APPLICATION NOTE

Antibiotic Residue Generated from Livestock

Compact and portable mass spectrometers bring novel approach to food and environmental safety analysis

Antibiotics have been used since ancient times, however it was not until nearly the dawn of the 20th century the idea of harnessing the chemicals into a therepeutic medication to kill bacteria came into fruition. It began with chemotherapy medication using synthetic sulfonamide antibiotics discovered in dyes. The use of antibiotic chemicals as therepeutic drugs, such as penicillin, revolutionized the world by making once deadly illnesses treatable, such as pneumonia and tuberculosis. The benefit of being able to use these life saving and world changing drugs, comes with great responsibility. The responsibility lies in ensuring antibiotics are managed so they are not excessively or frivoulously used within the healthcare industry as well as industries that produce products that can contain antibiotic residue transferrable to humans. The concern with over use and over exposure of antibiotics stems from the more antibiotics are used, the greater chance bacteria is to become antibiotic-resistant. Bacterial resistance to antibiotics occurs when bacteria has had enough exposure to an antibiotic for it to evolve where the properties of the antibiotic to inhibit or kill the bacteria are no longer effective.

Figure 1: Antibiotics are used to treat and prevent illness in livestock as well as increase animal growth.

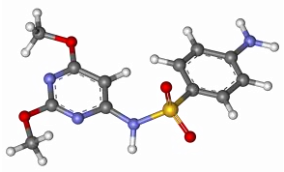
The ever growing demand for livestock commodities such as meat, eggs, and milk has led to increased numbers of livestock housed in confined areas, which increases the possibility of infections that if not treated properly can cause catestrophic damage amongst the livestock population. Antibiotics, such as sulfadimethoxine, can be used to treat an infection, as a preventative measure to keep the livestock healthy and free from infections, and also to increase the weight of livestock. The antibiotics can either be administered through an injection or oral route through distribution in the livestock food or water supply.

Antibiotic residue generates several areas of concern. The commodoties that are produced from the livestock such as meat, milk, and related products can be left with not only antibiotic residue, but also antibiotic-resistant bacteria as well. Because of the livestock being treated with antibiotics, the residues are also found in fertilizers used for the growth

Sulfadimethoxine

Molecular Weight: 310.33g/mol

Classification: Antimicrobial; Sulfonamide antibiotic



Portability™ MS

Features: Portable, field-analysis, results in seconds, rapid start, MS/MS capability
Detection Limit: < 10 ppb
Mass Range: 50 – 650 amu
Weight: 10 kg

Continuity™ MS

Features: Compact, high sensitivity, large mass range, results in seconds, MS/MS capability
Detection Limit: < 100 ppt
Mass Range: 50 – 1200 amu
Weight: 20 kg

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Sulfadimethoxine Analysis

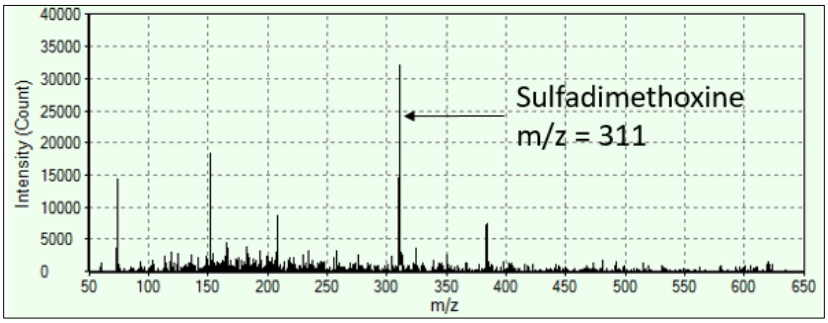

Figure 2: Real-time spectra as shown on Portability.

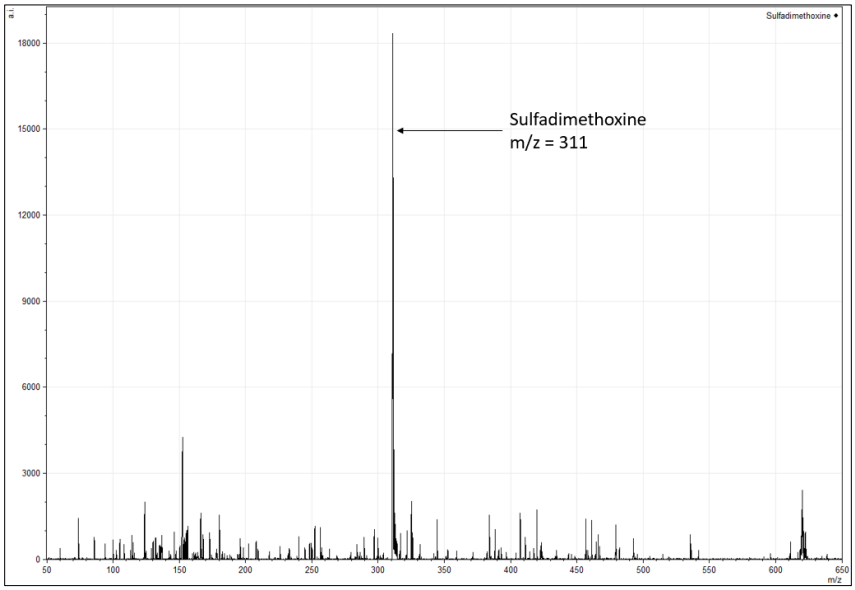

Figure 3: Spectra of sulfadimethoxine generated from data on Portability.

of produce, as well as water run-off and streams. Although the U.S. has regulations in place to decrease the amount of residue in meat, there are environmental concerns stemming from the residue in fertilizers contaminating produce and water supplies and also globally in areas that have "wet markets" where the meat sold is often not subjected to inspection and found to contain antibiotic residue as well bacteria such as E. coli.

Monitoring antibiotic residue effectively requires instrumentation that can bring laboratory quality analysis to the diverse locations of the samples, such as "wet markets", produce fields, water sources, slaughter houses, meat packing areas, and even barns and fertilizer plants. To bring analysis to these diverse environments, the instrument would require a small footprint, can be easily transported and operated by those with any level of scientific background, and produce laboratory quality results in real-time.

BaySpec's Portability™ and Continuity™ mass spectrometers are the solution for in-field and analysis. Compact and easily transportable, both instruments are made in the USA and manufactured at the BaySpec facility in San Jose, California. Portability™ and Continuity™ use atmospheric pressure and state-of-the-art proprietary linear ion trap technology which allows for the use of miniaturized oil-free pumps that are contained within the instruments. Both instruments can be paired with various ionization sources including ESI, APCI, EI, and DART and can also be customized to user-desired methods. Using Portability™, sulfadimethoxine, an antibiotic distributed to livestock, was measured using APCI. Sample introduction was performed by introducing a sample probe into a liquid solution and directly introduced into the sample inlet. The sample probe is able to be used directly with matrices such as meat, milk, water, soil, and produce and requires little-to-no sample preparation. Once the sample is introduced, the results are seen within seconds, providing real solutions to real-world problems.

Figure 4: Sample probe

Figure 5: Portability with ionization source module and sample probe.

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