Feed Acidifiers As Natural Growth Promoters in Poultry Feed
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Abstract
Feed additives are of great interest in the poultry industry due to their property to promote growth performance. Common feed additives used in poultry diets include antimicrobials, antioxidants, emulsifiers, binders, pH control agents and enzymes. Feed Acidifiers which are natural growth promoters, are acids included in feeds in order to lower the pH of the feed, gut, and microbial cytoplasm thereby inhibiting the growth of pathogenic intestinal microflora. Acidifiers can be in organic or inorganic acids or associated salts and added to the poultry feed to exert their antimicrobial action both in the feed and in the GI-tract. Organic acids have been identified as best alternative to antibiotic growth promoters by optimising the pH of gut, increasing the digestibility of the several minerals and thus increase the economic performance of poultry.

Key words: Acidifiers, poultry

Why poultry need feed additives?
Incompetent natural immune system of newly hatched poultry leads to predominance of pathogenic bacteria in their gastrointestinal tract through damaging effects on cell wall of intestine and decrease performance at the whole period of poultry life (Fuller, 1989; Parks et al., 2001). Feed additives are of great interest in the poultry industry due to their property to affect the microbial population in gastrointestinal tract (Doyle, 2001; Makkink, 2001). Antibiotics were used worldwide in poultry industry in the past six decades for preventing diseases and improvement of growth performance. But continuous and misuses of antibiotics in livestock production and specially poultry industry resulted many concerns about development of drug-resistant bacteria, drug residues in the body of the birds, and imbalance of normal microflora. Some other natural growth promoters like acidifiers, probiotics, prebiotics phytobiotics, feed enzymes, immune stimulants and antioxidants can be used as feed additives (Steiner, 2006).

What are feed acidifiers?
Acidifiers are generally regarded as safe and have been approved by most countries to be used as the feed additives. Feed Acidifiers are acids included in feeds in order to lower the pH of the feed, gut, and microbial cytoplasm thereby inhibiting the growth of pathogenic intestinal microflora. This inhibition reduces the microflora competing for the host nutrients and results in better growth and performance of the chicken. They also act as mould inhibitors. They are added up to 0.25% of the diet. Feed acidifiers or organic acids have been used extensively for more than 25 years in swine production and more recently in poultry. The antimicrobial effect of organic acid ions in controlling bacterial populations in the upper intestinal tract leads to beneficial effects.

**How are feed acidifiers classified?**

Acidifiers can be in organic or inorganic acids or associated salts. As a group of chemicals, organic acids are considered to be any organic carboxylic acid of the general structure R-COOH (including fatty acids and amino acids). Organic acids are widely distributed in plants and animals. They are also produced by microbial fermentation of carbohydrates and other fermentable material in the intestinal tract. There are a variety of weak organic acids on the market. They include acetic acid (used to make vinegar), benzoic acid, butyric acid, citric acid, formic acid (used to make formaldehyde), fumaric acid, lactic acid, propionic acid and sorbic acid. Although inorganic acids, such as hydrochloric acid (HCl) and phosphoric acid reduce the pH but found to be ineffective. Organic acids are weak acids and are only partly dissociated in the GI tract.

**How to use them?**

Acidifiers can be added to the poultry feed in solid form (reduces mould development and reduces pH of crop), sprayed onto poultry litter (attacks on uric acid breaking bacteria and limits the ammonia release) or injected into the water (facilitates chlorine in killing bacteria).

Acidifiers usually are not a single acid, but a combination of two or more. This is because one acid may be effective on one type of bacteria but not on another. For instance, lactic acid is found to be a good bactericide for E. coli but a poor oxidizer of Salmonella, moulds and yeast. Bacteria also have the capability of becoming resistant to a particular acid.

Salts form of organic acids are more advantageous because they are solid in consistency, less volatile, less corrosive, more water soluble, odourless and easy to handle.

Acidifiers can be mixed with fatty acids, mono- and diglycerides to form microgranules. Organic acid is released slowly from these microgranules and produce their effect.

**Where and how do they act?**
Acidifiers exert their antimicrobial action both in the feed and in the GI-tract of the animal. The antibacterial effect of dietary organic acids in chickens is believed to occur in the upper part of the digestive tract (crop and gizzard). Their mode of action may be related to maintenance of low gastric pH and possible effects on pepsin activation, inhibition of pathogenic bacteria proliferation, energy source in GI tract, gastric emptying rate, endogenous enzyme secretion, morphology, chelation of minerals and stimulatory effects on intermediary metabolism.

Undissociated organic acids enter the bacteria cell and disrupt the membrane (leakage, transport mechanisms). It further inhibits essential metabolic reactions (e.g. glycolysis) by targeting certain enzymes (Decarboxylases and Catalases) and disturbs the intracellular pH homeostasis. Anionic portion of organic acid becomes toxic inside the cell and cause anionic and internal osmotic imbalance and inhibits bacterial growth.

**What factors influence their efficacy?**

The actions of organic acids can be influenced by some of the factors like their chemical form (acid, salt, coated or not), molecular weight, kind of micro-organism in GIT, animal species for which they are used and buffering capacity of the feed.

**How do they benefit poultry production?**

Organic acids have been identified as best alternative to antibiotic growth promoters (AGPs) as they act like AGPs and control the enteric pathogens which compete for essential nutrients with GI microflora. Other beneficial effects of organic acids include improvement in digestive enzymes activity, microbial phytase activity, increased growth of intestinal mucosa which increases overall growth performance (Adil, 2010). Inclusion of formic and propionic acids reduced pH in crop and gizzard but not in intestinal tract. Organic acids in crop reduce salmonella populations. The short chain fatty acid butyrate specifically down-regulates expression of invasion genes in Salmonella spp. at low doses. Organic acids reduce production of toxic components by bacteria and a change in the morphology of the intestinal wall and reduce colonization of pathogens on the intestinal wall, thus preventing damage to the epithelial cells. Several studies demonstrated that supplementation of organic acids to broiler diets increased growth performance, reduced diseases and management problems (Gunal et al., 2006; Ao et al., 2009). The dietary inclusion of acidifiers reduces the clinical signs, mortality, incidence and bacterial complications of ascites (Urbaityte, 2009). The microencapsulated compound acidifiers in feed are found to reduce the ammonia concentration in chicken house as well (Gang et al., 2009).

**What are the constraints of using feed acidifiers?**
The use of organic acids in their free form has been proven to be efficacious, but can cause palatability problems, damage the stomachal and duodenal mucosas (Argenzio & Eisemann, 1996), as well as cause bone demineralization (Partanen & Mroz, 1999) and an acidic stress, inducing a resistance mechanism towards organic acids in certain bacteria.

- Bacteria are known to develop acid resistance when exposed to acidic environments for long time (Piva, 1998). Therefore, combination of acids with their alteration can be done to avoid resistance.
- Presence of other antimicrobial compounds can reduce the efficiency of the acidifier.
- Use of acidifiers can alter the buffering capacity of dietary ingredients.

References