

**ORGANIC ACID OR WEAK ACID ADDITION
TO ALUM TO INHIBIT AMMONIA
VOLATILIZATION FROM POULTRY LITTER**

PRIORITY DATA

[0001] This patent application is a non-provisional application claiming priority to U.S. Provisional Patent App. No. 62/114,190, filed on Feb. 10, 2015, which is hereby incorporated by reference herein.

FIELD OF THE DISCLOSURE

[0002] The present disclosure generally relates to control of ammonia that is volatilized from animal waste products, and conversion of ammonia to land fertilizers.

BACKGROUND OF THE DISCLOSURE

[0003] Animal litter or manure, particularly from farm animals such as poultry and pigs, contains ammonia and phosphates. The ammonia given off into the atmosphere adversely affects farm workers and even the animals themselves. When large amounts of ammonia are present in the atmosphere of animal enclosures, the result is lower weight gain and higher mortality rates for the animals.

[0004] The nature of a chicken house is such that a strong amount of urea and other compounds that break down into ammonia are generated. The ammonia is unhealthy to the chickens and the people that work in these conditions. For people, there are regulatory limits on exposure that require that either breathing apparatus is worn or strong ventilation is installed. For chickens, studies have shown that high levels of ammonia retard growth and can cause blindness, respiratory issues and can even cause burns on the young birds' feet. This condition causes a decrease in output in these farms but also creates growing conditions that are cruel. In order to deal with this, fans are installed in the houses to remove the ammonia but in the winter this can create other problems including high energy usage, and the heaters must also work to keep the animals warm.

[0005] Alum, such as aluminum sulfate, has been used to reduce the pH, and thus the ammonia generation, of manure and animal bedding material. Alum, either in solid or liquid form, will lower the pH of the manure by hydrolysis and will convert ammonia to ammonium ions. Ammonium ions will react with sulfates to form ammonium sulfate which will precipitate in the litter, reducing ammonia emissions; the ammonium sulfate is also a water-soluble nitrogen fertilizer and can be used as such after the litter is removed. The use of alum for this purpose has an added advantage in that the soluble phosphates present precipitate in the presence of aluminum and thus the soluble phosphate content of manure is also reduced by this treatment. Soluble phosphates are known to seep into ground water or are carried in surface runoff water.

[0006] Several years ago alum was introduced as a floor treatment in poultry houses as it reacts readily with the free ammonia precipitating a white ammonia sulfate. This reduces the ammonia level at its source. Unfortunately, the speed at which the alum dissolves is slow, so alum has been coupled with the use of sulfuric acid (a feed chemical to make alum) which allows the reaction (precipitation) to occur at a much faster rate initially due to the free acid. For example, PureTM

(Affinity Chemical, Dallas, Tex.) is a product on the market that is used to control the amount of ammonia that is volatilized in a chicken house.

[0007] In U.S. Pat. No. 5,622,697, a method for inhibiting ammonia volatilization in animal manure, particularly poultry litter for long time periods (3-6 weeks) is disclosed. The method comprises the steps of adding alum (aluminum sulfate) to poultry litter (comprising poultry manure, bedding material, spilled food and feathers) and mixing. Alum is added in sufficient quantities to reduce the pH of alum/poultry litter base composition. Other patents describing conventional approaches (alum or alum with sulfuric acid) include U.S. Pat. Nos. 5,914,104, 5,961,968, 5,928,403, and 6,468,518.

[0008] Unfortunately, as described in the above patents, the amount of acid needed to initiate the reaction is around 7-9%. This amount of sulfuric acid causes the pH of the liquid being transported to the houses and being applied to be well below 2.0. Materials with pH below 2.0 are considered hazardous (40 CFR §261.22) and as such farmers must take special precautions when using it. If any spills occur, the material must be handled under Department of Transportation hazardous materials rules.

[0009] In view of the aforementioned needs in the art, there remains a need for improved compositions that inhibit ammonia volatilization from poultry litter and other animal enclosures.

SUMMARY OF THE DISCLOSURE

[0010] In some variations, the present disclosure provides a composition for use in reducing ammonia generation in animal enclosures, the composition comprising metal sulfate and from about 0.01 wt % to about 25 wt % organic acid or a combination of organic acids (on a dry basis and based on the metal sulfate in non-hydrated form), wherein the organic acid or a combination of organic acids has an average pKa of about 3 or higher.

[0011] In some embodiments, the composition comprises from about 1 wt % to about 15 wt % organic acid or a combination of organic acids.

[0012] In various embodiments, the organic acid or a combination of organic acids has an average pKa of about 3.5 or higher, about 4 or higher, or about 4.5 or higher.

[0013] The organic acid or a combination of organic acids may be selected from the group consisting of acetic acid, acetoacetic acid, citric acid, formic acid, lactic acid, ascorbic acid, benzoic acid, propionic acid, 3-hydroxypropanoic acid, carbonic acid, glycolic acid, glyoxylic acid, glyceric acid, acrylic acid, adipic acid, malonic acid, methymalonic acid, succinic acid, malic acid, tartaric acid, itaconic acid, mesaconic acid, glutaric acid, and combinations or salts thereof. In certain embodiments, the organic acid or a combination of organic acids includes acetic acid.

[0014] Optionally, the composition further comprises an inorganic acid having a pKa of about 3 or higher. In some embodiments, the composition does not include any acids having a pKa of less than 2 or less than 3.

[0015] Other variations provide a composition for use in reducing ammonia generation in animal enclosures, the composition comprising metal sulfate and from about 0.01 wt % to about 25 wt % inorganic acid or a combination of inorganic acids (on a dry basis and based on the metal sulfate in non-hydrated form), wherein the inorganic acid or a combination of inorganic acids has an average pKa of about 1 or higher.