Poultry Diets Get scent-sitive Treatment

By Charmain Tan Courcelle

Supplementing poultry diets with activated carbon or other odor absorbers may help take the stink out of chicken manure.

Russell Bazemore, MAFES aroma chemist, is working on methods to control the odor of poultry manure using absorbers, deodorizers and other chemical compounds. His research may provide relief from unwanted odors for farmers and their neighbors.

"Mississippi and the state's poultry industry continue to grow, and as more people move to areas where poultry is raised, there's increased concern about foul odors," Bazemore said.

His group has examined the odor-reducing ability of three absorbent materials — chitosan, copper chlorophyllin complex (CCC) and activated carbon — when added as poultry diet supplements. Chitosan is produced from chitin that forms the hard outer skeleton, or shell, of crabs and shrimp. It is often used in agriculture as a fertilizer or food preservative, but it also has odor-absorbing traits.

CCC is a derivative of chlorophyll, which is found in green plants. It can bind to nitrogen-containing compounds such as ammonia. Activated carbon is a highly porous material that can bind and absorb different compounds.

Smells are composed of a mixture of volatile, or easily evaporable, chemical molecules called odorants. More than 70 odorants contribute to the smell of poultry manure. Because the ability to smell an aroma depends on odorants entering the nasal passages and binding to olfactory receptors, odor control strategies are based on capturing these molecules before they get to the nose. Examples of odor management practices for livestock facilities include treating manure and manure pits with odor absorbers, filtering exhaust from enclosed animal operations and trapping odors from waste lagoons with manure covers.

"Alternatively, we can try to trap odorous compounds before they exit the animal," Bazemore said.

Bazemore's team raised chicks on a standard poultry diet for their first three weeks. For four additional weeks, the birds received either the standard, control diet or one of five diets that included the standard feed supplemented with various odor absorbent treatments. These treatments included 3 percent medium-molecular-weight chitosan, 3 percent high-molecular-weight chitosan, 0.1 percent CCC, 0.01 percent CCC, or 0.1 percent activated carbon.

The researchers collected manure every week after the treatments were started for odor analysis. Odor intensity and unpleasantness were judged by a human "sniff" panel. Manure samples were also analyzed using gas chromatography-olfactometry and gas chromatography-mass spectrometry — techniques that allow individual odorants to be identified and scored for importance as odorous components. The group recorded the live weight of the chickens to determine bird health with and without treatment.

"The treatments did not appear to have a physiological effect on the birds," Bazemore said. "Weight gain was similar for birds fed diets with added supplements and those fed standard diets."

Results from the odor analysis showed treatment with 0.1 percent CCC and 3 percent high-molecular-weight chitosan were most effective at lowering odor intensity and decreasing odor unpleasantness of poultry manure. However, all of the other treatments tested had some effect on odor abatement.

"We saw a cumulative effect with the supplements," Bazemore said. "The longer the birds were on the supplemented diets, the better the odors became."

Jim Lytle

Jim Lytle

◀◀ ***MAFES aroma chemist Russell Bazemore, right, and graduate research assistant Youngmo Yoon use the gas chromatography-mass spectrometry technique to determine odorants in a manure sample.***

◀ ***Yoon prepares a sample for chemical analysis on a gas chromatograph.***

Further work will be required to determine whether additional odor reduction can be obtained if birds are fed supplemented diets before three weeks of age, Bazemore said.

Because most odor complaints are made after manure is applied to fields as a fertilizer, the scientists evaluated the effect of soil properties on odor.

"One important component in the odor of poultry manure is butyric acid. At low pH (acidic conditions), butyric acid is more volatile and is released into the environment," Bazemore explained. "We were interested to see whether acidic soils had an effect on manure odor."

Soils in north central Mississippi are mildly acidic. Therefore, manure samples from chickens fed a standard diet were adjusted from their natural pH (pH 6.98) to a pH that mimicked these acidic soil conditions (pH 5.58). Results from this study showed that manure odor is more intense and unpleasant when pH values are low.

"The pH of soil may account, in part, for the overpowering odor of manure after it's initially spread onto a field," Bazemore said. "The degree of odor intensity and unpleasantness can be affected by adjusting the pH."

The smell of ammonia within poultry houses is another common odor complaint. However, the manure samples collected for this study did not smell strongly of ammonia. Bazemore found the cause of this difference to lie in the pH of the manure — more alkaline conditions in poultry houses seemed to result in higher ammonia levels.

Bazemore said unwanted odors are not the only reason farmers should be concerned about the pH conditions in their poultry houses. Conditions that favor high ammonia levels are potentially dangerous to the health of humans and chickens.

Bazemore and Yoon judge the odor intensity and unpleasantness of manure samples.

Team Spreads the Message of Sustainable Design

By Charmain Tan Courcelle

Sustainable design balances human needs with the environment. Members of the Center for Sustainable Design built a salt marsh, left, to replace a storm drain carrying runoff into the Mississippi Sound.

Global warming, eutrophication (nutrient enrichment) of water bodies, deforestation, the mass extinction of species — all are well-known examples of our ability to alter the environment both temporarily and permanently, often to the verge of destroying the very natural resources we need for survival.

A new book, which is in its final stages of writing by MAFES biological engineer Tom Cathcart and MSU landscape architect Pete Melby, suggests that far from being at an impasse, we have the ability to meet our basic needs, while living within the constraints of our environment. The key? Sustainable design.

"The need for sustainable design is inevitable," Cathcart said. "We've gone from a population of less than 3 billion people 50 years ago to 6 billion today. By the year 2050, our population is projected to reach between 9 and 12 billion. We will eventually crowd the natural, cyclical systems we depend on if we don't learn to live within the rules of these processes."

Cathcart and Melby's book, which has the tentative title *Regenerative Technologies in the Sustainable Landscape*, outlines the rules of sustainable living and discusses "the systems and processes that we need for survival, the ways that we can disrupt them and how we might avoid such disruptions." Each chapter of the book describes methods for incorporating sustainable design into human practices.

Sustainable practices fulfill human needs but leave minimum impact on the environment. Cathcart said sustainable systems blend the human landscape with natural ecological systems.