

Cleaning and Sanitizing Food-Contact Surfaces



Onions contaminated because of poor cleaning and sanitizing of equipment were the likely cause of a pathogenic E. coli O157:H7 outbreak at a fast-food restaurant in Canada that sickened 235 people in 2008.

Public Health Reasons

Surfaces that typically come into contact with food are called food-contact surfaces. Examples include utensils, cutting boards, flatware, tables, and highchairs. Also included are surfaces onto which food may drip, drain, or splash, such as the inside of a microwave oven or refrigerator.

It is important to properly clean and sanitize food-contact surfaces because during use food-contact surfaces can become contaminated with harmful microorganisms that can be transferred to food. The purpose of cleaning is to remove soil and food debris. First, wash with a detergent. Detergents help reduce the surface tension of water, so they can surround and lift soil from a surface. Second, rinse with warm potable water. Rinsing removes the suspended soil and detergent. After this, a surface may look visibly clean, however, the surface may still be contaminated with pathogenic microorganisms. Food-contact surfaces must also be sanitized in order to reduce the number of microorganisms to a safe level. Food contact sanitizers reduce the bacterial count on a surface by 99.999% or 5 logs. For example, if there are 1 million bacteria on a surface before the sanitizer is applied, then there should only be 10 bacterial cells left after the sanitizer is dry. For food-contact surfaces, sanitizers are designed to function as a final rinse after cleaning. Sanitizers differ from disinfectants in that disinfectants eliminate all of the organisms listed on the product label, which may include viruses or fungi. Disinfectants are not generally used for food-contact surfaces because they can leave harmful residues. Both sanitizers and disinfectants are products regulated by the U.S. Environmental Protection Agency (EPA). The label should indicate if the product can be used on a food-contact surface. If the label does not indicate this, the information can be looked up online by finding the EPA registration number on the label and going to the EPA Pesticide Product Labeling System (PPLS) website: www.epa.gov/opp00001/pestlabels

In one research study conducted in child-care centers in Texas, the authors reported that 41% (68/167) of food preparation surfaces tested in 27 child-care centers were positive for bacterial contamination. Another study conducted in six child-care centers found *Escherichia coli* in 8 out of 575 swabs from food preparation sites and 1 out of 289 swabs from food serving sites. This indicates that food-contact surfaces can be a potential source of harmful microorganisms in the child-care setting. Therefore, proper procedures must be in place for cleaning and sanitizing. Food contact surfaces have been found to be contaminated in other institutions including schools, office buildings, military bases, food processing facilities, restaurants, hotels, and long-term care facilities.

Practices

There are three levels of cleaning and sanitizing/disinfecting surfaces. In increasing rigor, they are routine cleaning, vomit/fecal episode cleaning, and outbreak cleaning. This section covers routine cleaning. Additional measures are required when cleaning after a vomit or fecal episode and during an outbreak.

Cleaning

- Pre-flush items by running water over the surface and through the equipment, or pre-soak items in a sink of standing water to loosen soil.
- Wash equipment and utensils to remove remaining food material using appropriate cleaning agents and equipment. Cleaning agents will vary depending on the type of food soil, the hardness of water, and the surface characteristics of the object being cleaned.
- Cleaning agents are divided into four categories:
 - **Detergents:** Use detergents to routinely wash tableware, surfaces, and equipment. Detergents can penetrate soil quickly and soften it. Examples include dishwashing detergent and automatic dishwasher detergents.
 - **Solvent cleaner:** Use periodically on surfaces where grease is burned on. Solvent cleaners are often called degreasers.
 - **Acid cleaners:** Use periodically on mineral deposits and other soils that detergents cannot remove. These cleaners are often used to remove scale in dishwashing machines and steam tables.
 - **Abrasive cleaners:** Use these cleaners to remove heavy accumulations of soil that are difficult to remove with detergents. Some abrasive cleaners also disinfect.
- For manual cleaning, materials that retain water, such as sponges and wiping cloths, must not be used. Pads and brushes must be used instead.
- Pads and brushes used for cleaning must be cleaned and sanitized, as well, to further prevent contamination of equipment and utensils.
- Rinse to remove suspended soil and cleaning compounds.

Even though surfaces look visibly clean at this point, they may still be contaminated with microorganisms, so always sanitize the surface.

Sanitization

Hot water/heat sanitization

- Heat can be used to sanitize surfaces in one of three ways: as hot steam, water, or air.
- Hot water is the most common method.
 - If hot water is used in the third compartment of a three-compartment sink, it must be at least 171°F (77°C).
 - If a high-temperature dishwashing machine is used to sanitize cleaned dishes, the final sanitizing rinse must be at least 180°F (82°C).
 - For stationary rack, single temperature machines, the rinse must be at least 165°F (74°C).
 - Cleaned items must be exposed to these temperatures for at least 30 seconds.
- The utensil surface must reach 160°F (71.1°C) as measured by an irreversibly registering temperature indicator. When the indicator has been exposed to a temperature in excess of its rating, it provides a tamper proof display of temperature achievement.

