White Paper

A Cleaner Cut: How UVC Technology is Revolutionizing Chicken Processing

James Clements
Director of Product Marketing
Excelitas®

October 2025

Background

Global demand for chicken is sharply increasing, with the market growing from USD $160B in 2024, to an estimated $268B in 2033[1,2], representing a 5.87% compound annual growth rate. Key drivers for this increase include the escalating appetite for inexpensive protein, the rapid expansion of fast food and quick-service restaurants, and the growing popularity of processed and ready-to-eat (RTE) meals. For people of many nations, chicken meat is critical since it is one of the major protein sources.

Unfortunately, this increased demand for chicken has also seen a corresponding rise in the reported cases of foodborne illness around the world. *Salmonella* contamination is a leading cause of food poisoning globally, and poultry products are the primary vector. Annually, *Salmonella* contamination causes around 93 million cases of gastroenteritis and 155,000 deaths worldwide.[3] In the United States alone, the U.S. Centers for Disease Control and Prevention (CDC) estimates that *Salmonella* causes about 1.35 million infections, 26,500 hospitalizations, and 420 deaths annually. [Ibid]

The Stealthy Threat of Salmonella

Discovered by and named for American bacteriologist Dr. D. E. Salmon in 1884, *Salmonella* is an impressively hardy species with an enormous number of serotypes (2600 distinct, unique varieties). Compared to other bacteria, it can survive for extended periods in dry environments, as well as within wet and humid surroundings. It has the ability to flourish inside a temperature range between 5° C and 47° C, and it is capable of surviving within a pH range of 4 to 9. These resilient bacteria can multiply in numerous foods and can endure being frozen or dried for an extended period ***without*** losing their ability to be pathogenic. Recent evidence suggests that *Salmonella* can even survive in extreme environments with excessive salt.[4] These factors, along with a well-documented resistance to chemical and mechanical disinfection, make *Salmonella* a very dangerous threat throughout the entire poultry processing operation – from slaughterhouse to cold chain.

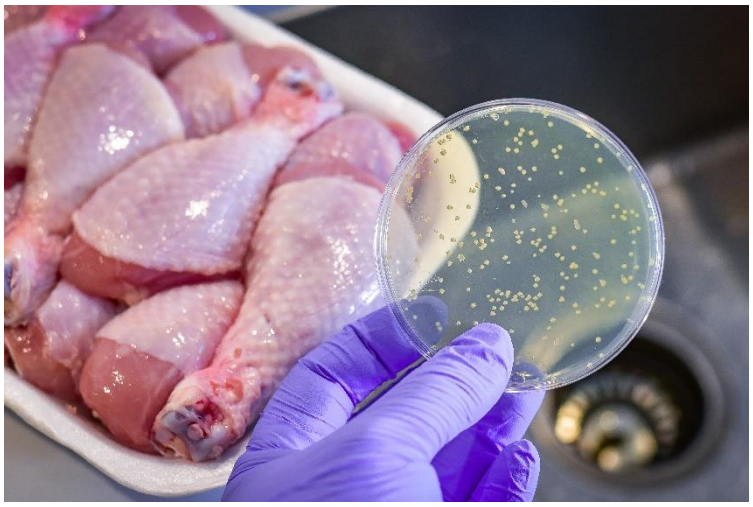

Figure 1: Indication of *Salmonella* contamination in raw poultry

Perhaps most worrisome are the newly emerging multiple drug resistant (MDR) and extensively drug resistant (XDR) varieties of *Salmonella* that have recently appeared in numerous countries such as Italy, Pakistan, South Korea, and Switzerland for which there are currently no effective antibiotic treatments. MDR and XDR *Salmonella* infections are much more difficult to treat, leading to extended illness durations, more complications, higher hospitalization rates, and increased mortality, especially in vulnerable populations like children, the elderly and the immunocompromised.[5,6]

