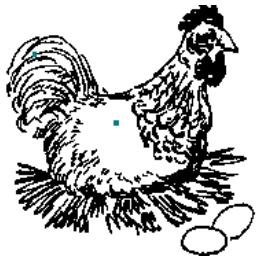
The University of Georgia
Cooperative Extension Service
College of Agricultural and Environmental Sciences / Athens, Georgia 30602-4356

SEPTEMBER 2010



COMMERCIAL EGG TIP . . .

IRON AND IRON BACTERIA IN EGG PROCESSING WELL WATER

In 2009, Georgia commercial egg plants processed almost 12.5 million cases (360 eggs per case) of table eggs (USDA, 2010). A survey of water use in 73 U.S. commercial shell egg processing facilities in 2005 showed that 2 out of every 3 (66%) facilities used water supplied by on-site wells (Jones and Northcutt, 2005). The survey also showed that the average shell egg plant utilizes 1.5 gallons of water per case, which means Georgia egg processors use about 19 million gallons of water each year.

In 2005, researchers from the University of Georgia's Agricultural and Environmental Services Laboratories (AESL) reviewed 10 years (1993-2004) of drinking water test results from private wells in Georgia and found that 15% had iron levels above the EPA's secondary drinking water standard of 0.3 ppm (Sonon et al., 2005). Also, according to the USDA, iron levels in egg processing plant water must not be higher than 2.0 ppm since egg white does not contain iron which aids in preventing microbial growth. Thus the introduction of iron to shell eggs could increase microbial spoilage (Zeidler, 2002).

Most Georgians are familiar with the effects that iron has in water supplies and the resulting yellowish- or reddish-brown stains that are a frequent sight in sinks and bathtubs. But you might not know that there is a bacteria that thrives in iron-containing water supplies that can intensify the effects of traditional iron nuisances and although rarely a health hazard, can cause significant undesirable odor and tastes in the products produced in a commercial egg facility.

Iron is one of the most abundant elements found in nature, making up more than 5% of the earth's crust, and being present in measurable amounts in nearly all water supplies around the globe. Iron can also make its way into water supplies thru corrosion of steel plumbing components. Iron can be present in water supplies in 4 different forms: dissolved, undissolved, organic, and in iron bacteria.

Dissolved iron in the "ferrous" form is usually only found in groundwater supplies that have not been exposed to oxygen. Ferrous-iron containing water is colorless and odorless until it comes in contact with oxygen (or another oxidant such as chlorine or ozone) at which time ferric oxide is formed. Ferric oxide is the undissolved form of iron and it is what gives water a yellow-/red-brown color and creates the familiar staining. Organic iron is created when iron-containing groundwater passes through organic matter in soils (usually decaying vegetation). Organic iron usually stains water a darker brown to even blackish color similar to coffee. Organic iron tends to be a problem associated with older shallow wells or surface waters.

Iron Bacteria

The final form that iron can take in water supplies is in iron bacteria. Iron bacteria is the name given to several non-disease-causing microbes that grow and multiply in water. These bacteria use dissolved iron as an essential part of their metabolism and have been found in waters containing as little as 0.1 ppm iron. Iron bacteria act as oxidizing agents in water to combine dissolved iron with oxygen and form a slimy gelatinous material (i.e., bio-film) that surrounds and protects the bacterial cells.

Iron bacteria are also aerobic (i.e., they need free oxygen to respirate), but only need 0.3 ppm of DO (dissolved oxygen) to survive. This low demand for DO is why iron bacteria can also be found in well systems. While iron bacteria have not been found to cause health problems in humans, they have several undesirable and often costly side effects such as increased intensity of staining, odors and unpleasant tastes; increased organic content of water; increased rate of corrosion in plumbing and increase chances of subsequent bacterial contamination.

In well systems the most iron bacteria-susceptible areas are those with low-flow and that are continually or intermittently exposed to air, such as around filters and quick contact fittings. Iron bacteria will appear as thick, rust-colored sludge or slime.

Treatment of Iron Bacteria

Although effective treatment of iron bacteria will depend on your specific well system, several treatment options for iron bacteria exist. Some of the most effective include:

- Prevention – The best treatment for reducing the chance of any bacterial contamination in your well system is prevention. During the drilling process all drilling materials should be treated with 200 ppm chlorine solution, followed by shock chlorination.
- Cleaning – Keeping well parts clean and maintained is very effective in the control of iron bacteria. Removing iron stains early from all parts of a well system can prevent the build-up of the bio-film iron bacteria deposits.
- Piping Dead-Ends Elimination and Flushing – Elimination of any dead-end sections of pipe in your facility and periodic flushing of low-flow areas are effective iron bacteria controlling tools.
- Chemical Treatment – Chemical treatments of your well system to kill iron bacteria are an option, but it should be noted that traditional treatments such as shock chlorination are not as effective against bio-film forming bacteria (such as iron bacteria) that have the advantage of the bio-film protection.

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"Your local County Extension Agent is a source of more information on this subject."