Improvement of Precision and Uptime in UHPLC by intelligent SmartInject Technology

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ABSTRACT
Over the last decade, UHPLC has been widely established as a powerful improvement over conventional HPLC technology. UHPLC instrumentation can achieve a high level of performance, featuring a high peak capacity when, however, minor deviations in the separation conditions can affect the analytical result. State of art pump technology provides a level of precision and speed that is difficult to achieve with smaller-scale systems along the same time. This is where pump technology comes into play: it increases a retention time precision (RT) precision. One significant cause for unsatisfactory peak shapes in micro- and nano-HPLC separations is the increase in pressure drop, due to a low flow rate and a too high system pressure. Consequently, the pressure drop is too high to record the full extent of the pressure drop, thus the pressure sensors are only partially used. Therefore, this study aims to evaluate the impact of SmartInject Technology (SIT) on retention time precision.

RESULTS AND DISCUSSION
Different system back pressure levels at constant flow rate were realized by using appropriate dichromatized SmartInject™ neutral (OFF) and light (ON) filters. The setup of the system was kept constant along the test (e.g., sample concentration, sample injection, etc.). The flow rate of the test was fixed at 450 µL/min. The system was run with identical operation points.

Data evaluation on the benefit of SIT was done based on statistical analysis. All variances for retention time precision were tested using ANOVA and a Tukey’s honestly significant difference (HSD) test. SIT benefit was identified for statistically significant better precision, with SIT rated as disadvantageous for the opposite result (p < 0.05).

CONCLUSIONS
SmartInject Technology (SIT) has proven to be an effective means to mitigate the pressure change during injection due to a sample loop at ambient pressure after sample aspiration.

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