

Equipment Cleaning and Sanitation

The US Food and Drug Administration Good Agricultural Practices (GAP) guidelines for fresh produce focus primarily on prevention of contamination and cross contamination at all stages of handling in order to effectively deliver wholesome product to the consumer. A critical component of any food safety program is an effective cleaning and sanitation program for the facility and its produce handling equipment. A deficient or non-existent packinghouse cleaning program can negate preventative steps taken to improve other facets of the harvest and packing food safety program.

Contamination Sources

Microorganisms are capable of establishing themselves in the packing and processing facility on equipment surfaces. Fresh

produce is a very rich source of nutrients for not only humans, but also microorganisms. Fruits and vegetables leave behind plant sugars and other nutrients on food processing equipment that can aid in the establishment of a community of microorganisms, known as a biofilm. Areas of the packing line that are inaccessible, wet, or in frequent contact with organic debris are prime locations for potential microbial contamination. The presence of potentially harmful bacteria including human pathogens in commercial produce facilities has been documented. Duffy et al. (2005) found that 10% of surface swabs of roller surfaces from packing facilities visited in their study tested positive for strains of both *E. coli* and *Salmonella*. This same study also found these organisms on belts used to transport product in the packinghouse. Johnston et al. (2005) reported an increase in *E. coli* levels on the surface of cantaloupes after fruit contacted equipment following the packinghouse washing step, with the highest levels found on the finished product (Figure 1).

Combating a Hidden Enemy

GAP guidelines call for equipment surfaces that contact fresh produce to be visibly clean, yet this does not guarantee that such a surface will be free from potentially harmful microorganisms. With the widespread adoption of 3rd party audits in the produce industry, commercial standards are evolving toward Good Manufacturing Practices (GMP), whereby documented and verified equipment cleaning and sanitation procedures (Sanitation Standard Operating Procedures, or SSOPs) are implemented on a facility wide basis.

Equipment such as deliveries, brushes, belts, rollers and other food contact surfaces must be visibly clean before a sanitizer is applied because it is not possible to sanitize a dirty surface. Large debris can be removed by hand, and air or water may be used to remove additional loose material.

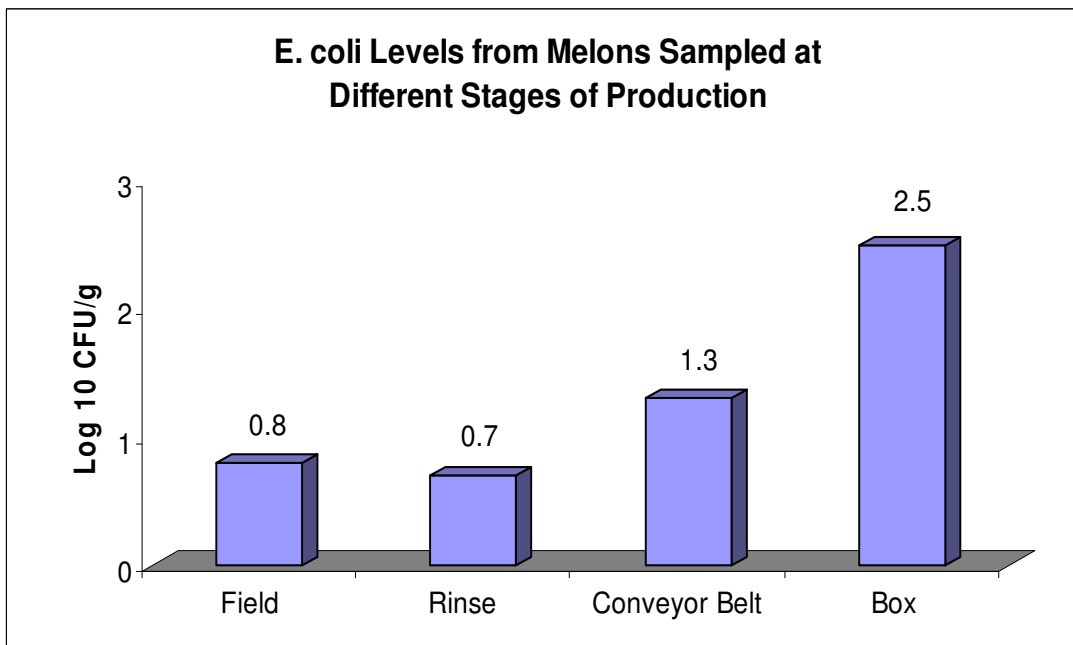


Figure 1: *E. coli* levels on cantaloupe sampled at different stages of packinghouse processing. Adapted from Johnston et al. 2005. *Journal of Food Protection* 68:1840-1847.

