

Poultry Farming

Bacterial contamination and biofilms

Contaminated poultry products are one of the key contributors of food poisoning. Since foodborne pathogens, in particular *Campylobacter*, *Salmonella*, *E. coli*, *Pseudomonas*, and, *Staphylococcus*, can be spread throughout the flock via the drinking water. So the industry needs to adopt technologies that can prevent this from happening.

Biofilms are a complex matrix of bacteria, fungi, and algae bound together in a sticky gel of polysaccharide and other organic contaminants attached to a surface. The bacteria produce a slime layer in which they live that anchors them firmly to a surface and which provides a protective environment to grow and reproduce. Biofilms generally form on any wet surface and are consequently found in many types of environments, especially poultry drinking water systems. Biofilms harbor harmful microorganisms such as *Campylobacter*, *Listeria*, *Salmonella*, *E. Coli*, *Pseudomonas*, and *Staphylococcus*. The existence of biofilm reduces the effectiveness of common disinfectants.

Water soluble additives used in poultry drinking water often contain sugar or sugar additives that can promote the growth of a biofilm inside the water line. I

Organic materials and additives will supply nutrients for microbial growth and will have a negative impact on medication and vaccines delivered through the water lines. Every time the bird consumes water, it will become exposed to an ever increasing microbial load. Other

negative effects of microbial growth include poor feed conversion, downgrading of carcasses, increased mortality and increased condemnation. This will affect the profitability of the integrator and the farmer.

Control of Biofilm using magnetic technologies

Magnetized water enhances properties of disinfectants. This allows them to be more effective in combating microorganisms in biofilms, as they are easily hydrolyzed on biofilm which causes removal of microorganisms.

Water sources, such as well or surface water that contain high mineral content, iron bacteria, or coliform, may produce biofilms. The use of vitamins or other sugar based products (Gatorade, Kool- Aid, etc.) is a food source for the microorganisms and will promote the formation of biofilms as well. Problems associated with biofilms in the poultry drinking water include a decrease in poultry survival time, lowered egg production, deterioration of equipment, and clogging of nipple drinkers.

Utilizing public water systems or applying a disinfectant throughout the growth cycle (Chlorine gas, chlorine dioxide/anthium dioxide, iodine, or ozone) will not make a farm immune to these biofilm. Traditional disinfectants do not effectively penetrate the biofilm matrix. The disinfectant must have access to the bacteria in order to be effective. Most disinfectants are active against planktonic (unattached) microorganisms but are not effective against microorganisms in biofilm. In order to penetrate and remove biofilms, it is necessary to hydrolyze the biofilm matrix. Hydrolysis breaks up the biological material and exposes the microorganisms within it to the killing action of disinfecting agents.

Commonly utilized treatments in the industry that are not effective against biofilm:

- Quats are surface antimicrobials. They have no chemical reactivity with biofilm polysaccharide and are bound up by negative charge on the biofilm surface. Quats leave much of the biofilm matrix intact and do not remove or destroy endotoxins.
- Chlorine Dioxide is a strong oxidizing agent. Chlorine Dioxide reacts with the surface of the biofilm but provides no hydrolytic breakdown of the biofilm matrix or mechanical removal.
- Peracetic Acid is active on surface regions of biofilm, but is rapidly

neutralized by catalase. There is no hydrolysis or mechanical breakdown of biofilm matrix polysaccharides.

- Citric acid, muriatic acid, sodium hydrogen sulfate, and other acidifiers used to lower pH are neither approved biocides (ability to kill microorganisms) nor bio dispersants (ability to penetrate and remove biofilms). These products are effective at removing scale as discussed later.

Scaling within infrastructure

Scale formation on the inner surfaces of water supply lines is mostly due to water hardness, and is usually associated with the groundwater in the regions where the composition of rocks contain a significant portion of minerals such as calcium and magnesium bicarbonates and sometimes iron and manganese. Over time, water containing these minerals will attach to plumbing and form scale. Rust, dirt and algae will attach to the inside lines. Also rough surfaces contain cracks and crevices harboring microorganisms.

Disinfectants such as chlorine and iodine, are not effective because they cannot penetrate, they simply pass through cracks and crevices. Thus, microorganisms continue to thrive. Therefore it is necessary to adapt a program to address this microbial infection by providing farms with high quality water.

