



## Reused Litter Treatments for Improved Bird Health

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### INTRODUCTION

Effective litter management is one of the most critical aspects of poultry production. Poor quality litter can have a significant negative impact on bird health and performance. Wet or caked litter can lead to elevated ammonia levels, increased incidence of pododermatitis and increased numbers of pathogenic organisms including bacteria, viruses, coccidia, intestinal worms and molds. Where reuse of litter is necessary effective litter management is vital if bird health is not to be compromised. To complement basic management practices, numerous litter treatment products and strategies have been developed. This article gives an overview of some of these and their role in effective litter management.

### EFFECTIVE LITTER MANAGEMENT

The aim of effective litter management is to ensure that the litter remains dry and friable. Wet or caked litter (**Figure 1**) will lead to reduced bird health and performance, due to elevated ammonia levels, increased incidence of pododermatitis and contamination from pathogens.

**Figure 1:** Wet and Caked Litter



Poorly managed water lines and inadequate ventilation are the two most common causes of wet litter. Health conditions that may cause birds to increase water excretion such as necrotic enteritis, mycotoxicosis and infectious bronchitis can also contribute to wet litter conditions. Nutritional imbalances, certain feed ingredients, and medications may also play a role in the problem.

Basic strategies for effective litter management include the provision of adequate ventilation, de-caking between flocks if litter reuse is necessary, and choosing appropriate litter material. There are a number of litter treatment products and strategies which when used appropriately in conjunction with good litter management, can be useful and economically justifiable litter management tools. This is especially true under some of the following conditions:

- High fuel costs
- Cold weather
- High stocking densities
- Short down times
- High disease challenge
- Litter reuse

### LITTER TREATMENTS

Ammonia control as a result of wet or caked litter is the primary stimulus for the development and use of most litter treatments. Ammonia is a gas produced by the bacterial breakdown of the uric acid excreted in chicken manure. The conversion to ammonia requires heat, oxygen, moisture, and a litter pH suitable for the bacteria that break down the uric acid. These conditions will be prevalent if effective litter management is not employed. At elevated levels ammonia can damage the eyes and respiratory tract (**Figure 2**), which in turn increases the bird's susceptibility to respiratory disease.

**Figure 2:** Ammonia burns and blepharitis caused by wet litter.



Litter treatment products can also be used to control microorganisms. Companies that reuse litter or have antibiotic free programs routinely use litter treatments as part of their pathogen control program.

## COMMONLY USED TREATMENTS

Numerous products with various mechanisms of action are commercially available for use in poultry houses. Some of the most commonly used types of litter treatments are listed below (a summary is given in **Table 1**).

### Acidifiers

Acidifiers convert ammonia to ammonium. Unlike ammonia, ammonium does not easily convert to the gaseous form and therefore remains in the litter. In addition to the effects on ammonia, acidifiers reduce litter pH to between 5.0 and 7.0. This creates an inhospitable environment that inhibits both ammonia producing bacteria and potentially harmful bacteria such as *E.Coli*, *Salmonella* and *Clostridia*.

Although the mechanism is not completely understood, darkling beetle populations are also reduced by acidification. These common poultry house pests have been associated with disease transmission which makes their control important.

The effectiveness of acidifiers is limited to 2-5 weeks under normal conditions. It is possible to extend the effective life of these products by preheating the house 48 hours before placement and then ventilating to purge the ammonia. This will reduce the amount of ammonia in the litter available to react with the product.

### Sodium bisulfate

Sodium bisulfate is a dry acid salt that is activated by environmental moisture. As with all acid products, it lowers ammonia (through the production of acid) and litter pathogen levels such as bacteria, worm eggs and fungi (through the sodium component). In addition, the sulfate component permanently binds ammonia preventing it from being released as a gas.

Sodium bisulfate works best when top dressed onto the litter close to bird placement. As with each of the acidifiers, this product can be applied with birds present during periods of bacterial challenge, prior to an expected challenge such as gangrenous dermatitis, or before processing to decrease carcass contamination. When birds are present, use this product according to the manufacturer's directions.

### Aluminum sulfate

Like sodium bisulfate, aluminum sulfate is a dry acid salt. With this product, acid is produced through the reaction with water in the litter. The degree of acidification is not as great as with some of other products but it does lower litter pH. Since water is utilized in the production of acid, this product will also dry out the litter. Aluminum sulfate also binds phosphorous, making it unavailable; this can be of benefit if phosphorus levels in the litter are a concern when spreading on pasture.