Basic steps required for effective equipment cleaning

- 1) Remove large debris and leftover product (leaves, sticks, fruit, etc.) from the processing equipment and surrounding area.
- 2) Apply a fresh water rinse of equipment surfaces that are to be cleaned and sanitized.
- 3) Apply equipment cleaning solution to all equipment surfaces.
- 4) Follow label directions for cleaning chemicals, ensuring adequate contact time. Do not allow foam cleaning product to dry on equipment surfaces – apply a fresh water rinse to all equipment surfaces to remove the cleaner and debris loosened by its cleaning action. Ensure that all surfaces contacted by the cleaner have been thoroughly rinsed. Manually scrub difficult to clean surfaces and built up grime as needed.
- 5) Following the directions on the sanitizer label, apply a final sanitizing spray on the previously cleaned and rinsed surfaces. No rinse sanitizers are preferred.

Specially formulated cleaning compounds are available that can reduce the need for manual scrubbing of equipment surfaces. There are also labor assist systems available that enable the operator to reach areas with limited access. The use of a cleaning compound will help penetrate grime build up on equipment surfaces, and remove organic soils and plant sugars that make produce equipment difficult to sanitize. The key to effective sanitation of equipment is getting the equipment clean BEFORE the sanitizer is applied. If the cleaning step is skipped, sanitizer effectiveness will be compromised or rendered ineffective.

Verification of Cleaning

Verification of the cleaning and sanitation program, particularly on food contact surfaces, is a critical component of a GMP based cleaning and sanitation program. Many 3rd party audits also call for some type of verification of cleaning, further highlighting the importance of an effective sanitation program.

There are multiple options for verifying the equipment surface has been properly cleaned. Of these options, the ATP bioluminescence test is preferred for the produce industry due to its non-specific, broad spectrum utility, and its rapid on-site measurement which yields results in seconds. The ATP test reveals the chemical compound adenosine triphosphate (ATP), the energy source for all living things, in an easy to use swab kit and photo-reactor. Use of this verification method provides a simple and effective means of verifying the equipment has been properly cleaned.

A Key Consideration: Materials of Construction

Porous surfaces, such as canvas belts or wood, are very difficult to clean and virtually impossible to sanitize. These types of materials have a tremendous surface area on which microorganisms can attach, and they should be replaced with non-porous materials such as PVC belts wherever possible.

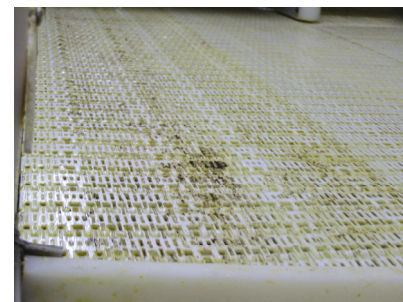
Effective cleaning and sanitizing will reduce the likelihood of cross contaminating product with organisms that may reduce shelf-life as well as those that pose a human health risk. Highland Fresh Technologies is pleased to offer a variety of products, application systems and verification methods to meet the equipment cleaning challenges in the produce industry.



Leftover product with dirty sidewall



Seeds from broken product stuck on equipment



Dirty belt

Literature Cited

Duffy, E.A., L.M. Lucia, J.M. Kells, A. Castillo, S.D. Pillai, and G.R. Acuff. Concentrations of *Escherichia coli* and genetic diversity and antibiotic resistance profiling of *Salmonella* isolated from irrigation water, packing shed equipment, and fresh produce in Texas. 2005. *Journal of Food Protection* 68:70-79.

Johnston, L.M., L. Jaykus, D. Moll, M.C. Martinez, J. Anciso, B. Mora, and C.L. Moe. A field study of microbiological quality of fresh produce. 2005. *Journal of Food Protection* 68:1840-1847.