pH Matters
by JONES-HAMILTON CO.

JHAg
WE KNOW pH MATTERS

SPRING 2017

Water Acidification in Antibiotic Free Operations

When the concept of water acidification was first introduced to the poultry industry, its validity quickly became favorable. Producers began to view lowering water pH below 4 as a necessary component to a salmonella control program. However, as the adoption of water acidification programs began to grow, misconceptions about methods for maximizing effectiveness and the ideal products to use grew with it. Some producers began using products that actually enhance the growth of biofilm, such as citric acid.

It's clear that continuing education plays a key role in the development of safe and effective water acidification programs; programs which will become increasingly critical as the number of antibiotic free (ABF), no human antibiotics (NHA) and no antibiotics ever (NAE) operations continues to grow, and with them the need for additional preventative measures against necrotic enteritis.

Varied Goals of Water Acidification Programs

Some of the confusion surrounding water acidification programs stems from a failure to clearly define the goal of the program—is it for waterline management or to directly affect bird health? Managing waterlines is focused on removing biofilm from drinker systems or making non-potable water, potable. These processes occur when the house is empty using products that are not necessarily FDA approved for bird consumption. Water acidification directed at improving bird health requires an FDA-approved product that will reduce pH levels without affecting the palatability for bird consumption or allowing bacteria to replicate.

Understanding pKA and Palatability

The taste or palatability of water is affected by the type of acid used. Acids that contain multiple hydrogen ions such as citric, lactic, malic and phosphoric will impart a sour taste to the water. Mineral acids with one acidic hydrogen can lower pH without a sour taste.

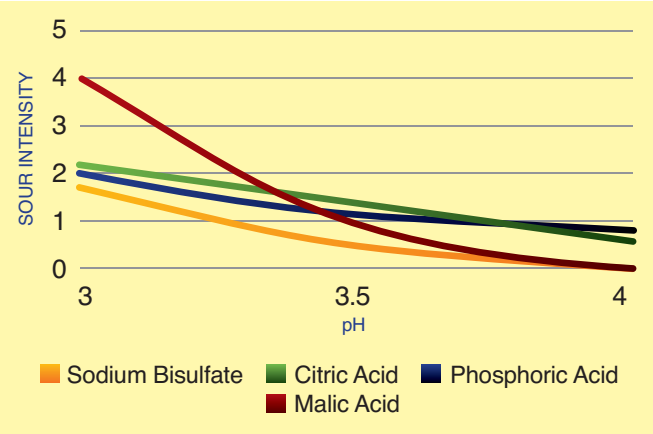
If water becomes too sour during acidification, birds will reduce the amount they drink—making palatability the most critical component of a water acidification program. To acidify the crop, water pH should be reduced below 4.0 without reducing water consumption.

Comparison of Sour Intensity and pH

In a study by Sensory Spectrum[1] the sour intensity of sodium bisulfate, citric acid, malic acid and phosphoric acid in water at three different pH values was evaluated. The panelist evaluated the samples to rate the perceived sour intensity of each acid at pH 3.0, 3.5 and 4.0.

For each pH level, sodium bisulfate had the lowest impact of sour across all acid sources. Mineral acids with a lower pKa bring water to the target pH with low addition rates that do not affect taste or consumption.

Comparison of Sour Intensity and pH



Benefits of Water Acidification in Antibiotic-Free Production

When antibiotics are removed from poultry production, the goal of water acidification is to aid in the development of normal gut flora and to prevent necrotic enteritis (NE), which is caused by the spore-forming pathogenic bacteria *Clostridium perfringens*. The toxin-producing capabilities of these bacteria are enhanced at a pH of 6.0 to 7.0.

Clostridium perfringens commonly invade the gut 48 hours after an inflammatory event, most commonly coccidiosis. Coccidiosis is a common protozoal gastrointestinal parasite that begins a new lifecycle every seven days. While it is difficult to prevent coccidiosis, birds do develop a sufficient immunity to protect themselves between 14-21 days. Continuous water acidification to a pH of 4.0 for the first 14 days will bring chicks through the second coccidiosis lifecycle, thereby decreasing the severity of the NE risk. For new farms that have not yet established an environment that aids in the development of normal gut flora, water acidification is vital from the first drink to inhibit NE outbreaks.

Proper Dosing for Acidification

Since every water source is different there is no one size fits all addition rate to reach the target pH. The most impactful variable in determining addition rate is alkalinity, which is essentially water's capacity to neutralize an acid, or its sensitivity to acid inputs. You must identify the alkalinity to determine the correct dosage; otherwise a pH change will not be seen until the last carbonate is neutralized, which may be greater than what a producer might define as a *standard* dose. Once the addition rate has been determined, continuous delivery for the first 14 days is vital to inhibit necrotic enteritis. After that period, intermittent use of water acidifiers can offer performance benefits.

References

[1] *Spectrum Descriptive Analysis of Acid Samples, Sensory Spectrum; Chatham, NJ, October 2002.*