Importance of Maduramicin Determination

The group of naturally occurring compounds known as "ionophores" (ion bearer) are carboxylic polyether antibiotics which were initially developed for use in the prevention and treatment of coccidiosis in poultry. Ionophores form complexes with alkaline cations, creating lipophilic channels through hydrophobic lipid membranes. This facilitates the movement of metal ions across the membrane, interfering with the osmotic pressure of the cell. Ionophores such as Monensin, Lasalocid, Maduramicin, Narasin, Salinomycin and Sermuduramicin are active against Gram-positive bacteria, mycobacteria, some fungi and certain parasites and coccidia.

In addition to their use in the treatment and prevention of infection, Ionophores are also used at sub-therapeutic levels to improve feed efficiency in livestock. They are generally administered as feed additives. The withdrawal period for ionophores varies between 3-5 days. Although generally considered safe and effective at therapeutic doses in target animal species, accidental overdose, misuse, mixing errors, and accidental ingestion in non-target species can result in toxicity in a number of animals. Horses, certain avian species, dogs, and cats are especially sensitive to ionophore toxicity. Effects of ionophore toxicity, which includes muscle degeneration, neuropathy, and cardiac toxicity, are often fatal.

To protect humans, regulatory agencies around the world have imposed regulatory limits regarding the amount of each ionophore allowable in products for human consumption, such as poultry and other edible animal tissues. In the US, the maximum residue permitted in chicken tissues is 0.24 µg/g in muscle, and 0.72 µg/g in liver. The Acceptable Daily Intake (ADI) is 1 µg/kg of body weight per day.

The Maduramicin ELISA allows for the analysis of 43 samples in duplicate determination. Less than 1 mL of sample extract is required. The test can be performed in less than 2 hours.

Performance Data

Test sensitivity: The limit of quantitation for Maduramicin (90% B/B0 calculated from the average of 30 calibration curves) is approximately 0.09 ng/mL. The middle of the test (50% B/B0 calculated from the average of 30 calibration curves) is approximately 0.74 ng/mL (average of 30 calibration curves). Determinations closer to the middle of the calibration curve give the most accurate results.

Test reproducibility: Coefficients of variation (CVs) for standards: <10%; CVs for samples: <15%.

Specificity: Cross-reactivity of the Abraxis Maduramicin Kit for related ionophores: Lasalocid, Monensin, Narasin, Salinomycin, Sermuduramicin < 0.1 %.

Standard Curve:

For demonstration purposes only. Not for use in sample interpretation.

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A. Reagents and Materials Provided
1. Microtiter plate (12 X 8 strips) coated with a secondary antibody, in a resealable aluminum pouch
2. Maduramicin Calibrators/Standards (5): 0, 0.25, 0.50, 1.0, 2.5 ng/mL (ppb), 1 mL each
3. Antibody Solution (rabbit anti-Maduramicin), 6 mL
4. Maduramicin-HRP Conjugate Solution, 6 mL
5. Wash Solution (5X) Concentrate, 100 mL, must be diluted before use, see Test Preparation (Section C)
6. Sample Diluent, 2 bottles, 25 mL each
7. Substrate (Color) Solution (TMB), 16 mL
8. Stop Solution, 12 mL (handle with care)

B. Additional Materials (not delivered with the test kit)
1. Micro-pipettes with disposable plastic tips (50-200 µL)
2. Multi-channel pipette (50-250 µL) or stepper pipette with disposable plastic tips (50-250 µL)
3. Microtiter plate reader (wavelength 450 nm)
4. Overhead tube rotator
5. Vortex mixer
6. Deionized or distilled water
7. Acetone, reagent grade
8. Paper towels or equivalent absorbent material
9. Timer
10. Centrifuge capable of spinning at 3,000 x g
11. 15 mL conical tubes with caps
12. 4 mL glass vials with Teflon-lined caps
13. Analytical 3 place balance

C. Test Preparation
Micro-pipetting equipment and pipette tips for pipetting the standards and the samples are necessary. In order to equalize the incubation periods on the entire microtiter plate, use a multi-channel pipette or a stepping pipette is recommended for adding the enzyme conjugate, antibody, substrate, and stop solutions. Please only use the reagents and standards from one package lot in one test, as they have been adjusted in combination.

