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GRN047979 Poultry Ammonia Emission Study

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Professional information for breeding poultry, cattle and pigs

Ammonia Emission

Drinking water additives are reducing emission

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(Study summary. The entire study is available on request in German language)

The emission of noxious gasses and odor from the poultry, pigs and cattle farms are considerable environmental issue.
Prof. dr. Günter Hörnig and dr. Reiner Brunsch, from german Institut für Agrartechnik Bornim e. V. are researching for over 15 ears whether the additive based on brown seaweed can reduce harmful emissions.

Biochemical processes in manure and feces in farms generate ammonia (NH3). In concentrations larger than 20 ppm the ammonia is harmful for health and performance of humans and animals.

With draining waste air from the farms ammonia can cause substantial damage to the woods and nature surrounding the farms. This, combined with the ever growth in numbers of breeding animals, was base for research how can we enlarge the number of animals and simultaneously reduce effects on the nature.

The testing is performed on the farm with 200.000 birds.

After drying the brown seaweed is melted and converted into the alginate. Alginate contains organic acids, mostly pectin, which influences animal digestive system in the way that prevents nitrogen excretion and with that ammonia emission from manure and feces.

Our additive was first tested by Gurk and Brunsch in 1994. They have achieved 50% reduction in ammonia emission in the farms.

Practical experiments

Two ventilated barn with approximately 21,000 broilers on litter from sawdust were used as experimental and controlling barn. Breeding time was 40 days in which the concentration of ammonia, CO2, water vapor, temperature and relative humidity (always in the barn and outside) was regularly measured. Waste air volume streams, which were needed for emission calculation, were calculated by distributable method for carbon dioxide in compliance with DIN18910, which is used also in newer post (Pedersen et al., 1998).

To avoid effects of natural alkaline calcium (Ca) and magnesium (Mg), water must be softened to 0.1 to 0.2 degrees by German hardness.

Softening and regeneration are unwinding alternately in two reservoirs. Calcium and magnesium ions are in regeneration phase exchanged with the help of the sodium ions coming from the cooking salt.

Laboratory chemical analysis and experiments with the gas emission from manure and feces from both farms were tested on the day when barns were cleaned.

Laboratory tests

We have created in our laboratory test reservoirs simulating field conditions. We are using the same techniques for measuring emissions as are used in the barns. Through the upper layer of manure and feces we release the air. Gas monitor is sucking from the contaminated air sample and measures the gas concentrations.

Comparison between the test and controlling barn showed ammonia emission reduction of 44.6% (summer test).

Table1: Structure of manure and feces from test and controlling barn.

Test	CM, % in IM	pH	N_i, g/kg CM	NH4-- N_i, g/kg CM	NH4-- N N_i
Feces (control)	51.6	8.9	61.2	20.3	0.332
Feces (test)	52.4	8.0	66.4	13.6	0.205
Manure (control)	65.2	8.9	59.2	12.5	0.211
Manure (test)	74.9	8.4	63.2	8.8	0.139

CM = Collective Mass, IM = Initial Mass, N_i = Collective Nitrogen, NH4-N = Ammonia Nitrogen

Table2: Relative ammonia emission from manure and feces in laboratory reservoirs

	Summer 1998	Winter 1999
Feces (control)	100.0	100.0
Feces (test)	29.2	36.1
Manure (control)	100.0	100.0
Manure (test)	25.2	19.9

Practical experiments results

In all tests, including repeating tests, the ammonia concentrations were below 20 ppm (equals to 14 mg NH_3/m^3), which shows healthy barn environment.

Ammonia emission was calculated based on volume flow of waste air. For one year with 7 production cycles of 52 days, they have calculated ammonia emission of 50.2 g NH_3/m^3 in the controlling barn and 27.8 g NH_3/m^3 in the test barn. The first value is within the margins of Dutch pointer (Groot Koerkamp we el,. 1998) which was valid also in Germany according to the German environmental authorities..

The research continued in the winter and spring 1999, where the controlling and testing barns were rotated. In each test series the emission was reduced 21% and 51%. Reason for these variances could be ventilation system, which differs with the seasons. Average emission reduction was 40%. Drinking water additives have also reduced the odor in the testing barn. Odor emission was reduced in the average for 18%. The chemical analysis showed differences in pH levels and nitrogen concentrations.

The samples from the barn treated with our product showed lower pH levels and lower values for ammonium nitrogen. This could explain lower ammonia (NH3) emission. The same trend was shown in all tests.

Laboratory tests

Manure and feces were transferred from barns to the laboratory reservoirs in thickness of approximately 5 cm (similar to the barn floor layer). Ammonia emissions were measured, where controlling barn values were set to 100 (table 2). Results on both manure and feces confirmed practical measurement results and, hence, positive effects of our product on ammonia emission reduction.

Conclusion

Complex practical and laboratory experiments showed substantial reduction in ammonia emission when using our solutions regularly. The reduction is in average about 40%. Brown seaweed solution is apparently reducing pH level and ammonia content in animals feces. Substances causing the odor were also largely reduced.