Chemical sanitizing

- Follow the instructions on the sanitizer's label and use proper dilutions.
- Different factors influence the effectiveness of chemical sanitizers. The three factors that must be considered are:
 - **Concentration:** The presence of too little sanitizer will result in an inadequate reduction of harmful microorganisms, while too much can be toxic.
 - **Temperature:** Generally, chemical sanitizers work best in water that is between 55°F (13°C) and 120°F (49°C).
 - **Contact time:** In order for the sanitizer to kill harmful microorganisms, the cleaned item must be in contact with the sanitizer (either heat or approved chemical) for the recommended length of time.
 - For example, the activity of chlorine is dramatically affected by such factors as pH, temperature, and organic load; however, chlorine is less affected by water hardness when compared to other sanitizers, such as quaternary ammonium.

Air-drying

- After applying the sanitizer, place utensils in a wire or plastic draining rack where they will not come into contact with any food or food residue and let them sit until dry.
- For equipment, after applying the sanitizer, let the equipment sit without use until dry.
- Do not use towels for drying, polishing, or any other purpose because they may re-contaminate equipment and utensils.

Never rinse or perform any other cleaning process after the sanitizing process.

Methods for Cleaning and Sanitizing

Machine-dishwashing

- Most tableware, utensils, and other equipment can be cleaned and sanitized in a dishwashing machine. Dishwashing machines sanitize by using either hot water or a chemical sanitizing solution.
- Check cleanliness of the machine at least once a day.
- Check temperatures and water pressure at least once a day.
- Make sure all detergent and sanitizer dispensers are properly filled.
- Scrape, rinse, or soak items before loading them into the machine.
- Load racks correctly and use racks designed for the items being washed.
- Check each rack as it comes out of the machine for soiled items.
- Air-dry all items.
- Keep your dishwashing machine in good repair.

High-temperature machines

- The temperature of the final sanitizing rinse must be at least 180°F (82°C). For stationary rack, single temperature machines, it must be at least 165°F (74°C).
- The machine must have a thermometer installed to measure the temperature of water at the manifold where it sprays into the tank.

Chemical-sanitizing machines

- Chemical sanitizing machines often wash at much lower temperatures, but never lower than 120°F (49°C).
- Rinse water temperature in these machines should be between 75°F and 120°F (24°C and 49°C) for the sanitizer to be effective.

Three-compartment sinks

- Rinse, scrape, or soak all items before washing them in a three-compartment sink.
- Wash items in the first sink in a detergent solution that is at least 110°F (43°C).
- Immerse or spray rinse items in the second sink using water that is at least 110°F (43°C).
- Immerse items in the third sink in hot water at or above 171°F (77°C) *or* in a properly prepared chemical sanitizing solution, made with warm water between 75°F and 125°F (24°C and 49°C).
- Air-dry all cleaned and sanitized items before storing them.

Cleaning equipment in-place

- Turn off and unplug equipment before cleaning.
- Remove food and soil from under and around the equipment.
 - Remove any detachable parts. Manually wash, rinse, and sanitize them, or run them through a dishwashing machine.
 - Wash and rinse all other food-contact surfaces that you cannot remove; then wipe or spray them with a properly prepared chemical sanitizing solution.
- Keep washcloths used for food-contact and non-food-contact surfaces in separate properly marked containers of sanitizing solution.
- Air-dry all parts and then reassemble.

Proper storage and handling

- Store utensils in a clean, dry location at least six inches off the floor, where they will not be exposed to food-splash, dust, or other contamination. It is best to keep items covered.
- Do not touch food-contact surfaces while storing the items.

Cleaning tables, countertops, and highchairs

- Tabletops, countertops, and highchair trays are considered food contact surfaces and must be sanitized.
 - Remove visible debris from the tabletop or highchair tray by washing with a disposable towel dipped in warm water and a detergent.
 - Rinse the surface with warm water to remove detergent and suspended debris.
 - Spray the surface with a sanitizer or use a disposable towel to apply enough sanitizing solution to cover the surface thoroughly.
 - Allow the recommended contact time.
 - Let the surface air dry before use.
 - Be sure to change to a clean, dry cloth or get new disposable towels between each step.

While guidelines state that a reusable towel can be used, it is recommended to use a disposable towel to avoid contamination. Whether using a reusable or disposable towel, never use the same towel to wipe the table and seat.

- Seats, benches, and chairs at the table and the seat portion of the highchair are considered high-touch surfaces and must be disinfected (See “Cleaning and Disinfecting High-touch Surfaces”).
 - Remove visible debris from the benches or chairs by washing with a disposable towel dipped in warm water and a detergent.
 - Spray the surface with a disinfectant or use a disposable towel to apply enough disinfecting solution to cover the surface thoroughly.
 - Allow the recommended contact time.
 - Let the surface air dry before use.
 - Be sure to change to a clean, dry cloth, or use a new disposable towel between each step.

