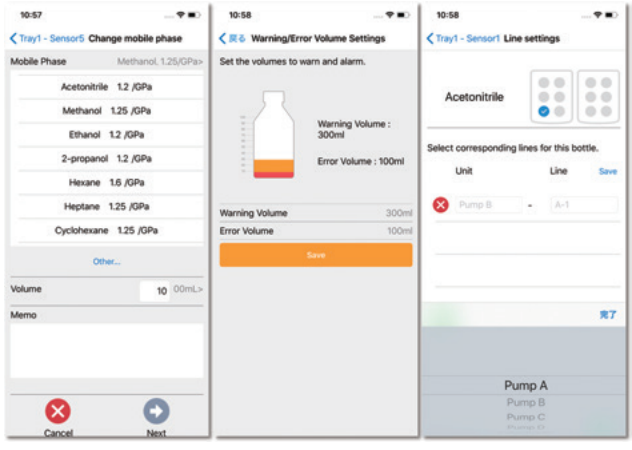

Fig. 4 Customizable settings for mobile phase monitoring

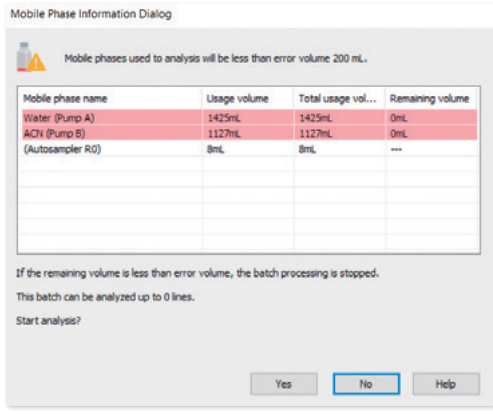

Fig. 5 Warning dialog before analysis start

4. Real Time Monitoring Possibilities

Even while the analysis is in progress, it is always possible to check the mobile phase consumption using smart devices or LabSolutions software. In particular, with a smart device, it is possible to check the remaining mobile phase even from outside the lab by configuring the Wi-Fi setting (Fig. 6). A notification will also be sent when the mobile phase becomes insufficient. So there is no need for the user to go to the lab to check the amount of mobile phase remaining.

Fig. 6 Software interface for MPM

5. Conclusions

- The Mobile Phase Monitor MPM-40, together with its dedicated software and application MPMChecker, weighs the mobile phase in order to display the amount of mobile phase on a PC or smart device, updated in real time. Moreover It is possible to receive warnings about the lack of mobile phase and perform automatic actions such as stopping analysis thanks to the integration of the Mobile Phase Monitor with LabSolutions.
- The MPM-40 can be used with any LC system. If LabSolutions is not used, some functions such as predicting and confirming the consumption of mobile phase will not be available.
- By eliminating the risk of mobile phase depletion by mobile phase monitoring, the interruption of analysis is prevented, and overall laboratory productivity is improved.

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