How digital is impacting food safety and open plant cleaning

We define food safety as the application of scientific principles, good manufacturing practices, prerequisite programs and preventative controls across the entire food system supply chain to help prevent illness or injury from microbiological, allergen, chemical residues and physical hazards.

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The digital revolution.

Digital tools to support food and beverage manufacturers are now being extensively deployed around the world.

There are several reasons for this, including the inter-dependency of all supply chain nodes along the farm-to-consumer continuum and the need for rapid and accurate sharing of data.

The advent of cloud computing, digital traceability, artificial intelligence, neural networks and machine learning coupled with digital food safety tools and handheld devices have further accelerated the pace of digital transformation in food safety and quality management.

Moving from the broader supply chain view to the food or beverage manufacturing facility, the collection and integration of data into meaningful, real-time insights has been improved by data-crunching algorithms integrated with new sensor, controller and graphical user interface technology.

This transformational shift is enabling quality assurance (QA) teams in food production plants to rapidly translate and transcribe data into actionable insights and more effective decision-making, for example:

- Third-shift clean team met the cleaning and disinfecting (sanitising) SOPs.
- Plant is clean and first shift production can start on time.
- Work-in process product that was placed on hold can be released to production.
- First pass quality attributes have been met – no corrective action needed.
- Sustainability goals are met and water and energy use are being effectively controlled during cleaning and disinfecting.

Digitisation of food safety's foundational pillars

Good manufacturing practices, prerequisite programs, hazard analysis and critical control points (HACCP) systems and preventive controls can run on digital platforms.

These platforms help the Food Safety and Quality Assurance (QA) team with the steps involved in developing and implementing HACCP.

Some of the reported benefits include improved and consistent hazard identification, monitoring, documentation, corrective actions, record keeping and improved compliance with regulatory and customer requirements.

Training in food safety has also been extensively digitised. Regardless of where in the food supply chain an operator sits, the option of digital food safety training may be appealing for several reasons – including cost of training per associate, less dependency on travel, self-paced, tracking of food safety competencies at the individual, plant or corporate level and pop-up reminders on training due dates and percent completion.

There are some downsides to online training, such as reduced interaction with the trainer and subject matter expert as well as network-building opportunities and food safety best practice sharing.

Approaches to cleaning and disinfecting (sanitising)

Sanitation is defined by the World Health Organization as 'All precautions and measures which are necessary in the production, processing, storage and distribution, in order to assure an unobjectionable sound and palatable product which is fit for human consumption.'

The purpose of cleaning and disinfecting (C&D) in production plants is to maintain and/or re-establish hygienic conditions for the manufacture of safe food and beverages.

In this section, we focus on C&D practices in a food or beverage manufacturing plant and more specifically open plant cleaning.

Success in open plant cleaning is achieved using validated procedures to clean and remove soils followed by disinfection with registered biocides, followed by verification. The four factors of cleaning are shown in Fig. 1.

Open plant cleaning and disinfecting is conducted during the overnight shift or mid-shift for high-risk foods, such as refrigerated ready-to-eat sandwiches. The overnight shift has been described by some as the ghost

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shift – the shift with less management and supervisory staff on-site and the shift that often sees high rates of associate turnover.

Verification checks are typically conducted after C&D is complete either at the end of the overnight shift or at the beginning of the first production shift.

Verification activities can include visual inspection, ATP bioluminescence testing, allergen swabbing, UV light inspection, equipment swabbing for total plate count and environmental monitoring for pathogens or indicator bacteria.

Digitisation of cleaning and disinfection platforms

In today's business environment, tight cleaning timelines are the norm. Every hour of production matters and customers have minimal patience for short orders and transportation delays. Our focus on minimising the use of our natural resources means every litre of water, every kilogram of chemistry, every kWh of energy and every hour of labour, matters more than ever.

Plant QA and C&D Managers are now seeking digital solutions, reports, and dashboards to obtain manual cleaning insights by measuring key parameters such as water temperature, water pressure, water flow and chemistry concentration.

They are seeking this information for several reasons:

- Bringing greater visibility, conformance, compliance and actionable insights to a critical element of food safety that, today, is minimally supervised.
- Monitoring and documenting duration of C&D processes 24/7.
- Enabling rapid access of C&D data for:
  - Records review, reporting and analytics.
  - Investigation and root cause analysis related to any start-up delays; failures in first pass quality not meeting the quality specification; consumer complaints and illness or injury reports.
- As a training and upskilling tool.
- A tool to help manage the plant's sustainability goals optimising water and sanitation chemical consumption and more efficient use of utilities.

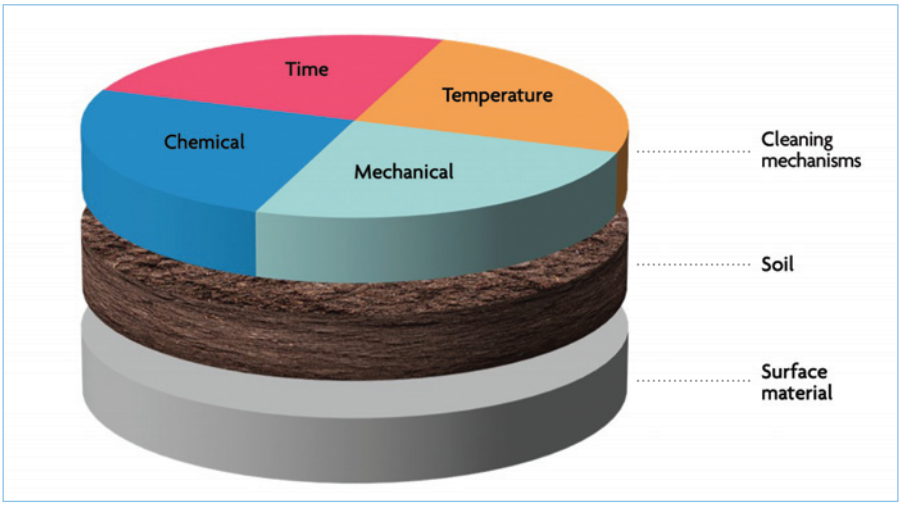

Fig. 1. The four factors for removal of soils from surfaces.

Generating manual cleaning insights as a digital footprint

Parameters such as water temperature, water flow/pressure, air pressure and chemistry concentration/flow can be measured using sensors on drop stations and data transmitted through controllers for storage, analysis and generation of actionable insights. These actionable insights can be displayed on a dashboard to show C&D activities such as rinse, foaming and disinfection steps, tracking of resource usage such as water and time, trend analysis and exception notifications with recommendations on necessary actions to take.

Conclusion

Monitoring all elements of your HACCP or preventive controls program can be burdensome and QA managers have long asked for data, tools and insights related to open plant cleaning and disinfection.

The digitisation of many aspects of food safety including manual open plant cleaning is now bringing visibility to an all-too-often invisible process. This visibility will increase food safety and brand reputation, the ultimate benefactors of digitisation. ■

References are available from the authors on request