From Art to Science

“From Art to Science” is an ongoing program and collaboration between manufacturers, GE Intelligent Platforms and STICORP to apply a rigorous and scientific approach to process optimization and product safety in the food and beverage industry.

Optimizing processes using analytical techniques is nothing new. Many trace the use of analytical tools to systematically improve manufacturing processes to Walter Shewhart who worked at Bell in the 20s. Shewhart was an American physicist, engineer and statistician and was considered the father of statistical quality control. Shewhart stressed that bringing a process into a state of statistical control is necessary to predict future output and manage a process economically.

In the 80s, computers provided the opportunity to analyze more data than was previously possible and build more sophisticated models, not just on one process variable, but on multiple variables. Computer software for “digital manufacturing” gave birth to the ability to model and to predict the behavior of a process in a digital environment.

Fundamentals

The fundamental concept behind any optimization is to first identify and understand the causes of process variation, then to minimize the impact of the causes so that the process is more predictable and also results in adhering to corporate and government product safety standards. This allows the process to be optimized by running the process at optimum conditions which is achievable by removing the variability in the process. The optimized process can mean higher quality and product safety and it can also mean running the process in a way that consumes less energy or raw materials.

Industry Challenges

In many industries, process optimization has been used for making products with characteristics that have a market advantage. The opportunity for this in food and beverage is less. Typically, the differentiation between products is less about the characteristics of the product but more often about the branding of the product. This means that the business case for process optimization is less likely to be about making a “better” product. The business case is more about making processes more efficient, reducing waste, etc. Today with the introduction of new U.S. government legislation, product safety and the health of the consumer are two additional top concerns for many manufacturers.

In the U.S., the Food Safety Modernization Act (FSMA) has equipped the Food and Drug Administration with new powers and policies aimed at improving food safety and the traceability of defective products. This has renewed interest from manufacturers to consider deployment of Information Technology (IT) solutions and analytical tools that will help them comply with government expectations as well as improve the commercial results of their manufacturing operations.

Manufacturers have always been extremely diligent with their operations to ensure the highest possible quality and safety of their products with the technology available in the past. What’s new is the speed and ease of deployment and lower costs of IT solutions available today, creating a rapid and effective path to transition present manufacturing facilities to “Factories of the Future.”

Outputs can either be desirable, such as a product that meets specifications and safety standards, or undesirable, such as too much waste, unwanted bi-products and effluents and government mandated recalls. In fact, an entire industry has been created to deal with the undesirable outputs from food and beverage processing. However, there are rewards in optimizing manufacturing and product safety processes. In terms of resource usage, the difference between a sub-optimal and optimal process could be a gain of as much as 50 percent. In addition, the cost of product recalls and negative PR affecting the brand image can be incalculable.

Food and beverage manufacturing is no longer a craft industry. It is now a highly automated business requiring high volume production equipment and close adherence to FSMA and FDA rules and regulations for manufacturers based in the U.S. and for imported products.

20 years ago the “science” wasn’t available. Now, a large body of knowledge in manufacturing processes has been developed including the Physics of Food, the Chemistry of Food and the Chemical Engineering of Food Processes. This and the development of computer software applications allow us to now build statistical operation models by unit, process lines and even an entire factory to optimize production and improve product safety.

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