

Potential of MALDI-TOF MS for improving the analysis efficiency of environmental drug residues

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Sulfamethazine (SMT) is used in swine feeds for disease treatment and control. Sulfamethazine, like all sulfonamides, is chemically very stable and may not be biodegraded quickly. With the recent public concern about intensive agriculture and water quality, there is a need to determine whether these compounds can be detected in the environment and whether these levels are meaningful for public health. Current residue analysis methods are slow and require a high degree of technical expertise to perform, making routine environmental residue analysis expensive and impractical.

A new method was developed to simplify confirmatory drug residue analysis in complex environmental samples using matrix-assisted laser /desorption ionization time-of-flight mass spectrometry (MALDI-TOF MS). MALDI-TOF MS is suited to high through-put analysis, and is more tolerant of impurities seen in environmental samples, so a less rigorous cleanup of samples is required. Laboratory and field samples were used to validate the method. In the lab, trace levels of SMT (parts per billion), and its major metabolite, N⁴-acetyl SMT, were recovered from spiked samples using a solid phase immunoextraction (SPIE) enrichment system, and then detected with MALDI-TOF MS. In the field, samples were tested from an Alberta pig farm with a 20 year history of using sulfamethazine medicated feed and spreading manure on the same field.

Results and Implications:

SMT and N⁴-acetyl SMT were detected in the manure pits, lagoons, field soil and water as follows, respectively: manure pit (13.9/13.9 ppm), weaner lagoon (1.81/0.62 ppm), feeder lagoon (490/110 ppb), field sample 1 (15/5 ppb), field sample 2 (11/0 ppb), and one of the water samples (4/0 ppb). This non-automated method was 2 to 3 fold faster than other definitive methods. It is expected that the rapidly evolving nature in both high through-put MALDI-TOF MS and automated sample preparation, could ultimately permit thousands of samples to be analyzed daily by one coordinated work station.