ACTA SCIENTIFIC NUTRITIONAL HEALTH

Volume 3 Issue 3 March 2019

Conceptual Paper

Impact of Environmental Conditions on Post-Processing Spoilage

Robert A Davis*

Sr. Director of Operations, Ainsworth Pet Nutrition, USA

***Corresponding Author:** Robert A Davis, Sr. Director of Operations, Ainsworth Pet Nutrition, USA.

Received: January 25, 2019; **Published:** February 22, 2019

A food manufacturing company that I was supporting recently had a series of post-processing spoilage incidents in their canning operations, spanning multiple production lines and multiple production dates across a two-month period. Instead of conducting a root-cause investigation, the company's leadership team prematurely jumped to the conclusion that they had experienced a double-seam failure due to improper set-up in the double-seaming operation. Across the next several weeks, they focused solely on the quality of their double seam set-up procedures, and in doing so, failed to resolve the spoilage problem, which continued.

The company shared with me the data they had collected from the spoilage incidents. The spoilage data contained some key pieces of information, as well as some obvious trends. The spoilage was occurring across multiple dates, but not consecutive dates. Spoilage was occurring from containers produced at different times throughout the dates in question, but not consistently throughout any date. The spoilage was also occurring at a low rate, but high enough to exceed the 1/10,000 threshold, and high enough to impact shipping pallets throughout their distribution network.

The data trends revealed spoilage dates to be consistently two and seven days apart, which when further analyzed and applied to days of the week, quickly identified Mondays and Fridays as the spoilage days, with one exception of a Tuesday, following a Monday holiday. The spoilage times were also intermittent, with another obvious trend noted of early mornings and late evenings, with a low occurrence of other times scattered throughout the day.

After a high-level review of the spoilage data, I reviewed their investigative summary of the seaming set-up records and their daily seam teardown records. With the company's laser focus on double-seam quality as the root cause, they performed a thorough review of their seam evaluation (teardown) records, none of which indicated a double-seam quality issue. They immediately launched into performing additional seam evaluations at 30-minute intervals. The additional seam evaluations also failed to identify any seam quality issues.

Their seamer logs, which recorded seamer set-up information, as well as any seamer adjustments that were made also produced interesting data. At no point on any spoilage dates were any seamer adjustments made, yet the spoilage would correct itself until the next spoilage date, two or seven days away. Also, at no point prior to any spoilage dates, were any adjustments made to potentially create an incident following days of spoilage-free production. An additional key data point was that the retort cooling water sanitary quality was acceptable, with continuous residual chlorine levels throughout the spoilage incidents.

The trends of the spoilage day, date, and time information, combined with the seam evaluation records and the seamer logs, strongly supported that the spoilage incidents were not related to double-seam set-up or double-seam quality. Taking that position, I suggested that additional investigative work needed to be conducted. The company and factory leadership strongly resisted, remaining focused on the seaming operations. They even hired a vibration analysis expert to evaluate potential bearing wear on the seaming machines. The vibration analysis also failed to identify any areas of concern.

I suggested high microbiological loads as a potential factor, but the factory's micro swab results did not indicate any issues. The swab records, however, upon closer review had some gaps. Swabs were not taken directly from the can sterilizer discharge belts. Their rationale for not taking swabs there was because they had installed continuous sanitizer sprays on the belts. (It should be noted that when I observed the discharge belts, the sanitizer sprays were not functioning). Swabs were also only taken on can conveyors 15 feet from the sterilizer exit belts. Swabs were not taken past that point, leaving packaging areas completely unchecked.

With no focus outside of the seaming operations, no progress was made, and the spoilage continued. My requests for additional investigative work outside of the seaming operations was strongly resisted, until their product hold situation became so large that customer service was impacted.

Given the opportunity to lead the investigation, I moved the focus outside of the seaming operations. We implemented micro swabs at the can sterilizer exit belts. We also added additional swab point at points on the can conveyors all the way into packaging. As we were walking along the conveyors to identify the additional swab points, other critical observations were made. There were long passes in wall tunnel areas that were thick with dirt and rust, and were not included in the sanitation or housekeeping lists. There were multiple conveyor speed issues, resulting in conveyor line back-ups and stoppages, which resulted in container abuse from high-speed in-line collisions. And finally, we observed water from the sterilization cooling process, still on the containers into packaging, resulting in trapped moisture inside the case packaging shrink wrap.

I suspected that the spoilage was linked to the containers coming into contact with areas of high micro loads. The containers were then abused in conveyance to packaging, weakening what was originally a good-quality double-seam. The trapped moisture in case packaging then provided an extended time period for the micro growth to impact the compromised container seams.

My suspicions were quickly confirmed with the additional swab results. Micro loads were high on both the sterilizer discharge belts and the conveyor lines into packaging. They were also high in the wall tunnel areas, albeit not as high as the discharge belts. The additional swabs also demonstrated key trends. Micro loads were high on Monday mornings, following weekend downtime, following what was also identified as a less-than-fully-effective sanitation process. Those high micro loads coincided with the Monday morning spoilage times. As the factory continued to run throughout the week, additional in-operation/between shift sanitation work (potentially in conjunction with the automatic sanitizer sprays) resulted in micro load reduction. As the production week wore on, the loads increased, reaching another peak late on the last operating shift of the week, coinciding with the Friday evening spoilage times.

Immediate action was taken to address these areas:

- The additional micro swabs were permanently implemented into the micro swab program
- Additional focus was placed on weekend sanitation effectiveness
- Additional Monday Morning start-up sanitation steps were implemented
- Additional mid-week and late-week sanitation steps were implemented
- Can conveyance from sterilizer discharge to packaging was added to the master sanitation list
- Speed controls were added to the conveyance systems to minimize in-line container collisions
- Filtered air-drying was added prior to packaging to eliminate the packaging moisture.

With these corrective actions taken, and no changes made to the seam set-up processes, the spoilage incidents were permanently resolved. These corrective actions were then taken as preventive actions at the company's other locations to prevent future post-processing spoilage incidents.

There was however, a knowledge gap that had to be resolved. This company had long believed that all post-processing spoilage was due to double-seam quality issues. They did not understand the impact of environmental conditions (micro load/container abuse/trapped moisture) on elevating the risks of spoilage. Until there was company-wide knowledge of this relationship, there was a potential risk of loss of focus on the corrective an preventive actions that we had implemented. As such, I developed the Seam and Environment model, which identifies the critical relationship between double seam quality and environmental conditions necessary to prevent spoilage. The model also highlights the truly small area of opportunity for success against spoilage.

This model highlights that with poor environmental conditions, even good double-seam quality will have low spoilage resistance. Good environmental conditions will have marginal spoilage resistance with poor double-seam quality. However, with good environmental conditions, as double-seam quality improves, spoilage resistance becomes strong, with the obvious best combination of good environmental conditions combines with good double-seam quality delivering the strongest spoilage resistance. Again however, the key is that double-seam quality alone, no matter how good, will not provide strong spoilage resistance.

Figure

Volume 3 Issue 3 March 2019