[TECHNOLOGY BRIEF]

Improving Sensitivity and Selectivity for Primary Aromatic Amines Analysis with ACQUITY QDa Detector

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GOAL

To demonstrate the use of Waters ACQUITY® QDa Detector for the analysis of Primary Aromatic Amines with improved sensitivity and selectivity, compared with existing analogue detection methodologies.

BACKGROUND

The inks and dyes industry is highly legislated and manufacturers who use inks and dyes must monitor and quantify various regulated parameters, including the presence or absence of Primary Aromatic Amines (PAAs).

PAAs can be used to produce many commodities, such as pharmaceuticals, pesticides, explosives, epoxy polymers, rubber, aromatic polyurethane products, and azo-dyes. They can be found in final products due to incomplete reactions, as impurities, by-products, or as degradation products.

Many PAAs are suspected carcinogens and therefore have a range of potential health risks, which have lead to strict worldwide regulations. U.S. FDA regulations (21 CFR 74.705 and 21 CFR 74.706) restrict the use of azo dyes that could degrade to PAA; whereas EU regulations (Commission Directive 2002/72/EC and Directive 19/2007/EC) state legislative limits.

Analytical laboratories require accurate and robust techniques to ensure confidence and versatility in meeting legislative requirements. Waters® ACQUITY UPLC® H-Class System with the ACQUITY QDa Detector is the solution for this industry.

Waters ACQUITY UPLC H-Class System with the ACQUITY QDa Detector provides enhanced confidence in the identification and quantification of Primary Aromatic Amines for the inks and dyes industry.

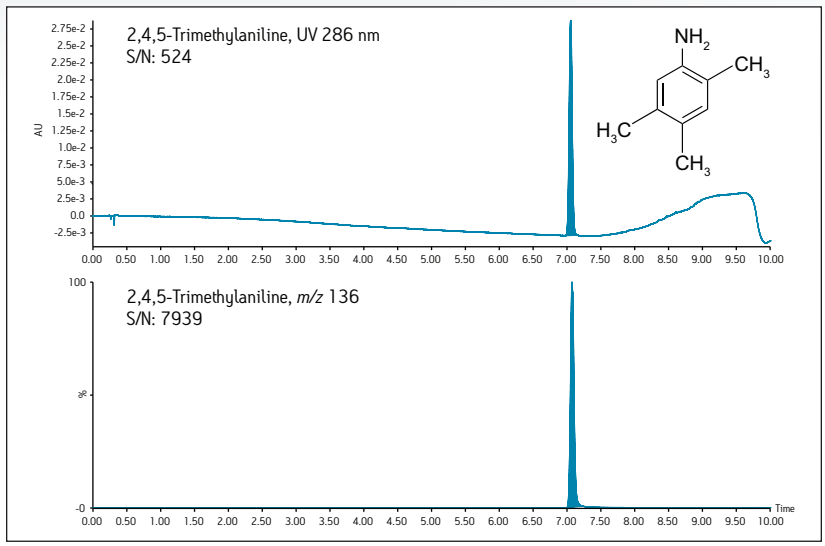

Figure 1. UV and extracted ion chromatograms for 2,4,5-Trimethylaniline.

THE SOLUTION

The ACQUITY UPLC H-Class System with the ACQUITY QDa Detector was used to monitor PAAs. The ACQUITY QDa Detector is the mass detector designed as a synergistic element of a chromatographic separations system. The ACQUITY QDa Detector complements optical data with enhanced qualitative mass spectral data to confirm the identity of components. The ACQUITY QDa Detector extends the sample coverage of optical detection to quantify compounds with no UV response or compounds at levels not amenable or accessible by optical detection.

Developing analytical method development and validation with enhanced sensitivity, selectivity, and method robustness to meet legislative requirements can be costly and time consuming. The ACQUITY UPLC H-Class with ACQUITY QDa Detector realizes multiple business benefits. Financial savings are achieved through much faster run time, reduced solvent consumption, and increased sample throughput. A method with a run time of 10 minutes was developed for PAAs, which is up to seven times faster than many existing methods. In addition, no time-consuming derivatization stages are used, affording further savings in the sample preparation stages.

