STERILEX®
Innovative Solutions for Microbial Control

PQ

Increasing Shelf Life of Injected Meats

For centuries, the benefits of enhancing meat flavor and texture with injected brines, marinades and phosphates has been well accepted as a way to add value to customers, while also improving marketability by improving color, texture, and shelf life. The modern injection process typically consists of five main components—injector needles, brine or marinade mixing tanks, filters, heat exchanger and saddle tank, all connected in a recirculation loop with sanitary CIP piping.

The injection process is inherently susceptible to microbiological challenges in the brine/marinade and equipment components. Therefore, a thorough microbiological testing and sanitation protocol is important to achieve and maintain product quality and integrity.

Brine Dumping

Throughout the course of a processing day, the microbial levels of the injected solution increases as it is recirculated, until it reaches a predetermined level. At this point, the solution must be discarded or "dumped," and a new batch of solution mixed before continuing production. While this procedure ensures that the injected solution is maintained at safe levels, it does not address the sanitation component of the injection process.

Sanitation of the Injection Loop Components

By its nature, the injection process allows the needles to transfer surface skin pathogens and spoilage bacteria into the muscle tissue. While proper cooking temperatures mitigate the food safety risks associated with this contamination, the shelf life of fresh injected product can suffer dramatically as a result. It is critical to adopt a thorough cleaning regimen for the injector and its components.

It is common to clean the injectors using a chlorinated alkaline cleaner recirculated through the system, followed by a water rinse. Needles are often soaked overnight in a vinegar solution. This helps unclog needles by loosening bone, cartilage and fat that has accumulated throughout the day. The needles are then rinsed and blown out with compressed air. However, this approach is often not sufficient to eliminate all spoilage organisms from the injection system.

The Problem: Biofilm

Biofilms are a complex matrix of bacteria, fungi and algae bound together in a extracellular polymeric substance (EPS) made up of polysaccharides, lipids and other proteins (Lopez et al. 2010). The EPS is composed of long, sugary molecular strands that not only attach biofilm to a surface but provide a protective environment to grow and reproduce. Biofilms generally form on any surface that is exposed to water or other liquids.

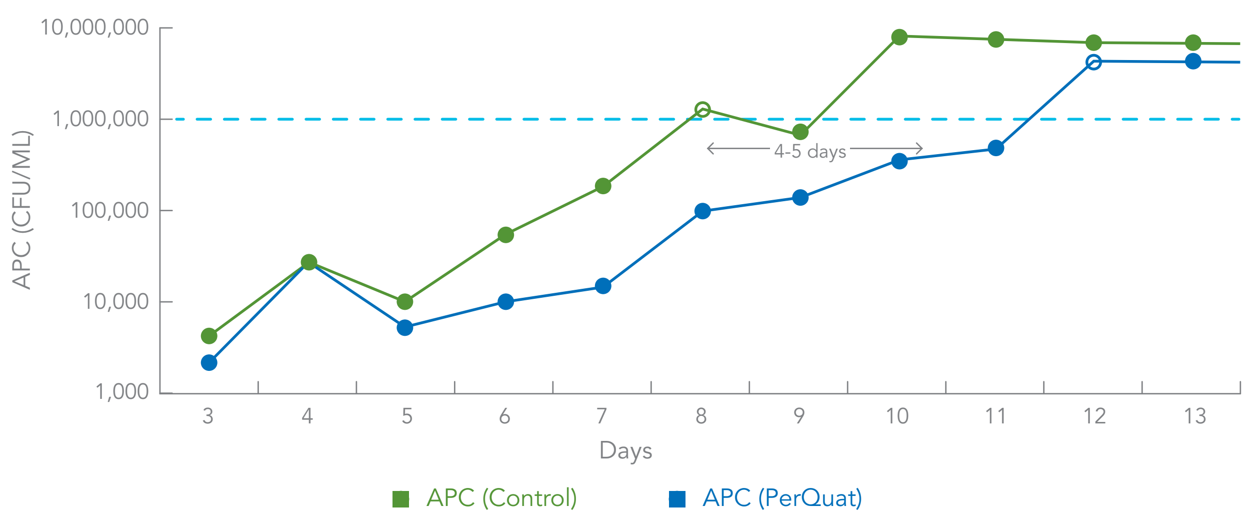
Brine/marinade injection systems are particularly at risk to biofilm buildup due their nutrient enriched make-up. Pathogens in biofilm can be up to 1,000 times more resistant to traditional cleaners, sanitizers and disinfectants as compared to their free-floating (planktonic) counterparts living in water-based environments. Given these characteristics, biofilm becomes a natural foe in the injection process. Needles, tubing, CIP piping, heat exchangers, and saddle tanks are at risk, and it is not economical to disassemble and hand scrub equipment to remove biofilm. As such, an effective biocidal, biofilm removal technology becomes crucial.