1. Adjust the microtiter plate and the reagents to room temperature before use.
2. Remove the number of microtiter plate strips required from the aluminum pouch. The remaining strips are stored in the aluminum pouch and zip-locked closed. Store the remaining kit in the refrigerator (4-8°C).
3. The standard solutions, conjugate, antibody, substrate and stop solutions are ready to use and do not require any further dilutions.
4. Dilute the Wash Solution (5X) Concentrate at a ratio of 1:5. If using the entire bottle (100 mL), add to 400 mL of deionized or distilled water and mix thoroughly.
5. The stop solution must be handled with care as it contains diluted H₂SO₄.

D. Sample Preparation
Dog/Cat Food, Vitamin, and Rice Hull Extraction
Note: Dog or Cat Food which is in pressed pellet form must be ground into powder before extraction.

Samples should be analyzed immediately after extraction.

1. Weigh 1.0 g of feed, vitamin mix, or rice hulls into a 15 mL conical tube.
2. Add 5 mL of acetone.
3. Vortex for 30 seconds.
4. Mix using an overhead tube rotator for 15 minutes.
5. Centrifuge for 5 minutes at 3000 x g.
6. Dilute 40 µL of the supernatant solution into 920 µL of Sample Diluent (1:24 dilution). Vortex. This will then be analyzed as sample (Assay Procedure, step 1).

The Maduramicin concentration in the sample is determined by multiplying the ELISA result by a factor of 120. Highly contaminated samples, those outside of the calibration range of the assay, must be diluted further and re-analyzed.

E. Working Scheme
The microtiter plate consists of 12 strips of 8 wells, which can be used individually for the test. The standards must be run with each test. Never use the values of standards which have been determined in a test performed previously.

F. Assay Procedure
1. Add 50 µL of the calibrator/standard solutions or sample extracts (Section D) into the wells of the test strips according to the working scheme given. Analysis in duplicate or triplicate is recommended.
2. Add 50 µL of enzyme conjugate solution to the individual wells successively using a multi-channel pipette or a stepping pipette.
3. Add 50 µL of antibody solution to the individual wells successively using a multi-channel pipette or a stepping pipette. Cover the wells with parafilm or tape and mix the contents by moving the strip holder in a circular motion on the benchtop for 60 seconds. Be careful not to spill the contents.
4. Incubate the strips for 60 minutes at room temperature.
5. Remove the covering and decant the contents of the wells into a sink. Wash the strips four times using the diluted washing buffer solution. Please use at least a volume of 250 µL of washing buffer for each wash step. Remaining buffer in the wells should be removed by patting the inverted plate dry on a stack of paper towels.
6. Add 150 µL of substrate (color) solution to the wells. Cover the wells with parafilm or tape and mix the contents by moving the strip holder in a circular motion on the benchtop for 60 seconds. Be careful not to spill the contents. Incubate the strips for 20 minutes at room temperature. Protect the strips from direct sunlight.
7. Add 100 µL of stop solution to the wells in the same sequence as for the substrate solution.
8. Read the absorbance at 450 nm using a microplate ELISA photometer within 15 minutes after the addition of stopping solution.

G. Evaluation
The evaluation of the ELISA can be performed using commercial ELISA evaluation programs such as 4-Parameter (preferred) or Logit/Log. For a manual evaluation, calculate the mean absorbance value for each of the standards. Calculate the %B/B₀ for each standard by dividing the mean absorbance value for each standard by the Zero Standard (Standard 0) mean absorbance. Construct a standard curve by plotting the %B/B₀ for each standard on the vertical linear (y) axis versus the corresponding Maduramicin concentration on the horizontal logarithmic (x) axis on graph paper. %B/B₀ for samples will then yield levels in ppb (or ng/g) of Maduramicin by interpolation using the standard curve. Results can also be obtained by using a spreadsheet macro available from Abraxis upon request.

The concentrations of the samples are determined using the standard curve run with each test. Sample extracts showing a lower concentration of Maduramicin than standard 1 (0.25 ppb) should be reported as containing < 30 ppb of Maduramicin. Samples showing a higher concentration than standard 4 (2.5 ppb) must be diluted further with the provided sample diluent and re-analyzed.

Semi-quantitative results can be derived by simple comparison of the sample absorbances to the absorbances of the calibrators. Samples with lower absorbances than a calibrator will have concentrations of Maduramicin greater than that calibrator. Samples which have higher absorbances than a calibrator will have concentrations of Maduramicin less than that calibrator.