Prevention of scale formation using magnetic water

Scale is formed because of water hardness, which leads to the formation of deposits made of soluble salts of rigidity. It is possible to prevent the formation of scale by changing the physical structure of these salts. Magnetic treatment changes the structure of molecules of water, which enhances solubility of salts.

For example, in a modified structure of magnetized water, crystals of calcium carbonate grow as "aragonite calcite ", as in ordinary water. Unlike calcite crystals, aragonite crystals have lower adhesion to each other and less spikes on the surface of pipes. Thus, salts remain in suspension which prevents scaling. Due to this water lines, sprinklers and cooling pads will work more efficiently.

Formation of bacterial slime, which scale usually 'feeds' on, also decreases.

Benefits of using magnetic water for drinking purposes:

- Improves process of bone formation
- Improves morphology of blood.
- Decrease by 2-3 times of death rates of chicks.
- Increased feed conversion.
- Reduces the required feeding period.
- Target weight is achieved with a minimum of 10% of feed.
- Increase of their mass (average weight gain increases by 5-7%).
- Egg-laying qualities increase by 10%.
- Taste of meat improves.
- Better quality product.

Return on investment

- Average size of poultry farm: 7,500 birds
 - Average daily water consumption per bird: 275 ml
 - Average food per bird for 40 day life cycle: 4.5 kg
 - Cost of feed per kg: RS 25
 - Sewage treatment water (daily): approximately 1,500 liters
1. Magnetic device: U050 (½ inch diameter), 350 m³ / h.
 2. Amount of magnetized water in a 12 hour period: 4,200 l/h
 3. Daily requirement of water for drinking and cleaning: 3,600 l/h
 4. Price of magnetic device U050: RS 16,000 (including customs and local tax).
 5. Note: The device can be used within 24 hours and flow rate can easily support 400 l/h

Aim: to achieve target weight of poultry, while reducing the amount of feed and reducing mortality rate.

Assuming target weight will be achieved with the use of 10% less feed, then:

- Total cost of feed for 1 bird on the whole cycle: RS 112.50 Paisa
- 10% savings on feed cost: RS 11.25
- Total savings achieved from 7,500 birds: RS 84,375
- Price of magnetic device: RS16,000
- Return on investment after 40 days of use: 500%

Equipment Warranty: 10 years

No maintenance required, only periodic cleaning (regular washing with water to remove natural impurities blocking the passage).

India

In the last decades the livestock sector has been one of the fastest growing sectors in Indian agriculture, currently accounting for about 25 percent of agricultural GDP as compared to less than 14 percent in 1980 (GoI, 2006b). Both, demand and supply side factors are responsible for the growing importance of livestock in Indian agriculture. These drivers include income growth and urbanization, advances in production and processing technology and improvements along the supply chain" (Khan and Bidabadi, 2004; Narrod *et al.*, 2008; Pingali, 2007).

"Within the livestock sector, poultry has been the fastest growing sub-sector: between 1985 and 2005 poultry meat and egg production grew by about 12 and 5 percent per year, compared to an annual growth rate of 1.5 to 2.0 percent for beef, milk and mutton and lamb. At present, with an average annual consumption of 1.5 kg of poultry meat and 1.8 kg of eggs (35-40 eggs) per person, exclusive of milk though, poultry meat and eggs contribute almost 50 percent to the per caput consumption of animal protein" (GoI, 2006b).

Enhancement

Consequently any form of enhancement will significantly contribute to general food and income sustainability for families, the local community incomes and the wider commercial benefits derived from provincial high capacity factory farming.

Summary of Magnetic benefits of Chicken, Ducks,

Geese:

- Reduces mortality rate
- Lessens the Feed Conversion Ratio
- Stabilizes the food intake
- Shortens the required nourishment period
- Increases size and health

All aimed at a higher performance index Using magnetic water for drinking purposes of chicks results in an increase in the process of bone formation. As well as, improves morphology of blood. Magnetic water increases growth and development of poultry: decrease by 2-3 times of death rates of chicks and an increase of their mass (average weight gain increases by 5-7%), egg-laying qualities by 10%.

Poultry and Water Fowl Rearing

Water is needed for: bird consumption; reducing air temperature; (including evaporative cooling pad and fogging systems) and facility sanitation. Broilers consume approximately 1.6 to 2.0 times as much water as feed on a weight basis. Water is a critical nutrient in bird metabolism and nutrition. From a physiology perspective, water consumed by the bird is used for nutrient transportation, enzymatic and chemical reactions in the body, body temperature regulation and lubrication of joints and organs.

