Implementing a fully integrated solution for the food industry

In-depth process knowledge for outstanding performances.

Outstanding performances for healtier food.

Case study

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The challenge for the food canning industry is to minimize the quality losses while providing an adequate process to achieve the desired degree of sterility. Temperature deviations are costly while representing under or over processed food, waste of energy and low productivity. (Datta et al., 1986)

The challenge

- Overcoming undesirable temperature fluctuations and overheating, guaranteeing homogeneous heat distribution throughout the load.
- Developing a fully integrated solution for treating different tuna can formats, increasing productivity and, consequently, reducing operating costs.

The context

The nutritional quality of the products as well as microbiological and sensory quality are essential factors in the food industry. The thermal processing of canned food is the most important step in the canning procedure[1]. Currently, a large quantity of canned goods is rejected during production and has to be destroyed or reprocessed due to inefficient performances of sterilization. This increases the energy consumption and other significant food processing costs.

[1] Ibrahim M. Ismail, Alaa Fahmy, Ahmed Azab, Magdy Abadir, and Seif-Eddeen K. Fateen. "Optimizing the sterilization process of canned food using temperature distribution studies" IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS) 6.4 (2013): 26-33. Available at: http://works.bepress.com/sfateen/17

For example, overcooking may cause a weight reduction of the product which obligates the manufacturer to complete the cans with additional product in order to comply with the weight indicated on the labelling. Such practices are costly. Sterilization plays a vital role in the food industry as the final product is intended for human consumption. It also represents a critical process since it may influence the quality and safety of the food. In this context, only optimal processing conditions through the proper application of the F-value approach in sterilization allows to optimize the balance between food safety and quality requirements. It assures an appropriate and homogeneous thermal treatment, thus avoiding over- or undercooking, and consequently maintaining the highest standards for uniformity of texture, flavor, and retention of nutrients.

The requirements

- Sterilization process improvements:
  - Temperature uniformity:
    ΔT max 1 °C during sterilization
  - F_0 uniformity:
    max 3 min. spread during sterilization
- Cycle time reduction

- Standardization: one chamber model capable of sterilizing different can formats (from 80 to 240 g)
- Complete integration into the customer process system and logistics standards
- Reducing product losses during the sterilization cycle due to superheating and/or inefficient performance thus avoiding reprocessing costs
- Recording/traceability/validation of all processes according to pharmaceutical standards
- Reliable operations around the clock (24/7)
- Most efficient plant layout.

The solution

Process knowledge applied in the development of a fully integrated solution for food preservation and throughput maximization.

Fedegari superheated water sterilizers - FOW series (Fig.1) were chosen for improving process performance and throughput. The choice focused on the simplest, most robust and cost-effective solution for sterilizing at a wide range of temperatures with the shortest process time. Fedegari designed an unique, but completely integrated and accurate system. The key for an outstanding performance is the effective control of temperature and F-value which guarantees the highest uniformity to the sterilization process. Control efficiency eliminates errors and rejected loads while operating cost-effectively. The goal was to guarantee the microbiological target along with thermometric performance, through a new process design capable of offering competitive advantage over conventional alternatives. Besides, an additional concern was raised regarding the packaging quality.

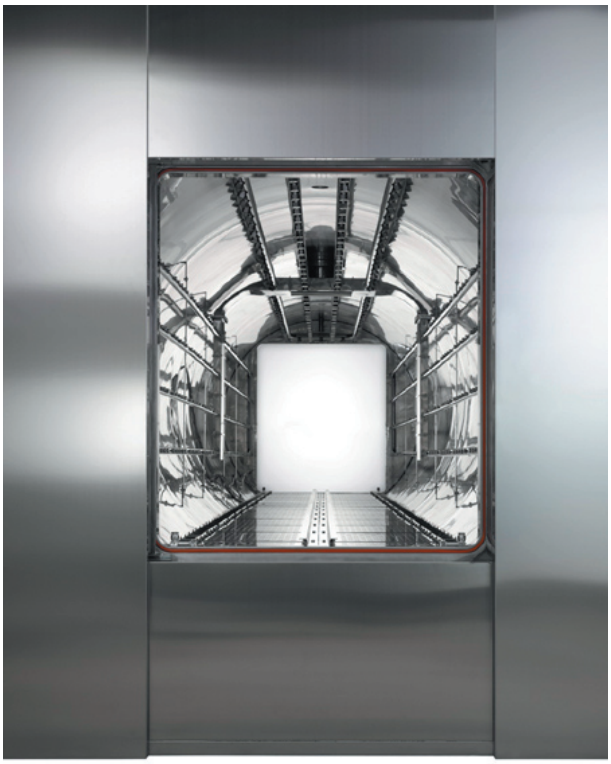

Fig. 1 – Fedegari Superheated Water Sterilizers

Fedegari worked side by side with the customer finding the best chemical reagent to add to the water process in order to avoid surface corrosion of the different packaging

Improvements in the sterilization process

	PAST	**FEDEGARI solution**
ΔT chamber distribution during sterilization phase	± 2 °C	± 0.5 °C
F_0 spread at the end of the cycle	8 min	3 min

PAST	**FEDEGARI solution**
Different machine sizes and different pallets were necessary to sterilize several can formats.	The same machine model and the same stackable shelves to handle all can formats.

Standardization: a single retort model for treating different can formats (from 80 to 240 g)

Complete integration into the customer process system

PAST	**FEDEGARI solution**
- Difficulties to integrate the different machines into the automated production and packaging system - Lack of communication among different process control systems (hardware and software incompatibility)	- complete integration with the un/loading system - complete control of the machine through the integration with the customer SCADA system - remote GUI (Graphical User Interface) to control the autoclave from a remote PC connected to the customer's IT network - utilities managed by Thema4 controller

Cycle development activity

Fedegari developed a sterilization process to optimize the final results while reducing the overall cycle duration to one hour.

Thema4 process controller

Improving process performance would not be possible without a highly reliable and completely integrated process controller. Thema4 is a high performance, fully validated control system with the highest level of flexibility and configurability. Through its hi-precision temperature and pressure control loops in combination with properly calibrated sensors Fedegari guarantees process performances otherwise unattainable cycle after cycle.

In addition, Thema4 offers full traceability and validation:

- backup of data and parameters on a USB drive or IT network
- audit reports (traceability of each action on the controller)
- compliance with FDA 21 CFR, part 11
- electronic signature option
- parametric release option.

The results

Fedegari has supported the customer, one of the biggest European tuna can producers, with in-depth knowledge in sterilization processes, developing a turn-key integrated solution focused on throughput maximization. The customer has increased its productivity at the end of every cycle and the number of rejected cans has been reduced to zero.

Productivity	**Pcs. per cycle/ machine**	**Pcs. in 24 h**
Tuna cans (80g)	37.150	222.900

References:
Datta, A. K., A. A. Teixeira and J. E. Manson. (1986). Computer-based Retort Control Logic for On-line Correction of Process Deviations. Journal of Food Science, 51, pp. 480-483.
Ibrahim M. Ismail, Alaa Fahmy, Ahmed Azab, Magdy Abadir, and Seif-Eddeen K. Fateen. "Optimizing the sterilization process of canned food using temperature distribution studies" *IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)* 6.4 (2013): 26-33.