Sanitizer Testing

- It is necessary to have a testing kit to measure chemical sanitizer concentrations.
- To accurately test the strength of a sanitizing solution, first determine whether chlorine or iodine is being used.
- Test kits are not interchangeable, so check with the chemical supplier to be certain that the correct kit is being used.
- The appropriate test kit must then be used throughout the day to measure chemical sanitizer concentrations.

Recommended Disinfectants

See U.S. EPA list of registered products effective against noroviruses.

- Chlorine (5.25-6.15% household bleach diluted to provide 50-100 ppm available chlorine)
Do not exceed 200 ppm available chlorine for food-contact surfaces.
- Iodophor germicidal detergent solution (12.5 to 25 ppm)

References

1. Boxman, I., et al. 2009. Norovirus on swabs taken from hands illustrate route of transmission: A case study. *Journal of Food Protection* 72 (8):1753-1755.
2. Boxman, I. L. A., et al. 2011. A year round prevalence study for the environmental presence of norovirus in catering companies without a recently reported outbreak of gastroenteritis. *Applied and Environmental Microbiology* 77 (9): 2968-2974.
3. Chen, Y., et al. 2001. Quantification and variability analysis of bacterial cross-contamination rates in common food service tasks. *Journal of Food Protection* 64 (1): 72-80.
4. Cosby, C. M., et al. 2008. Microbiological analysis of food-contact surfaces in child care centers. *Applied and Environmental Microbiology* 74 (22): 6918-6922.
5. Hirakata, Y., et al. 2005. Multiprefectural spread of gastroenteritis outbreaks attributable to a single genogroup II norovirus strain from a tourist restaurant in Nagasaki, Japan. *Journal of Clinical Microbiology* 43 (3): 1093-1098.
6. Kimura, H., et al. 2011. A norovirus outbreak associated with environmental contamination at a hotel. *Epidemiological Infections* 139: 317-325.
7. Malek, M., et al. 2009. Outbreak of norovirus infection among river rafters associated with packaged delicatessen meat, Grand Canyon, 2005. *Clinical Infectious Diseases* 48: 31-37.
8. North Carolina Cooperative Extension. 2009. Harvey's *E. coli* O157:H7 outbreak report released. <http://foodsafetyinfosheets.files.wordpress.com>.
9. Ohwaki, K., et al. 2009. A foodborne norovirus outbreak at a hospital and an attached long-term care facility. *Japan Journal of Infectious Disease* 62: 450-454.
10. Parker, A. 2007. Effective cleaning and sanitizing procedures. *JIFSAN Good Agricultural Practices Manual*. College Park, MD: Joint Institute of Food Safety and Applied Nutrition.
11. Schmidt, R. H. 2009. Basic elements of equipment cleaning and sanitizing in food processing and handling operations. <http://edis.ifas.ufl.edu/fs077> (accessed October 5, 2012).
12. Setiabuhdi, M., et al. 1997. Integrating hazard analysis and critical control point (HACCP) and sanitation for verifiable food safety. *Journal of the Am. Dietetic Association* 97: 889-891.
13. Sneed, J., et al. 2004. Microbiological evaluation of foodservice contact surfaces in Iowa assisted-living facilities. *Journal of the American Dietetic Association* 104 (11): 1722-1724.
14. Staskel, D. M., et al. 2007. Microbial evaluation of foodservice surfaces in Texas child-care centers. *Journal of the American Dietetic Association* 107: 854-859.
15. U.S. Environmental Protection Agency. 2009. EPA's registered antimicrobial products effective against norovirus.
16. U.S. Environmental Protection Agency. 2012. Pesticide product label system. <http://iaspub.epa.gov/apex/pesticides/f?p=102:1:6477914021094066> (accessed October 5, 2012).
17. Wadl, M., et al. 2010. Food-borne norovirus outbreak at a military base, Germany, 2009. *BMC Infect. Diseases* 10: 30-39.
18. Yoon, Y., Kim, S. R., Kang, D. H., Shim, W. B., Seo, E., & Chung, D. H. 2008. Microbial assessment in school foodservices and recommendations for food safety improvement. *Journal of Food Science* 73 (6): M304-M313.
19. Yu, J. H., et al. 2010. Epidemiology of foodborne norovirus outbreak in Incheon, Korea. *Journal of Korean Medical Science* 25:1128-1133.
20. Santana, N. G., Almeida, R. C. C., Ferreira, J. S., & Almeida, P. F. 2009. Microbiological quality and safety of meals served to children and adoption of good manufacturing practices in public school catering in Brazil. *Food Control* 20: 255-260.

Authors and Acknowledgements

AUTHORS: Cortney Miller, MS, Angela Fraser, PhD, Roman Sturgis, MFA (editor), Department of Food, Nutrition, and Packaging Sciences, Clemson University, Clemson, SC 29634

Published: March 31, 2013 **Revised:** March 5, 2013

This material is based upon work supported by the Cooperative State Research, Education and Extension Service, U.S. Department of Agriculture, under Agreement No. 2008-51110-04335, the National Integrated Food Safety Initiative of the Cooperative State Research, Education, and Extension Competitive Grants Program. Any opinions, findings, conclusions or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture.

