FRI BRIEFINGS

Food Antimicrobials, Cleaners, and Sanitizers

A Review of the Scientific Literature

M. Ellin Doyle, Ph.D.
Food Research Institute
University of Wisconsin
Madison, WI 53706
medoyle@wisc.edu

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Food safety is ensured largely, but not exclusively, by controlling the presence and growth of pathogenic organisms in and on foods. Numerous cleaning compounds and processes have been developed to remove and destroy bacteria, viruses, and parasites from equipment and surfaces in food processing plants and from fresh produce and animal carcasses. Antimicrobial compounds are used to eliminate or limit the growth of pathogens in foods.

Pathogenic and spoilage organisms may be present in and on foods but only a few of these are a serious health concern because of their ability to cause human illness. These include viruses, notably noroviruses and hepatitis A, parasites such as *Cryptosporidium* and *Cyclospora*, molds such as *Aspergillus* spp. and *Penicillium* spp., and several bacteria. *Salmonella* spp., *E. coli* O157:H7, *Clostridium botulinum*, and *Listeria monocytogenes* are the most frequent or serious causes of foodborne bacterial infections. Other bacteria of concern include *Bacillus cereus*, *Campylobacter jejuni*, *Clostridium perfringens*, *Shigella* spp., *Staphylococcus aureus*, *Vibrio* spp., and *Yersinia enterocolitica*.

This review includes a brief overview of issues related to the effective cleaning of surfaces in food processing plants and the cleaning of animal products and fresh produce. Recent articles in the scientific literature from 2000 to 2005 that provide data on antimicrobial effects of various sanitizing compounds and processes are referenced below by categories of different foods and processing equipment/surfaces.

Destruction of vegetative cells of bacteria, molds, and parasites may not be very difficult as they are sensitive to heat and chemicals. However, many organisms excrete extracellular polysaccharides and form biofilms that protect individual cells and can be quite difficult to remove from surfaces. In addition, molds, *Clostridium* spp., and *Bacillus* spp. form spores that are resistant to heat, acids, and other compounds. Parasites also produce resistant cells called cysts, and virus particles are notoriously resistant to heat, chemicals, and drying. Over time microbes evolve to become resistant to some sanitizers and disinfectants. Thus, it is a significant challenge to maintain a clean environment in food processing plants.

Ready-to-eat foods should be free of pathogens. Processing facilities should be clean and organized to minimize opportunities for cross-contamination. Packaged RTE foods need to be stored properly. In addition, RTE foods may require the addition of approved compounds that will prevent growth of pathogenic microbes that may be present such as spores and cold-tolerant species. A recent book on *Antimicrobials in Foods* (*49*) discusses antibacterial and antifungal additives, including organic acids, sulfites, nitrite, nisin and other bacteriocins, lysozyme, natamycin, parabens, dicarbonates, medium chain fatty acids and esters, and other natural plant and animal compounds. Antimicrobial effects, applications, toxicology and safety, and regulatory status of each group of compounds is presented. Development of resistance and adaptation to some antimicrobials necessitates continued research to identify new antimicrobial compounds and processes.

Equipment and Surfaces in Plants

Cleaning of equipment and surfaces in plants is difficult because many microorgansims can adhere to these surfaces and may concentrate in crevices that remain moist (*117*). Surface composition and topography resulting from wear affect microbial attachment (*28;71;76;98;131;201;244*). Remnants of foods attached to surfaces enhance survival of bacteria (*4;8*) and therefore it is important to clean surfaces before disinfection. Some pathogens may survive the actions of alkaline cleaning products but then become more sensitive to disinfectants (*197;224*). In addition, many bacteria can secrete extracellular polysaccharides that protect them from cleaning agents and form biofilms (*72;187*). Several recent reviews discuss biofilms and treatments to remove them (*96;166;196;243*) and other reviews consider cleaning and sanitation practices (*48;87;120;176*).

Cleaning of surfaces and destruction of bacteria may be accomplished by alkaline detergents (*75*), ozone (*46;102;103;144*), hydrogen peroxide vapor (*97*), encapsulated lysozyme (*21*), chlorinated compounds (*12;133;182*), peroxyacetic acid (*12;182*), numerous commercial disinfectants (*1;167;189; 201*), quaternary ammonium compounds (*133*), sunlight (*152*), and electrolyzed water (*78*).

