

“Synthetic Dye Mass Spectrometry and the In-Situ Analysis of Disperse Dyes”

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ABSTRACT

The application of mass spectrometry in textile and textile dye analysis is relatively new, though the forensic and quality control potential of this methodology is significant. In-line confirmation of chemical structures during dye synthesis, as well as the potential to identify and confirm which dye is present (and how much), could significantly impact dye and textile manufacturing. Mass spectrometry also provides an avenue for studying how dyes degrade over time and in the environment, which could help to identify potential environmental threats and direct the future development of synthetic dyes. Direct Analysis in Real Time (DART) ionization can provide non-destructive analysis in-situ using a relatively simple mechanism, as well as analyze multiple colorants simultaneously while retaining the mass spectrometer's ability to differentiate dyes by more than their reflectance/absorbance behavior. This study collected mass spectra for several synthetic dyes for use as a reference for identification and provided information regarding their ionization behavior. The application of DART ionization and the development of characterization and quantitation methodology narrowed the focus to disperse dyes applied to polyester and other synthetic materials. During the study, the ability to differentiate not only dyes, but also different fabrics and textile finishes was established, further expanding the potential applications and allowing for multi-point analysis in a single method.