

Egg-sanitizer machine could save millions of chicks annually

July 8 2013, by Robert Burns



Dr. Craig Coufal, left, a Texas A&M AgriLife Extension Service poultry specialist, examines the second-generation egg-sanitizing machine built from his design by a local College Station fabricator. Credit: Texas A&M AgriLife Extension Service photo by Robert Burns

Dr. Craig Coufal hopes his egg-sanitizing machine may revolutionize the poultry industry.

Every year, the U.S. poultry industry incubates about 9 billion eggs to

hatch the [chicks](#) that will become billions of pounds of meat, most of which will be consumed domestically, according to Coufal, a Texas A&M AgriLife Extension Service poultry specialist in College Station.

Eggs destined to hatch into broiler chicks are not normally washed, Coufal said. Instead, producers have accepted one percent or more losses from bacteria entering the shell and causing the egg to become rotten or the embryo to abort or the chick to hatch malformed.

A one percent loss may not seem like much, Coufal noted, but one percent of 9 billion means about 90 million chicks lost yearly.

"It's a highly competitive industry that measures profit per chick as a penny or two," he said. "If we could just cut that one percent loss in half, it would represent substantial savings to the industry."

When an egg is laid it is coated with a waxy layer called a "cuticle." The cuticle seals the pores of the eggshell for the first week or so, working as a kind of "invisible natural barrier" against bacterial invasion, Coufal said.

The cuticle protects the egg until the embryo needs to respire—to take in oxygen and give off CO₂. During the early stages of development, the embryo doesn't need much oxygen, but as its needs increase, the cuticle breaks down and flakes off which allows the pores to open up, allowing the embryo to breathe.

For eggs to be eaten, producers use mild detergents along with water as hot as 110 to 120 degrees to sanitize, according to Coufal. Such washing, while it sanitizes the eggs for consumption and does not change the taste or nutritional content of eggs, destroys the delicate cuticle.



Dr. Craig Coufal's egg sanitizing machine uses a combination of germicidal UV light and a hydrogen peroxide spray to kill bacteria on hatching eggs. Here, an acrylic panel allows the operator to check the condition of the UV lights while blocking any harmful effects. Credit: Texas A&M AgriLife Extension Service photo by Robert Burns

"The breeder part of the [poultry industry](#) does not want hatchery eggs to even get wet as it is believed that may aid bacteria to enter the pores and may actually increase the number of rotten eggs during incubation," Coufal said.

To this end, Coufal and his team have designed a machine that can sanitize eggs quickly and cheaply without leaving a residue that would damage the cuticle or interfere with the embryo's natural development.

The machine sprays the eggs with hydrogen peroxide—identical to

what's used to disinfect a skin cut or abrasion – followed by exposure to germicidal UV light. The UV lamps are similar to those used to sterilize barber shop equipment or medical instruments.

Coufal found that neither treatment alone was sufficient to completely kill bacteria on the egg surface. But when the treatments are used together, his lab tests found eggs are rendered essentially bacteria-free. This is because the UV light changes the hydrogen peroxide into hydroxide ions, which actually does the sanitization process.

"With most eggs treated with the process, we are unable to culture any bacteria at all," he said.

The process proceeds very quickly, within a protective housing, allowing the [eggs](#) to be carried on a rapidly moving conveyor belt, he said. The hydroxide ions quickly react with the bacteria or other matter and are consumed, leaving no toxic chemicals to be disposed of or any residue on the egg.

Just as important, there's no apparent damage to the egg cuticle.

"We haven't found any increase in bacteria invasion into the egg or any loss of hatching weight that would signal we've damaged the cuticle," Coufal said.

Coufal actually started the project for his master's thesis in 1999. Since then he's done lab tests on egg sanitization, mainly by hand in the lab, but wanted to streamline the process so it could be used commercially.

He and his colleagues started the construction on a prototype in early 2012.

"We built it with common shop tools, using off-the-shelf materials," he

said.

During 2012, they did a lot of fine-tuning, found they needed two treatments of hydrogen peroxide, each followed by a bath of UV light, to achieve the high sanitization rate.

By June 2013, a local machine fabricator finished building a second-generation unit based on Coufal's prototype. The second-generation unit has electronic controls and monitoring and automatic shutdowns. During the next year, Coufal, working with a local commercial hatchery, will measure just how effective the sanitization process is in reducing egg losses during large-scale field testing.

Provided by Texas A&M University

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