Recent reports on removing biofilms from surfaces include data on the use of: (a) numerous commercial disinfectants (*8;77;242*); (b) acidic, neutral, and alkaline electrolyzed water (*10;59*); (c) alkaline based cleaning compounds (*6;198*); (d) chlorinated compounds (*29;63;65;98;129;131;140;151;178;186; 191;198;210;217*); (e) peroxyacetic acid (*210;217; 218*); (f) nisin, lauricidin, and lactoperoxidase (*65*); (g) carvacol (*107;108*); (h) hydrogen peroxide (*107;178*); (i) chitosan (*107*); (j) ultrasound (*157;158*); (k) ozone (*63;178*); (l) irradiation (*149*); and (m) acidification (*191*).

Bacteria may develop resistance to some disinfectants (*44*), and it has been suggested that different types of disinfectants should be used alternately to prevent establishment of resistant house strains (*25*). Viruses, including hepatitis A, are generally much more resistant to disinfectants than bacteria (*95*).

Animal Products

Raw meat remains a major source of foodborne pathogens, and a variety of techniques have been devised to reduce bacterial contaminants on animal carcasses and on pieces of raw meat. These include: (a) chemical decontamination with organic acids and trisodium phosphate; (b) physical processes such as irradiation, steam or hot water dips or sprays, UV and pulsed light, and high-pressure processing; (c) natural antimicrobials such as bacteriocins and iron chelating compounds; and (d) combination treatments (*61;109*).

Decontamination processes reduce microbial populations but if the meat is subsequently recontaminated with a pathogen during processing, then the pathogen may multiply rapidly because of the lack of competing bacteria (*150*). Some decontamination processes may cause undesirable effects on the color or texture of meats (*91;128*).

Beef

Recent data have been reported on the effects of the following treatments on cattle hide or carcasses: (a) trisodium phosphate (TSP) (*47*); (b) lactic, peracetic and other organic acids (*37;38;47;53;62;81; 105;141;150;169*); (c) hypochlorite and other chlorinated compounds (*26;81;88;141*); (d) steam or scalding water (*45;47;82;83;136;137;142;150;169; 173;177*); (e) ozone (*39*); (f) commercial sanitizers (*206*); and (g) bacteriocins such as nisin (*53*).

Reported sanitizing treatments of pieces of meat and beef trimmings included: (a) organic acids (*7; 55;67;100;101;115;125;127;145;212;214;215; 219*); (b) chlorinated compounds (*27;126;192; 213;220*); (c) ozone (*213*); (d) nisin (*7;145*); (e) irradiation (*11*); (f) hot water or steam (*55;100;101;115; 130;214*); (g) cetylpyridinium chloride (*126;220*); (h) acidic or basic oxidized water (*215*); and (i) ammonium hydroxide (*215;220*).

Pork

Lactic acid dips lowered microbial counts on pork chops while preserving a good color (*128*). Organic acid washes added to the effectiveness of scalding (*66*) and irradiation (*104*) in reducing bacterial populations on meat. Saturated steam with rapid re-evaporation significantly reduced bacterial contaminants but adversely affected meat color (*91*) while spraying acidified electrolyzed oxidizing water on carcasses reduced levels of *Campylobacter coli* but not of other bacteria (*70*).

Poultry

Data have been reported on the effects of the following treatments on poultry skin or carcasses: (a) trisodium phosphate (TSP) (*16;32–36;40;155;238*); (b) lactic, peracetic and other organic acids (*41;57; 155;205*); (c) hypochlorite and other chlorinated compounds (*16;41;159;185;205;238*); (d) steam or scalding water (*9;205;239;240*); (e) hydrogen peroxide (*232*); and (f) an herbal extract (*60*).

Reported sanitizing treatments of chicken meat included TSP (*85*), organic acids (*85*), chlorinated compounds (*85*), ozone (*3*), yogurt and nisin (*84*).

Sheep/Goat Meat

Organic acids (lactic, acetic, and propionic) have been reported to decrease populations of *E. coli* and other bacteria when sprayed on carcasses or used as washes *(64;175)*. Steam condensate and hot water immersion, particularly chlorinated hot water, also decrease the bacterial load (*94*). Some spices, including cloves and cinnamon, inhibited bacterial growth on pieces of meat and extended shelf life (*116*).

Fish

Acidified sodium chlorite reduced total bacterial count and numbers of *L. monocytogenes* on salmon fillets (*221*). Treatment of salmon fillets with ozonated water did not significantly reduce bacterial contamination and increased rancidity in the fish (*46*). However, ozone treatment of live *Tilapia* fish prolonged shelf life and reduced bacterial populations (*80*).

