

Microbial Additives to Reduce Ammonia Emission from Poultry Houses

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Species: Poultry
Use Area: Animal Housing
Technology Category: Biological Amendment and Diet Modification
Air Mitigated Pollutants: Ammonia

Description:

Intensive and sustainable animal production is very crucial for agricultural based economies. Gaseous ammonia is a byproduct of animal production that has to be managed for the well being of the animals and the environment. Various chemical amendments have been used to minimize ammonia gas release (Arogo et al., 2001) Excessive ammonia levels compromise bird health and the health and safety of workers in the poultry environment (Carlile 1984). The handling and storage of manure generated from layers has become a major concern and in some cases a major expense for layer producers. The application of large amounts of raw poultry manure to fields is thought to contribute to odors and other environmental concerns. Treatment methods such as composting can be used to reduce the odors, pathogenic bacteria and insect eggs thereby improving the economic value of the final material. However, at present only a small percentage of all layer producers compost their manure. Composting is a biological process that requires the carbon nitrogen ratio, moisture, microbial populations and aeration all be in the proper proportions to initiate the aerobic process and produce an acceptable end product. Poorly composted layer manure does not reach and maintain high temperatures and thus requires much more time to complete the process. Slow, extended compost periods also tend to result in higher concentrations of offensive odors and ammonia. In most manure composting management plans, the microbial population is secondary and receives little or no attention. However, the types and numbers of microorganisms determine the extent and efficiency of the compost process which significantly influences the characteristics of the end product.

Mitigation Mechanism:

Gram negative bacteria are highly prevalent in poultry litter and waste. These Gram negative bacteria convert uric acid in the poultry waste to make harmful ammonia. Application of MicroTreat P[®] to poultry litter lowers the gram negative counts in the litter and poultry waste. The reduction in Gram Negative bacterial population helps in nitrogen retention and reduced ammonia production. *Bacillus* based feed additives Provalen is efficacious and effective to improve performance and reduce ammonia. It also improves odors and other handling and processing problems of layer manure and provides a significant benefit to layer producers. *Bacillus* are sporeforming organisms. Spores are very resistant to environmental stress such as heat and contact with minerals. Therefore, the product will be stable in feed and premixes. The field trials indicate that feeding a *Bacillus* product to layers improves the decomposition process of the manure and provides evidence for the successful direct fed microbial feed additive using *Bacillus*.

Applicability:

Ammonia reduction interventions using microbial products are suitable and safe in all animal production systems. It is also specially suited for poultry production facilities that are computer controlled to allow for air exchange. MicroTreat P[®] is a biological litter treatment product that utilizes the activity of specifically selected bacteria to control the gram-negative microorganisms in poultry litter. MicroTreat P[®] is effective in reducing the level of gram negative bacteria present in poultry litter. Gram negative bacteria are known to have detrimental effects upon bird health due to the fact that many avian pathogenic bacteria are classified as gram negative. Besides this direct effect upon bird health, gram negative bacteria also indirectly reduce performance by negatively impacting the bird's environment. Gram negative bacteria have the ability to break down the uric acid excreted by poultry and convert it to the end product of ammonia. As is well documented, high ammonia levels decrease bird health and performance and also can be a health hazard for farm workers. Regulations restricting ammonia emissions are also in the near future for agricultural companies. Because MicroTreat P[®] reduces the poultry litter gram negative bacterial population, there are less gram negative bacteria present to break down the uric acid and produce ammonia. MicroTreat P[®] is applied to the litter either directly or through the drinking water. The timing of the application is at the beginning of the production phase, brooder or finisher, and is a one time application for each phase.

Research with MicroTreat P[®] has consistently shown a 50-90% reduction in total gram negative bacterial litter levels. The reduction of gram negative bacteria has been correlated in an improvement in production cost of \$0.0055 / lbs. This cost savings has been demonstrated in paired house testing up to large field trials and entire integrator usage that

resulted in 1000's of flocks being tested. The reduction of ammonia with the use of MicroTreat "P" has been well documented within several poultry integrators. MicroTreat P[®] use typically results in a 40-60% reduction of in-house ammonia levels.

Limitations:

There are no known limitations of this technology. The bacterial organisms are listed as GRAS (Generally Regarded As Safe). Unlike chemical amendments, microbiological additives work in the animal production environment reducing the cumulative ammonia emission.

Cost:

MicroTreat P comes in foil packs and is concentrated for convenient use. The application rate is based on type of poultry and fecal material produced. Typically the treatment costs are as follows: Broilers \$0.005 per bird, Turkeys \$0.055 (40 pound tom) and \$0.028 (16 pound hen). The cost to treat layers feed with Provalen is approximately \$2.00/ton.

Implementation:

Provalen is a *Bacillus* based feed additive that utilizes the enzyme producing activity of specifically selected strains to enhance performance, control manure decomposition and thus reduce ammonia and odors associated with the storage of poultry manure. The Provalen *Bacillus* strains were selected on their ability to produce proteolytic and amylolytic enzymes. Feeding trials have consistently demonstrated a 30-50% reduction in the level of ammonia in laying production facilities. Also seen in these studies was an improvement or retention of nitrogen values in the manure produced by the laying hens of approximately 15%. A feeding study demonstrated the ability of Provalen to improve the feed efficiency of laying hens without reducing overall egg production. There was observed benefits for shell quality, as measured by a reduction in cracked eggs, an increase in large egg production and improvements in overall feed efficiency that resulted in an annual \$0.019 per hen housed net return with Provalen use. This study is being combined with field data demonstrating reductions in the levels of ammonia in production facilities.

Technology Summary:

Future Environmental Regulations will force the animal production industry to find new interventions that will provide improvements in the decomposition of stored manure. A by product of the decomposition of stored manure is ammonia. Ammonia will play a key role in the regulation of confined animal facilities. Commercial products will need to be targeted to lower the level of ammonia in the confined animal facilities and more importantly, lower the overall amount of ammonia that is generated at each facility. Regulations will be based upon total production of ammonia from each facility. In addition, regulations will also include other compounds (gases, odors) emitted from confined animal feeding operations. Agtech possess a portfolio of products and bacterial species (*Bacillus* and *Propionibacteria*) that alter ammonia formation and have efficacy in the area of ammonia and odor production.

References:

- Arogo, J., P.W. Westerman, A.J. Heber, W.P. Robarge, and J.J. Classen. 2001. *Ammonia in Animal Production*. ASAE Paper No. 014089, Sacramento, CA.
- Carlile, F.S. 1984. *Ammonia in Poultry Houses: A Literature Review*. World's Poultry Science Journal. 40 : 99-113.

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