

Case Study

LC-MS/MS Analysis of Antibiotics and Pesticide Residues in Honey

50 Antibiotics Screened with Thermo Scientific TurboFlow Technology

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Dr. Hye-Suk Oh
The Korea Beekeeping Association (KBA)

Introduction

The Korea Beekeeping Association (KBA) was founded in 1967: to promote apiculture development in Korea, protect consumers through high quality testing for honey, and conduct research, advertising and promotional programs to help maintain and expand domestic and foreign markets for honey. Located in Seoul, the KBA today employs 21 people to fulfill these goals.

Increasing concern over the presence of antibiotics and pesticide residues in foodstuffs and the related potential health threats to humans have required food quality control laboratories to develop fast and efficient methods of detecting these contaminants. Some of the challenges facing these organizations include their need for multi-component quantitation, preference for simple sample preparation, and desire for an automated, online method to make quality control screening cost-effective.

Because KBA is responsible for testing products that are exported worldwide, the organization has the added pressure of following regulations from countries around the world in addition to the Korean Food and Drug Administration, which sets the standards for pesticide residues and conducts toxicology research in that country.

The Challenge

The large number and variety of potential contaminants in honey presented a challenge to the KBA. Current screening techniques for the antibacterial agent residues in food matrices typically require solvent extraction followed by an analyte-specific cleanup process.



Korea Beekeeping Association Team

The organization needed to find an analytical solution that could detect multi-component antibiotics simultaneously and at low levels. The KBA decided that a simultaneous screening method for the multiple classes of antibiotics and acaricides at trace levels in honey was best served by an LC-MS/MS technique.

“Other techniques like HPLC, LC/MS, and GC/MS could only detect a small number of analytes at one time,” said Hye-Suk Oh, Laboratory Manager, Korea Beekeeping Association. “We needed to identify multiple contaminants as

well as process a fairly large number of samples. We screen for up to 50 antibiotics in every sample and prefer the advantages of limited or no sample preparation and an online analysis technique to make the screening cost-effective.”

The Solution

The KBA discovered that LC-MS/MS using the Thermo Scientific Aria system powered by TurboFlow™ technology presented the best potential as a technique for antibiotic residue analysis in honey, in contrast to utilizing offline sample preparation.

“The Aria™ system coupled with MS/MS met our organization’s goals of both increasing the analysis throughput and acquiring higher reproducibility because of its capability for automation,” Hye-Suk Oh said. “We were pleased with the system’s ability to provide a sensitive and reliable analytical method in order to detect a full range of antibiotics. Now we can ensure Korean honey samples are free of contaminants, which in turn helps us assure both the consumer and the global marketplace about the safety of our products.”

When used with the Thermo Scientific TSQ Quantum Ultra triple stage quadrupole mass spectrometer, the Aria system delivers fast, efficient quantitative results with the lowest ion suppression and chemical noise. This results in development of highly sensitive, robust methods and reduction in analysis failures. The TSQ Quantum Ultra™ enables Highly Selective Reaction Monitoring (H-SRM) performance, allowing scientists to analyze complex samples quickly and efficiently. H-SRM can eliminate chemical noise, lower detection limits and reduce the chances of false positives. Figures 1 and 2 show the chromatographic results of 9 of the 50 antibiotics screened.

Business Benefit

“We found that using the Aria system with TurboFlow technology was a powerful analytical tool for the testing of antibiotics and pesticides in honey,” Hye-Suk Oh said. “Our pre-injection sample preparation was virtually eliminated. This advantage alone enables us to carry out the analysis in only 17 minutes, compared to between five and ten hours using our traditional offline method. In addition, eliminating the consumption of cartridges and solvent has significantly reduced analytical costs.”

The Aria system also assisted KBA researchers in reducing matrix effects — a typical challenge in LC-MS/MS analysis. This enables KBA scientists to directly inject samples into the LC-MS/MS system prior to analysis, a significant advantage in analyses where extensive sample preparation is time-consuming and costly.

Conclusion

The KBA found that the Aria system coupled with MS/MS is a powerful analytical tool for the testing of antibiotics and pesticides in honey. Pre-injection sample preparation is virtually eliminated, saving labor costs as well as increasing productivity. Limits of detection of 1 ng/mL are well below the maximum residue limits of the antibiotics tested. The KBA method proved to be a valuable tool for the determination of antibiotics and pesticides in honey samples and presents future applications for a larger range of antibiotic contaminants and possibilities for the screening of other veterinary drugs in agricultural food product matrices.

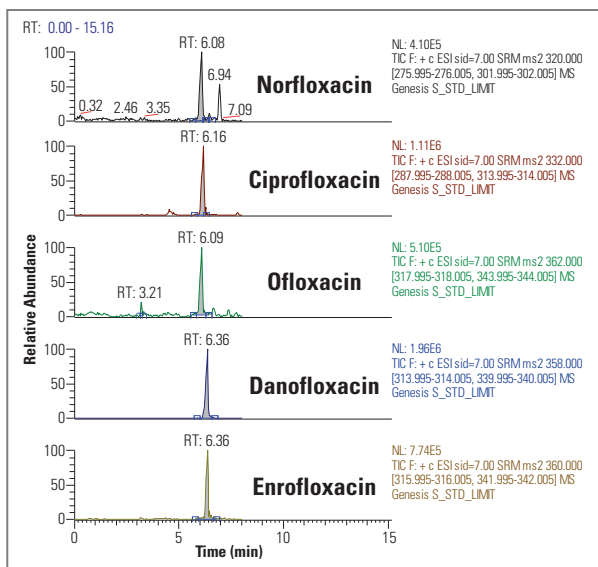


Figure 1: Chromatogram of 5 fluoro quinolone antibiotic standards at 5 ppb using online clean-up of the Aria TLX-1 system. The system provided a sensitive and reliable analytical method of detecting a full range of antibiotics.

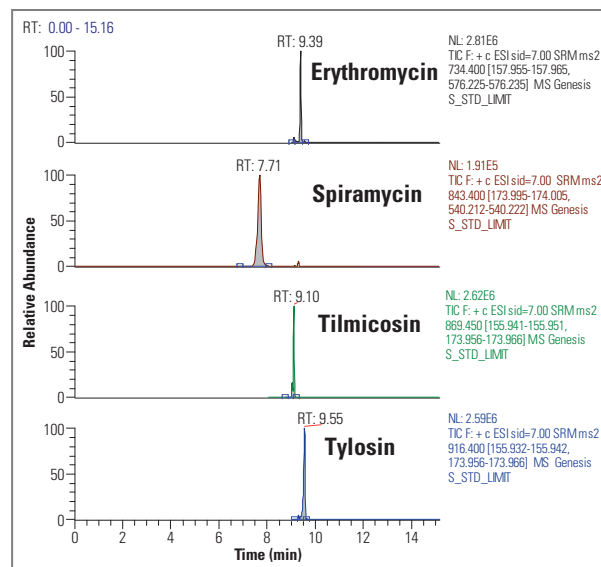


Figure 2: Four macrolide antibiotic standards at 5 ppb in 14 minutes with online sample extraction on the Aria TLX-1 system provides both increased analysis throughput and higher reproducibility.