Improvements in sensitivity can be demonstrated by considering the signal-to-noise (S/N), when comparing the UV and the mass spectral data for the PAA 2,4,5-Trimethylaniline. This PAA has a precursor ion at *m/z* 136 and a maximum UV absorbance at 286 nm. The increase in S/N when using mass spectral data is illustrated in Figure 1.

In order to observe improvement in selectivity, the ability to measure analytes of interest accurately and specifically in the presence of a complex matrix needs to be considered. This is demonstrated by considering the PAA 2,4,5-Trimethylaniline, which when spiked in ink cannot be distinguished due to other UV absorbing compounds present, as shown in Figure 2. However, mass detection is sufficiently sensitive and selective to enable confident detection and quantification of 2,4,5-Trimethylaniline in an ink matrix.

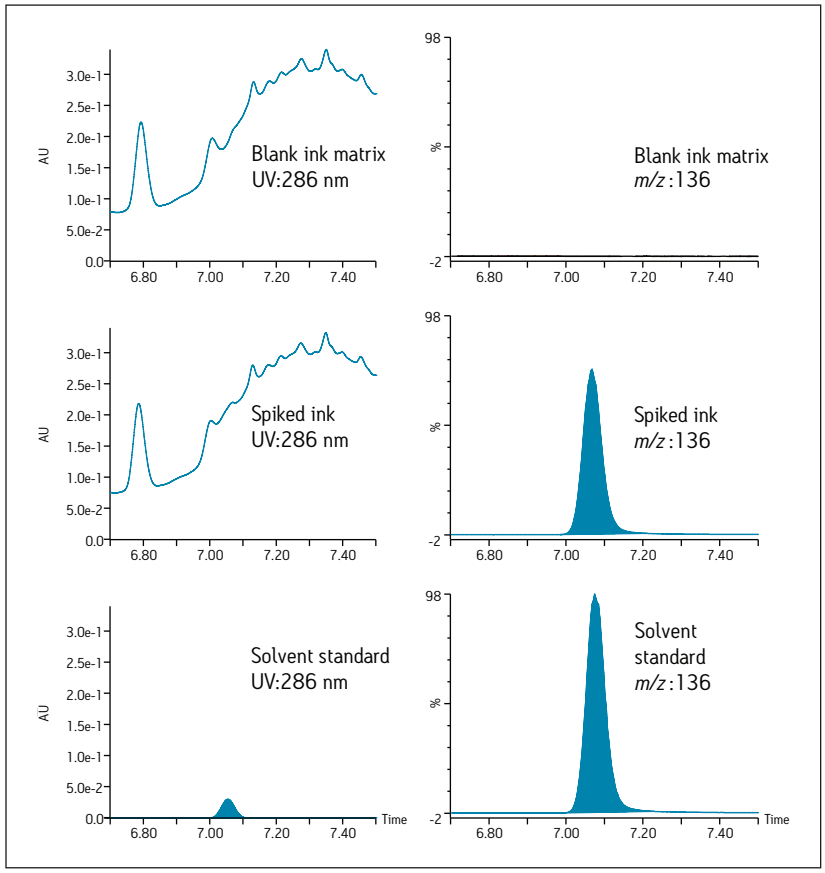

Figure 2. UV and extracted ion chromatograms for 2,4,5-Trimethylaniline spiked in ink (0.5 mg/mL), solvent standard (5.0 µg/mL equivalent to 0.5 mg/mL in spiked ink) and blank ink matrix. UV and MS data were acquired simultaneously.

SUMMARY

Waters ACQUITY H-Class System with the ACQUITY QDa Detector provides increased confidence in the identification and quantification of PAAs in ink, compared to techniques typically used for this analysis.

Due to reduced run time, UPLC® analysis for PAAs affords increased sample throughput and a reduction in solvent usage, offering businesses valuable time and cost savings.

The ACQUITY QDa Detector, provides enhanced selectivity and sensitivity of mass detection, delivering increased confidence when reporting quantitative results.

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October 2013 720004797EN TC-PDF

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