The Power of PerQuat® Technology

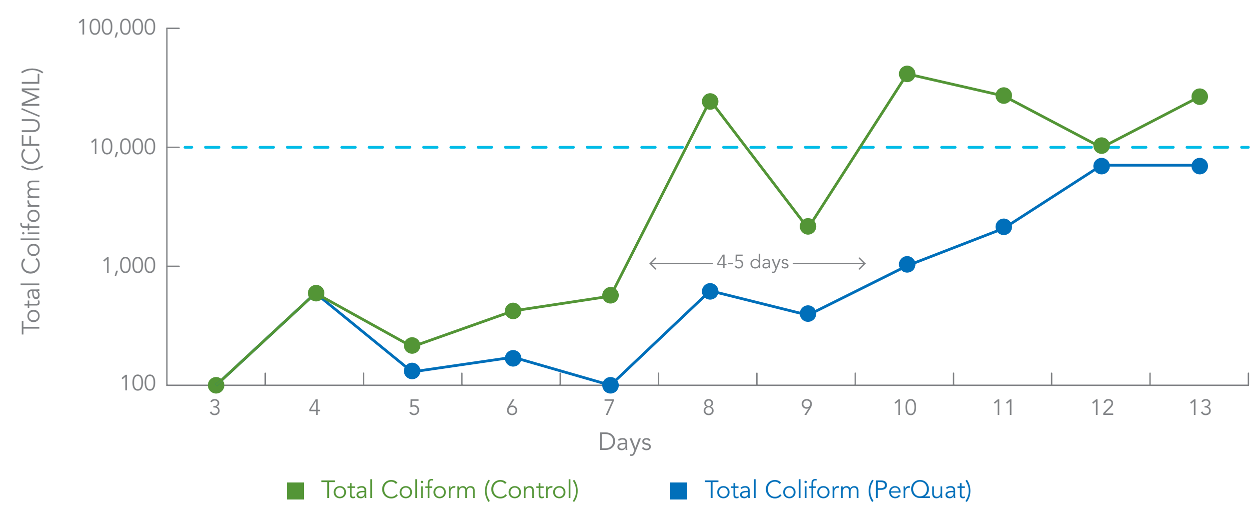
A major U.S. poultry processor worked with Sterilex to conduct a shelf-life case study using Sterilex Ultra Disinfectant Cleaner Solution 1 and Sterilex Ultra Activator Solution to treat an injector and components for approximately two weeks, nightly. Baseline samples were collected and compared against samples of raw, dark poultry meat after injector treatment with the Sterilex product. Shelf life of meat was determined by looking at both microbiological metrics (APC, Total Coliform counts) as well as organoleptic observations. The results follow.

> “As observed in this trial, daily treatment of the injector loop with **PerQuat technology** for two weeks resulted in a **4–5 day extension of shelf life** for raw dark poultry meat.

