



Digital Transformation in Food Safety & Quality

A C O C O A C A S E S T U D Y

Cotterel Cocoa Services (CCS) is a subsidiary of H.D. Cotterell warehousing, which melts cocoa products for the food industry. It has partnered with Novolyze to install a Software as a Service (SaaS) food safety platform combining real-time data collection and cloud-based analytical services to manage a kill step and protect its products against harmful bacteria.



A Cocoa Case Study

As in any other low-moisture food (LMF), pathogens cannot grow in cocoa liquor due to the low level of water activity. However, they can remain viable for several months, which poses potential risks for consumers. Pathogen control in cocoa liquor can be achieved by applying a heating step, which aims to attain a repeatable and homogeneous reduction of the most heat-resistant pathogen of concern — most frequently a 99.9999% reduction of *Salmonella* in cocoa products.

Due to the heterogeneous nature of *Salmonella* prevalence in cocoa, testing the final product for pathogen detection is seldom effective.

In a batch of two or three metric tons of liquor, only a small portion could be contaminated; thus, testing only a ‘randomized’ sample for *Salmonella* may give a false sense of safety. Validating the heat treatment and constantly monitoring to ensure the correct time and temperature combination are maintained, is far more effective for manufacturing a safe cocoa liquor. This has also become a key requirement of international food safety regulations, including the United States FDA (Food & Drug Administration) FSMA (Food Safety Modernization Act). This white paper presents a unique and beneficial means of dynamically monitoring a cocoa liquor sterilization system, while maintaining the highest level of pathogen control.

CCS Background on Cocoa Liquor Processing

Since 2010, CCS has melted liquor for cocoa processors and the sweet confectionery industry as an independent service provider. Due to increasing demand, they built a new production hall and expanded the melting volume for cocoa liquor from 70mt/day to 150mt/day, while also adding cocoa butter melting and deodorization to its product range. Cocoa beans grow along the Earth’s Equator, with the Ivory Coast and Ghana providing more than 50% of the world’s cocoa. Most cocoa produced is processed in West Africa but there are also processing companies in the rest of the world. In order to obtain the liquor from the beans, cocoa processors take fermented, dried cocoa beans, and deshell and grind them. The cocoa liquor is shipped to Hamburg, Germany as 25kg blocks in containers. The cocoa liquor arrives in solid form and CCS melts it. If de-bacterization is required, water is added and heated up in a vessel on-site. After successful de-bacterization, a vacuum is applied to remove the water. The liquor is then shipped in liquid form to customers in Germany and across Europe, to make chocolate products, chocolate candies or cookies.

From Static to Dynamic Monitoring of the Cocoa Process

Ensuring that the process is efficiently and constantly monitored is a key prerequisite for establishing a treatment as a kill step.

Monitoring thermal systems for pathogen control is usually achieved by the equipment's programmable logic controllers (PLCs), which verify that the minimum time / temperature combination is reached: in the specific case of CCS's thermal treatment, this requires 25 minutes of heating at minimum 106°C. In order to optimize productivity and reduce the environmental impact of the process, while maintaining the required level of pathogen control, a dynamic monitoring system was implemented for this project. The objective was to allow a wider range of temperatures to be taken into account when evaluating the microbial reduction. Dynamic monitoring of pathogen control requires real-time collection of processing parameters to calculate pathogen reduction. This was achieved by implementing the Novolyze Platform within CCS's process. The Novolyze Platform is a food quality and safety automation system comprised of several modules, including process control, environmental monitoring and product testing. The process control module was used for this project, which necessitated the installation of a connecting gateway to the PLC network to ensure real-time collection of the processing parameters.



Once connected, Novolyze was able to configure the gateway remotely, setting it up to enable the collection of target data (temperature, batch number, etc) and transmission to the cloud platform to feed a microbial reduction algorithm. Using the Novolyze Platform, CCS now has access to real-time bacterial reduction data throughout the process and is alerted when the target level of control is reached. This affords them the option of stopping the process early or letting it continue to run until the end. When each batch is complete, a specific report is generated detailing the total level of bacterial inactivation. This, and all, reports can be accessed at any time on the secured cloud platform, which is ideal in case of client or regulatory audits. Jérôme Defillon, Chief Technology Officer at Novolyze, commented,



The process control module of the Novolyze Platform enables food manufacturers to use a wider range of processing temperatures and times while receiving highly accurate log reduction data. The system provides flexibility and allows process optimization to increase process throughput, increase productivity, reduce environmental impact and improve product quality while maintaining high product safety standards.

Feeding the Microbial Reduction Algorithm

Developing a robust food safety algorithm to model pathogen reduction requires a sufficient amount of data. Due to the lack of robust data evaluating the fate of *Salmonella* in heat-treated cocoa liquor in literature, Novolyze designed a tailor-made experimental program to generate data specific to the CCS liquor product. The procedure entailed conducting lab trials, Thermal Death Time (TDT) studies, at Novolyze's BioSafetyLevel 2 (BSL2) labs.

CCS provided Novolyze with a sufficient quantity of cocoa liquor, which was further inoculated with a cocktail of several *Salmonella* strains and heat treated using a similar range of treatment conditions relating to time and temperature that is used at industrial scale. Upon completion of the TDT studies, sufficient data points had been generated to facilitate a precise model of *Salmonella* inactivation during heat treatment. The model parameters generated at lab scale were then integrated into the Novolyze platform to enable the real-time calculation of *Salmonella* reduction. Laure Pujol, Ph.D., Scientific Project Manager at Novolyze, added that



After the implementation of the model into the Novolyze Platform, we conducted an evaluation of the first 80 sterilization batches. Based on the evaluation of the thermal profiles we gathered from the platform, a minimum reduction of 5.2 log was achieved, confirming the capability of the CCS cocoa liquor system to achieve at least 5-log reduction of *Salmonella*.

Testimonial

Since installing the Novolyze Platform, CCS has improved processing efficiencies by 15% per day and improved efficiencies in the FSQ team with quicker access to data, facilitating faster corrective actions and decision making by the food safety team.

The biggest advantage for us is that while we were doing the work (analysis) we saw we could reduce our holding time and can now process more batches, which is a big advantage for us.

We have a real-time overview of our actual process online so we can log into a data bank and a website and see the process happening. We get real log reduction data for each batch, which is something we never had before. It's a massive step forward for us in terms of food safety. The operators receive a notification from Novolyze when a batch is processed and the desired log reduction is reached; only then do we turn off the process. It's a doubly efficient way to ensure the liquor is treated successfully.

DR. SANDRA WILSON-MUNDT • QUALITY MANAGER



Dynamic monitoring of food thermal treatments offers a significant opportunity for manufacturers to optimize throughputs, reduce energy costs and lessen their impact on the planet while maintaining the highest levels of food safety.

This case study provides a real-life example of how combining the latest developments in digitalization with the most robust scientific standards enabled significant optimization of a process, while adding a further layer of control on a preventative pathogen treatment.

About Novolyze

Novolyze empowers food and beverage companies to enhance food safety and quality performance and compliance in a rapidly changing environment.

We offer application-driven, tech-enabled solutions to activate a groundbreaking, holistic approach to food safety and quality. We leverage the power of IoT and cloud-computing to unify food safety and quality data, transform them into actionable insights, and enable real-time decision-making.



Do not hesitate to
contact our team at

NOVOLYZE.COM
contact@novolyze.com

USA

1875 K St NW, 4 Fl,
20006 Washington DC

+1 (301) 241-6261

FRANCE

50 Rue de Dijon
21121 Daix

+33 (0) 983 694 213