Aluminum sulfate is most commonly top dressed onto the litter three to seven days before placement depending on litter conditions. Product application time depends on the level of litter moisture. Wet litter conditions will activate the product faster than dry conditions. Application should occur three to four days before placement when the litter is wet, and six to seven days before placement when the litter is dry. If the litter is very dry, add moisture to activate the product. To maximize moisture reduction it is necessary to work the product into the litter. This is not necessary for pH reduction.

### Sulfuric Acid Clay

Sulfuric acid is most commonly incorporated into a clay bead for safety purposes and ease of application. Sulfuric acid is a strong acid that does not require moisture for activation. As with the other products, ammonia is both converted to ammonium and bound to sulfate. As an adsorbent material, the clay in this product may also bind ammonia and lower litter moisture. Sulphuric acid works best when top dressed on the litter within a few days of placement.

## Enzymes

There are several enzyme products available for ammonia control. Many of these products utilize a compound that physically binds ammonia and prevents its release. A second type of enzyme that can be used, blocks the breakdown of uric acid into ammonia. These products can be directly applied to the litter or put in the feed. A wide range of products exist that use these enzymes alone or in combination with other ingredients such as microbes or acids.

## Bacteria

There are numerous bacterial preparations for use in managing poultry litter. The mechanisms of action for these products include competitive exclusion of pathogenic or ammonia producing bacteria, competitive utilization of uric acid to prevent its conversion to ammonia, production of organic acids and conversion of ammonia into nitrate or nitrite. These products have not been widely studied up to this point and they are often used in combination with other products such as acids or enzymes.

## Osmotic Agents

Feed grade salt can be applied to the chicken house floor before litter placement to destroy any organisms that may still be present after clean out and disinfection. This technique has been most widely used for the control of intestinal worms.

Salt can be very corrosive to metal so it is important to avoid contact with equipment in the house. It is helpful to lightly wet the salt after application to allow it to dissolve. It is also very important to use feed grade salt instead of granular salt. Toxicity may occur if birds ingest large granules of salt.

## Windrowing

Windrowing is a litter management technique that, if performed correctly, will lower the pathogen load of reused litter. The litter is scraped into a long row in the middle of the house and left to sit for five days or more. It works best when the cake is removed and the litter clumps are broken down before being piled but this is not necessary. Heat is created in the pile from the breakdown of the organic material. The target temperature for the interior of the pile is +130°F (+54°C). Heating the litter to this temperature for five days has been shown to reduce levels of pathogenic bacteria including *Salmonella* and *Clostridium*. It has also been shown to eliminate some viral pathogens from the litter. This technique has not been evaluated for control of parasites and molds but is likely to significantly lower the levels of these poultry pathogens

also. After treatment, the litter is spread back out in the house to cool and dry before birds are placed.

## CONCLUSIONS

Effective litter management is a critical part of good poultry husbandry particularly where the re-use of litter is necessary. There are a number of commercially available litter treatment products (**Table 1**) and strategies that can aid litter management.

**Table 1:** Commonly Used Litter Treatments

| Main Component*       | Primary Purpose   | Cautions                               |
|-----------------------|---|--|
| Sodium Bisulfate      | Lower ammonia<br>Reduce litter pH                           | Corrosive                              |
| Aluminum Sulfate      | Lower ammonia<br>Reduce litter pH<br>Reduce litter moisture | Corrosive                              |
| Sulfuric Acid<br>Clay | Lower ammonia<br>Reduce litter pH                           | Corrosive                              |
| Feed Grade Salt       | Osmotic agent   | Corrosive<br>Salt toxicity if ingested |

*\*When using a litter treatment product, follow the manufacturer's application guidelines and instructions closely.*

The decision whether or not to use a litter treatment and the type of product to use will be based on many factors including:

- Goals for treatment
- Product cost
- Ease of use
- Potential for equipment damage
- Human safety
- Use of litter after removal

If used appropriately and in conjunction with good basic litter management practices, the use of such litter treatments can be a practical and economically justified means of ensuring that litter quality is maintained and that bird health and performance are optimized.