APC CONTROL VS PERQUAT



TOTAL COLIFORM CONTROL VS PERQUAT



CONTROL: DARK MEAT SHELF LIFE BASELINE

DAY	APC CFU/mL	T. Coliform CFU/mL	ODOR	COLOR	FEEL
3	5,000	100	Fresh Smell	Normal	Normal
4	20,000	500	Fresh Smell	Normal	Normal
5	10,000	200	Fresh Smell	Normal	Normal
6	55,000	400	Fresh Smell	Normal	Normal
7	170,000	500	Slight Odor	Normal	Slight Slippery Coating
8	1,200,000	26,000	Definitely Smelling	Slightly Darker	Slippery Feel
9	590,000	2,500	Slight Rancid Odor	Slightly Darker	Slippery Feel
10	6,500,000	30,000	Foul Smell/Sulfur	Brown Color	Slippery Coating on all Parts
11	6,500,000	20,000	Foul Smell/Sulfur	Grey Spots	Slippery Coating on all Parts
12	6,000,000	10,000	Foul Smell/Sulfur	Brown Color	Slippery Coating on all Parts
13	6,000,000	20,000	Foul Smell/Sulfur	Grey Spots	Slippery Coating on all Parts
14	Stopped				

Control Result: Shelf life of raw dark poultry meat *before* PerQuat trial: 8 DAYS

TRIAL: DARK MEAT SHELF LIFE POST APPLICATION

DAY	APC CFU/mL	T. Coliform CFU/mL	ODOR	COLOR	FEEL
3	2,000	100	Fresh Smell	Normal	Normal
4	20,000	480	Fresh Smell	Normal	Normal
5	3,000	130	Fresh Smell	Normal	Normal
6	10,000	150	Fresh Smell	Normal	Normal
7	16,000	100	Fresh Smell	Normal	Normal
8	100,000	590	Fresh Smell	Normal	Normal
9	150,000	300	Fresh Smell	Normal	Normal
10	430,000	830	Fresh Smell	Normal	Normal
11	500,000	2,100	Fresh Smell	Normal	Normal
12	4,000,000	7,200	Off Odor	Normal	Tacky
13	Stopped		Foul Smell/Sulfur	Normal	Slippery Coating on all Parts

Trial Result: Shelf life of raw dark poultry meat *following* PerQuat application: 12/13 DAYS

Results

Microbial Testing Results

From day 3–12, dramatic reductions in APC counts and total coliform counts by day were observed. In general, microbiological thresholds were reached 4–5 days later after PerQuat treatment as compared to the control sample, leading to an increase in shelf life.

Organoleptic Results

Organoleptic differences between the two sets of samples were even more dramatic. The pretreatment samples began to emit odors at Day 7, while the post-treatment samples remained fresh smelling until Day 12.

The color of the control samples remained normal until Day 8, at which time the meat began turning brown in color. Grey spotting was also observed until Day 13 when the testing was stopped. There was no discoloration of the post-treatment samples. Color remained normal from Day 3–13.

The surface characteristics of the control samples only remained normal until Day 7, at which time a slippery coating was observed on all parts. The feel of the post-treatment samples remained normal until Day 12.

Conclusion

Biofilms are recognized as a public health threat because of their ability to shelter and protect harmful pathogens and have an outstanding resistance to antibacterial treatments and disinfection. Additionally, biofilms cost the U.S. billions of dollars every year in operational inefficiencies such as product contamination, energy loss, and equipment damage, placing brands and consumers at risk for a foodborne disease outbreak.

As observed in this trial, daily treatment of the injector loop with PerQuat technology for two weeks resulted in a 4–5 day extension of shelf life for raw dark poultry meat. Delays in microbiological thresholds as well as significant improvements in organoleptic properties were seen throughout the trial.

References

Lopez D., Vlamakis H., & Kolter R. 2010 June. Biofilms. Cold Spring Harbor Perspectives in Biology. [accessed 2022 March 30];2(7). https://cshperspectives.cshlp.org/content/2/7/a000398.short. doi:10.1101/cshperspect.a000398.

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