Environmental Temperature/Heat Stress: Birds consume more water as temperature increases. One of the main ways birds regulate body temperature is by evaporating water through the respiratory system during panting. As birds pant, water is lost and needs to be replaced in order to maintain body- water balance. Water consumption can double and even triple during periods of heat stress. Water consumption in broilers increases approximately 7 percent for each degree Fahrenheit increase in temperature.

Water Temperature: Several studies have examined the effects of providing cool water to birds during hot weather. In most of these studies, water temperature has improved the performance of broilers and layers. Any water temperature below the body temperature of the bird will be beneficial. The water consumed will help dissipate body heat and aid the bird in body temperature regulation. However, it is very difficult to cool the water significantly when moving the water hundreds of feet down a house.

Electrolytes: During periods of potential heat stress, many producers supplement drinking water with electrolytes. Electrolytes are minerals that can be found in the blood and are important for normal cell function and growth. Electrolytes, as the name implies, help regulate nerve and muscle function by conducting electrical signals from nerves to muscles. Electrolytes are also important for the acid-base balance of the blood and fluid retention. Some of the electrolytes found in blood plasma include sodium (Na), potassium (K), calcium (Ca), magnesium (Mg), chlorine (Cl), bicarbonate (HCO_3) and sulfate (SO_4). The addition of the electrolytes not only replenishes those depleted during heat stress, but also stimulates water consumption. When the results of these are added together (electrolyte intake and increased water consumption), the mortality due to heat stress can be reduced.

Bird Metabolism: The correlation of water consumption with feed intake and many environmental factors indicate its importance in bird metabolism and body function. Efforts should be made in all poultry operations to ensure that adequate and unlimited access to water is provided. Failure to do so will result in reduced feed intake, poor egg production, and reduced growth and reduced feed efficiency.

Water quality should be of concern to all poultry operations. Poor water quality may interfere with digestion and subsequent bird performance. The effectiveness of vaccines and medications administered through the water lines could be reduced when water quality is poor. Water contaminants could create equipment problems that would either restrict the amount of water available for consumption or the effectiveness of the evaporative cooling and fogging systems. Reduced water consumption or cooling capacity may have detrimental effects on both growth and reproduction. Poor water quality could also result in leaky water nipples inside the house, which will wet litter and lead to increased ammonia production. Poor litter quality and high ammonia can result in reduced performance and livability.

Water is one of the most important components of growth and development of birds, animals, plants and all living organisms. Rapidly growing birds often consume twice as much water, as the water dilutes the feed and transports nutrient to the cells.

Since molecules in magnetized water are independent, solubility and transport of nutrients in such waters is significantly higher. Since single water molecules can easily carry nutrients through tiny pores of cell membranes for its absorption and assimilation.

Aquaporins - specialized protein which supports channels in cell membranes and facilitates the passage of nutrients easier when passing through individual water molecules. However the overall hydration cannot be achieved by system of reverse pumping, since this technique can not break hydrogen bonds of the molecules. Therefore magnetized water alone plays a key role in enhancing utilization of blood, oxygen and nutrients in different tissues and cells.

Magnetic enhancement of water supply

Scientific research was carried out by the scientists of "Magnetic Technologies" company that described the effect of magnetic water on the growth and development of some bone structures of chickens and animals.

Installation of magnetic system for indoor intensive farms

Taking into a consideration that the industrial production of poultry in all cases, except waterfowls/water birds, occurs in closed buildings, and waste of water for drinking purposes is insignificant, magnetic devices should be installed on water pipes close to the drinking apparatus. Usually, a device of 0,5" can be installed on a water pipe.

Installation of magnetic systems for free range poultry

The choice of a magnetic device for waterfowls/water birds occurs by using the same method as when choosing a device for fish-breeding in open lake.

Water consumption increases with age. Poultry production is more competitive than ever before and clean water will surely make a difference in the profitability for the grower. Magnetized water can reduce overheads and increase volumes of meat and eggs, making it more profitable for farmers.

Magnetized water is more penetrating, it improves better assimilation of the various nutrients and vitamins in the cells. It also increases solubility of minerals and therefore improves the transfer of nutrients to all parts of the body, making the organisms work more efficiently.

- 2-3 times lower mortality rates