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Reduction of Ammonia Emission from Stored Laying-hen Manure Using Topically Applied Additives: Zeolite, Al⁺Clear, Ferix-3 and PLT

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Species: Poultry (Layers)

Use Area: Manure storage

Technology Category: Chemical Amendment

Air Mitigated Pollutants: Ammonia

Point of Contact:

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System Summary:

Manure storage can be a significant source of ammonia (NH₃) emission that could negatively impact the environment. Ammonia emission from manure storage may be controlled through physical, chemical and/or biological means. In this study, five treatment agents, including zeolite, 48.5% liquid Al⁺Clear (aluminum sulfate), granular Al⁺Clear (aluminum sulfate), granular Ferix-3 (ferric sulfate), and PLT (sodium bisulfate) were topically applied to stored nearly fresh laying-hen manure. Each agent was tested at three application rates, i.e., low, medium and high. Hen manure was stored in 19-liter Teflon-lined vessels under a constant ambient temperature of 23°C (73°F) and a ventilation rate of 11 air changes per hour (3 L/min). The NH₃ concentrations and emissions from the vessels were measured and NH₃ emission reductions by the treatment regimens were evaluated with reference to the control. The results show that there were no significant difference between the high and medium dosages for Al⁺Clear, Ferix-3, and PLT after the 7-d storage period. Reduction of NH₃ emission by the topical application of the agents over a 7-day manure storage/testing period was as following: A) 36%, 62% or 92%, respectively, for zeolite applied at 0.6, 1.3, or 1.9 lb/ft² (3.1, 6.3, or 12.5 kg m⁻²) of manure surface area; B) 63% or 89%, respectively, for liquid Al⁺Clear applied at 0.2, or 0.4 lb/ft² (1, or 2 kg m⁻²); C) 56% or 81% respectively, for dry granular Al⁺Clear applied at 0.1 or 0.2 lb/ft² (0.5 or 1.0 kg m⁻²); D) 42% or 90%, respectively, for Ferix-3 applied at 0.1 or 0.2 lb/ft² (0.5 or 1.0 kg m⁻²); and E) 74% or 90%, respectively, for PLT applied at 0.1 or 0.2 lb/ft² (0.5 or 1.0 kg m⁻²).

Applicability and Mitigating Mechanism:

- NH₃ volatilization from litter is dependent on pH, moisture content, air velocity, NH₄ concentration, and temperature
- Application of acidulant additives reduces litter pH and suppresses NH₃ emission
- Additives is topically applied to the fresh hen manure in storage

Limitations:

- An effective, automated delivery system(s) is (are) needed for the applications and should be fully investigated.
- The material has a low pH and can be corrosive to handle
- Ability of the acidulants to reduce pH, and thus reduce emissions, decreases over time

Cost:

The costs of the additives with dry form are based on the 50 lb/pack prices of 2008. Ability of the additives to reduce emissions decreases over time. The costs of the topical application of the agents at end of the 7th day was as following: A) 1.56, 1.81 or 1.83 cent/ft²-10% NH₃ reduction, respectively, for zeolite applied at 0.6, 1.3, or 1.9 lb/ft² (3.1, 6.3, or 12.5 kg m⁻²) of manure surface area; B) 0.25 or 0.36 cent/ft²-10% NH₃ reduction, respectively, for liquid Al⁺Clear applied at 0.2, or 0.4 lb/ft² (1, or 2 kg m⁻²); C) 0.36 or 0.49 cent/ft²-10% NH₃ reduction, respectively, for dry granular Al⁺Clear applied at 0.1 or 0.2 lb/ft² (0.5 or 1.0 kg m⁻²); D) 0.46 or 0.42 cent/ft²-10% NH₃ reduction, respectively, for Ferix-3 applied at 0.1 or 0.2 lb/ft² (0.5 or 1.0 kg m⁻²); and E) 0.45 or 0.60 cent/ft²-10% NH₃ reduction, respectively, for PLT applied at 0.1 or 0.2 lb/ft² (0.5 or 1.0 kg m⁻²).