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Reducing Ammonia Emissions from Poultry Litter with Alum

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Species: Poultry (Broiler and Turkey)

Use Area: Animal Housing

Technology Category: Chemical Amendment

Mitigated Pollutants: Ammonia

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System Summary:

Aluminum sulfate (alum) additions to poultry litter have been shown to reduce ammonia concentrations in and emissions from poultry rearing facilities. Adding alum to litter also decreases phosphorus runoff. There are three types of alum can be used in poultry houses; dry, liquid and high acid liquid alum (this paper focuses on dry alum). Typically alum is not applied to fresh bedding material, but added to used bedding prior to each subsequent flock. Ammonia levels in poultry houses receiving alum have been shown to be reduced by over 75% for the first two weeks of the flock, 50% the third week, and 20-30% thereafter. However, the exact length of time that ammonia is controlled is dependent on the rate of alum application, with higher rates resulting in better ammonia control. Recommended rates of alum vary from 0.045 to 0.09 kg/bird. However, these rates were based on broilers weighing 1.82 kg (4 lbs) at market age. Recently, more companies are growing larger broilers, which result in higher manure production and more ammonia emissions. Hence, for large birds the final market weight of the bird should be considered, with the corresponding range in alum application rates being 0.025 to 0.05 kg alum/kg bird. Alum application rates will be dependent on the desired length of time ammonia is controlled and whether or not controlling P runoff is desirable. Rates of 0.09 kg/bird have been shown to control ammonia for six weeks, while 0.045 kg/bird only controls ammonia for three weeks. Other benefits of alum include heavier birds, better feed conversion, lower condemnation, and reduced propane use during cooler months as a result of lower ventilation needs. Crop yields are also higher with alum-treated litter because of higher nitrogen content. Phosphorus, heavy metal and estrogen runoff are also reduced when litter is treated with alum, improving water quality.

Applicability and Mitigating Mechanism:

- NH₃ volatilization from litter is dependent on pH, moisture content, air velocity, NH₄ concentration, and temperature
- Litter pH is an important factor for controlling NH₃ volatilization
- Alum applications reduce litter pH and suppresses NH₃ emissions
- Alum is applied to the litter before birds are placed

Limitations:

- Alum loses its effectiveness with time
- Since alum begins working as soon as applied, birds should be placed 2-5 days after application
- Dry alum results in dusty conditions during application; dust masks and goggles should be worn
- The material has a low pH and can be corrosive to handle
- Cost of alum is variable, dependent upon proximity of the production facility to the supplier

Cost:

The cost of alum is dependent upon both the chemical cost, the proximity of the production facility to the supplier, and the charge made by a third party to apply it (if applicable). In the economic evaluation made by Moore et al. in 1999, the cost of alum was \$0.26/kg alum applied (\$0.12/lb), which was equivalent to \$480 for a 1459 m² house (16,000 ft²) treated with 1816 kg alum(4000 lb). Savings to the grower and integrator from lower propane and electricity use, heavier birds, improved feed conversion and lower condemnation totaled \$940, resulting in a benefit cost ratio of 1.96. As a result of these benefits, currently 700-800 million chickens are grown with alum each year.