Speeding up antibiotic measurement

Gemma Regan, Walsh Scholar of the Year, Food Programme, and Institute of Food Science and Technology Ireland (IFSTI) medal winner.

Gemma's research developed a new and improved rapid method for measuring banned nitrofuran antibiotics in meat.

Background

Nitrofurans are a class of broad-spectrum antibiotics, which were previously licensed as veterinary drugs for the prevention and control of disease, and as feed additives for growth stimulation. Upon administration, nitrofuran drugs are biochemically transformed in the muscle tissue into protein-bound metabolites, which can persist for months. It was found that these bound residues posed a potential threat to the consumer, due to concerns regarding their toxicological properties. Hence, nitrofurans are now classed as a zero-tolerance substance and are completely banned from use in food-producing animals.

Challenges in nitrofuran analysis

Due to the efficacy, availability and low cost of nitrofuran drugs, their illegal use still occurs. To ensure food safety, strict legislation exists for monitoring the levels of nitrofuran marker residues in food. Methodology for analysing these banned compounds is standard in most countries, with analysis primarily focusing on four main compounds, namely furazolidone, furaltadone, nitrofurantoin and nitrofurazone, detected as their respective marker residues: AOZ; AMOZ; AHD; and, SEM. Analysis of nitrofurans using the traditional bound-residue approach provides the most sensitive and selective detection; however, it is time consuming and leads to longer sample turnaround times.

Rapid method development

The aim of this research project was to extend the scope of analysis for nitrofurans and to develop a high-throughput liquid chromatography-tandem mass spectrometry (LC-MS/MS) method to include four additional nitrofuran compounds, namely nifursol, nifuroxazide, nifuraldezone and nitrovin, detected as their respective markers: DNSAH; HBH; OAH; and, AGN. The conventional analysis approach includes a 16-hour overnight derivatisation step, followed by a double liquid-liquid extraction. In this work, the analysis time was shortened from four days to 1.5 days, by developing an alternative rapid sample preparation approach, which incorporates a 13-minute microwave-assisted derivatisation step and a modified Quick Easy Cheap Effective Rugged and Safe (QuEChERS)-based extraction (**Figure 1**). The impact of this project is the development and application of a more efficient, reproducible and greener method for nitrofuran analysis, resulting in shortened laboratory turnaround times and higher method throughput for these substances. This improved confirmatory methodology for nitrofuran analysis in food aims to harmonise trade between the EU and China.

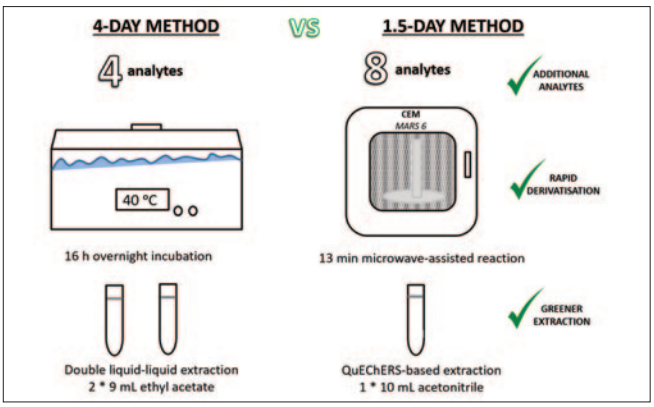

FIGURE 1: New research method used in this project, versus the older analysis approach.

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