Overview of UVC for Poultry Processing

One of the best, most effective ways to help reduce *Salmonella* and many other foodborne and food-prep pathogens is through the use of ultraviolet-C (UVC) irradiation, a proven, non-thermal disinfection method that does not alter the taste or texture, nor lessen the nutritional value of food. And because there are so many different ways to generate and safely deliver UVC, this technology offers a remarkably broad array of options for any integrated cleaning and disinfection poultry processing program.[7]

For decades, UVC has been an established, dependable technology used in the microbial disinfection of water, beverages, food solids, fruits and vegetables. From initial food processing and greenhouses to warehouses and cold chain distribution, UVC has long been recognized for its capacity to sterilize food packaging, extend product shelf life (*e.g.,* meats and blueberries), and even to enhance a food's nutritional value (*e.g.,* mushrooms). In addition, more recent advances and new research indicate that some *combinations* of generated UVC, such as that from excimer (KrCl) lamps coupled with LED UVC emitters, or multiple wavelength LED treatment, or excimer lamps with mild heating, actually provide a synergistic gain in disinfection. And most notably, newly available LEDs and excimer UVC sources may prove superior to low-pressure mercury lamps (LP Hg) for enhanced bactericidal effect.[8,9]

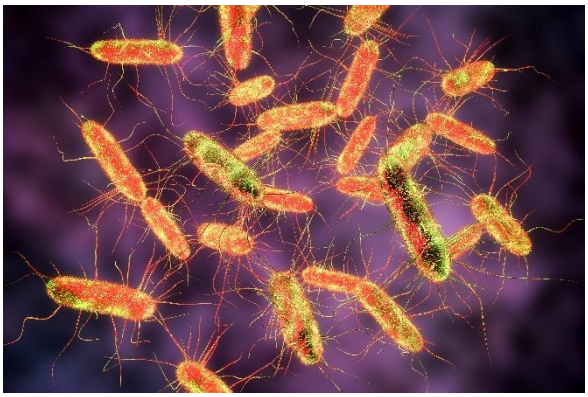

Figure 2: An image of pathogenic *Salmonella* bacteria

Commercially available UVC technologies offer food processors and food-prep providers a wide, versatile range of effective high-performance solutions to enable improved economy, energy efficiency, enhanced scalability, and environmental responsibility.

Consequently, when designing any new food safety program, it's best to consider all available and emerging UVC technologies to determine best practices, best fit, and the best long-term combination of emission sources to optimize your disinfection program.

Pulsed Ultraviolet Irradiation

For raw chicken meat disinfection, one of the most effective and powerful tools is Pulsed Ultraviolet (PUV) irradiation. Pulsed UV is a form of ultraviolet disinfection that uses short, high-intensity bursts of UVC radiation, typically in the 200–280 nm wavelength range. These rapid pulses deliver significant energy more quickly, enhancing microbial inactivation through a wavelength range which is well-established for its germicidal properties. High-energy UVC photons disrupt bonds in DNA/RNA (causing dimerization), which prevents replication and renders the organisms inactive and unable to cause infection. Unlike continuous UVC systems, PUV emits light in rapid, intense pulses. These pulses deliver significantly more energy in a shorter time, enhancing microbial inactivation. In addition, unlike the most commonly used chemical spray and dip, Peroxyacetic Acid (PAA), the PUV process emits no chemical fumes into the local, confined operating environment, thus improving localized working conditions for employees.

PUV is recognized by regulatory bodies like the FDA and USDA for surface and packaging disinfection, and meets the growing consumer demand for non-chemical, sustainable food safety technologies. PUV has very broad-spectrum efficacy and is extremely effective against a very wide range of pathogens, including bacteria (e.g., *Salmonella, Campylobacter*), viruses, yeasts, and molds.

One additional, intriguing feature of PUV is its proven ability to work in concert with peracetic acid (PAA) to generate localized hydroxyl radicals – enhancing the effectiveness of both the PUV and the PAA. This synergistic effect is notable because the impact is at the cellular level: The hydroxyl radicals deliver significantly stronger disinfection power under UV/PAA than under UV/H2O2 or either PUV / PAA alone.[10]

Conclusion

Even as the poultry industry employs a multi-hurdle approach to control *Salmonella* (e.g. pre-harvest interventions (probiotics, vaccines), hygienic slaughter practices, and post-harvest decontamination (e.g., chemical rinses, chilling)), *Salmonella*'s resilience and the variability of serotypes complicate control and eradication efforts.

