Completed Research

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Sanitation of Hatching Eggs by High-Intensity Ultraviolet Light Irradiation

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"UV and Peroxide Sanitation of Hatching Eggs"

Hatchery sanitation is an important concern to primary breeder and integrated broiler producing companies and is an important step in an overall pathogen reduction program. Proper hatchery sanitation not only yields maximum hatchability, but also can improve overall chick quality. However, hatchery sanitation and pathogen reduction in day-old chicks is difficult to achieve if the eggs entering the hatchery from the breeder farm are already heavily contaminated. Hatching eggs are the main source of organic material entering the hatchery and can harbor pathogenic bacteria. Sanitation of broiler hatching eggs continues to be a problem in the broiler industry due to the lack of an economical, safe and effective alternative sanitation method to formaldehyde fumigation.

The purpose of this research project was to investigate ways to maximize the effectiveness of ultraviolet (UV) light to sanitize the shells of hatching eggs. This technology has advantages over previously researched egg sanitation methods in that no washing of eggs or spraying of hazardous chemicals onto the eggs is necessary, and UV light is easy and inexpensive to use. The main objectives of this project were two-fold. First, experiments were conducted to determine the optimum methodology to achieve maximum sanitization of hatching eggs. Second, incubation trials were conducted to determine the effects of UV egg sanitization on hatchability, embryo mortality, bacterial contamination of eggs and day-old chicks, and early broiler performance.

Using an experimental chamber equipped with UV-C (germicidal) lamps producing a high intensity of UV light (approximately 11 mW/cm^2 at egg level), it was determined that UV light alone could significantly reduce bacterial counts on eggshells, but not completely sanitize the eggshells as would be optimal. A series of experiments were conducted to determine if the application of hydrogen peroxide (H_2O_2) prior to UV exposure would increase bacterial kill. It was determined that a synergistic effect was produced, and a large percentage of eggshells treated with this combination yielded zero bacterial counts by standard rinse and plate methodology. While eggshells were not shown to be completely "sterile", their level of bacterial contamination was extremely low, with treated eggshell counts averaging less than 2 log_{10}CFU/egg (100 bacteria per egg) compared to 6 log_{10}CFU/egg (1,000,000 bacteria per egg) for control broiler hatching eggs. It was also observed that eggshell bacterial counts of treated eggs were further reduced during egg storage.

In two hatchability studies conducted, results indicated that the combined UV and H_2O_2 treatment effectively reduced eggshell bacteria while having no detrimental effect on hatchability, embryo mortality, egg weight loss during incubation, or any chick quality measures performed. No differences were also observed in bacterial

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contamination of chick meconium samples, chick yolk sacs, or unhatched contaminated eggs (rotten eggs). Therefore, it was concluded that this methodology could be an effective egg sanitization procedure for use in the commercial industry.

Additional research needs to be conducted to further optimize the procedure. Additional areas of study would include the relationship of hydrogen peroxide concentration to UV intensity, bacterial reduction during storage, and development of application equipment for commercial use. If this method of egg sanitization could be implemented by the poultry industry, this technology could yield significant value to both poultry companies and contract producers through reduced microbial contamination of hatching eggs and the hatchery environment.