Post-harvest contamination remains a critical control point. Even with rigorous sanitation and chemical interventions, *Salmonella* can persist on carcass surfaces and equipment throughout the operation – from slaughterhouse to cold chain. Chemical disinfectants are often inadequate, and there's growing consumer demand for chemical-free and minimally processed foods driving interest in non-chemical alternatives.

Pulsed Ultraviolet irradiation has emerged as a very effective, easy-to-integrate option for processors who want to reduce their demand on oxidative chemical treatments while improving disinfection protocols for controlling *Salmonella* and *Campylobacter* on raw poultry surfaces and packaging. PUV does not rely on heat, making it ideal for temperature-sensitive products like raw poultry, and is effective in controlling pathogens while preserving the texture, flavor, and nutritional quality of the food. Studies show that PUV can achieve up to a 99.9% reduction in *Salmonella* without affecting the quality, texture or appearance of the meat, making it a safe, chemical-free solution for poultry processors seeking enhanced food safety.[11, 12]

References

1. *Chicken Market Size and Share Analysis - Growth Trends and Forecast Report 2025-2033*, Research and Markets, March 2025
2. *Global Chicken Prices: Supply, Demand, and Pricing Trends,* husfarm.trade, September 27, 2024
3. *Salmonellosis: An Overview of Epidemiology, Pathogenesis, and Innovative Approaches to Mitigate the Antimicrobial Resistant Infections*, Bibek Lamichhane et al, MDPI Journal / Antibiotics, January 13, 2024
4. *Effect of pH and Salinity on the Ability of Salmonella Serotypes to Form Biofilm*, Sara Petrin et al, Frontiers in Microbiology, April, 2022
5. *Antibiotic resistance in Salmonella spp. isolated from poultry*: A global overview, Rafael Enrique Castro-Vargas et al, Veterinary World, Vol. 13, October 2020
6. *Study finds 'alarming' levels of drug-resistant Salmonella in Pakistan*, Chris Dall, MA, University of Minnesota Center for Infectious Disease Research and Policy, March 12, 2025
7. *UVC radiation for food safety: An emerging technology for the microbial disinfection of food products*; H. Singh, S. Bhardwaj, M. Khatri, K-H. Kim, N. Bhardwaj, Chemical Engineering Journal, December 2020, https://www.sciencedirect.com/journal/chemical-engineering-journal
8. *Inactivation dynamics of 222 nm krypton-chlorine excilamp irradiation on Gram-positive and Gram-negative foodborne pathogenic bacteria*; Jun-Won Kang, Sang-Soon Kim, Dong-Hyun Kang; Food Research International 109, 2018
9. *Application of a 222-nm krypton-chlorine excilamp to control foodborne pathogens on sliced cheese surfaces and characterization of the bactericidal mechanisms*; Jae-Won Ha, Jae-Ik Lee, Dong-Hyun Kang, International Journal of Food Microbiology, Volume 243, February 2017
10. *Rapid Disinfection by Peracetic Acid Combined with UV Irradiation*, Peizhe Sun, Tianqi Zhang, Benjamin Mejia-Tickner, Ruochun Zhang, Meiquan Cai, and Ching-Hua Huang, Environmental Science & Technology Letters 2018 5 (6), 400-404 DOI: 10.1021/acs.estlett.8b00249
11. *Decontamination of Chicken Thigh Meat by Pulsed Ultraviolet Light*, Joshua Casser, Edward Mills, Jonathan Campbell et al, Meat and Muscle Biology, 3(1):479–487 (2019)
12. *Physical Methods for the Decontamination of Meat Surfaces*, Thiemo Albert, Peggy G. Braun, Jasem Saffaf & Claudia Wiacek, Bacteriology, Volume 8, pages 9–20, (2021)