Eggs

Salmonella spp., particularly *S. enteritidis*, has been an ongoing problem in egg safety. Improved sanitary processes at some farms and egg packing plants have decreased but not eliminated salmonellae from the surfaces of shell eggs (*50*). This has led to investigation of a number of sanitizing treatments to clean egg shells in the U.S. In Europe, cleaning of egg shells is not as commonly practiced (*51*).

Treatment of eggs with cleaning/sanitizing solutions has given mixed results for the elimination of salmonellae and their efficacy is dependent on total dissolved solids in wash water (*106;165;209*). Application of commercial sanitizers by an electrostatic spraying system was reported to be more effective (*184*). Several research groups reported that electrolyzed water decontaminated eggs (*2;24;51;164;183*) and exposure to ozone in a humid atmosphere and to ultraviolet light also appeared to effectively kill salmonellae on eggs (*51;181*).

Fresh Produce

Fresh fruits and vegetables may harbor a variety of microbes originating in the environments where they grew, water used for cleaning, and handling and storage conditions. Cross contamination may also occur in kitchens and food preparation areas (*231*). Outbreaks of hepatitis, shigellosis, salmonellosis, *Cyclospora*, *Cryptosporidium*, and *E. coli* O157:H7 associated with fresh produce have demonstrated that pathogens may be present. Some of these organisms are more resistant than others to certain treatments and even serovars of *Salmonella* differ in their susceptibility.

Fruits and vegetables can be very difficult to clean because of their soft tissues that are easily damaged and irregular surfaces with microenvironments that protect microbes. Natural waxes on plant surfaces and oils and waxes commercially applied to plant surfaces may also affect the efficacy of cleaning procedures and sanitizers (*31*). Some treatments may be too harsh and destroy the appearance or integrity of fresh produce.

Fruits

Research on sanitary issues related to fresh fruits has been targeted to address two concerns: cleaning of whole, intact or slightly damaged fruits that will be sold as fresh fruit or used to produce juices and cleaning of sliced fruits that that may be sold or served fresh or as dried fruit. A review on extending shelf life of fresh cut fruits considered the impact of various aspects of processing (*208*).

Apples. Several studies have demonstrated that some commonly used sanitizers (acetic acid, potassium sorbate, sulfur dioxide, H_2O_2, and hypochlorite) are not very effective in reducing microbes on whole fruits (*43;190;216*). Other reports indicated that some treatments reduced populations of some microbes. These include treatment with: (a) hypochlorite and copper ions (*180*); (b) electrolyzed oxidizing water (*156*); (c) UV light (*69;247*); (d) acetic acid (*43*) ozone and chlorine dioxide (*179*); (e) chlorine combined with lactic acid (*69*).

Dipping of apple slices in organic acids (ascorbic, citric or lemon juice) was reported to prevent growth of bacteria (*56*). Washing apple slices in acetic acid, hypochlorite, H_2O_2, and sodium phosphate significantly reduced numbers of *Salmonella* spp. (*123;124*). A *Salmonella*-specific phage was found to be ineffective as a biocontrol agent on apples, possibly because of the acidic pH (*122*).

Berries. Sanitizing solutions, including hypochlorite, ozonated water, acidic electrolyzed water, peroxyacetic acid, and H_2O_2, were not very effective in destroying pathogens on strawberries and raspberries (*52;86;112;132*). Chlorine dioxide gas and ozone did reduce bacterial populations on strawberries (*90;179*).

Cantaloupe and other melons. Cut pieces of melon have been associated with foodborne illness. This was presumably a result of transfer of pathogens from the surface of melons to the slices during cutting. Washing melons appears to be most effective when surfaces are scrubbed with some sanitizer (*13;168*). Several sanitizer solutions appear to aid in reducing bacterial populations on melon surfaces. These include: H_2O_2 (*227;228;230*), hot water (*230*), hypochlorite/chloramine (*13;17;134;138;160; 168;188;228*), and organic acids (*134;188*). Nisin alone did not inactivate bacteria on melon surfaces but combined with organic acids it had some effect (*229*). A *Salmonella* phage inactivated *Salmonella* bacteria on honeydew melons (*122*). Electron beam irradiation (*160*) and chlorine dioxide gas and ozone (*90;179*) also decreased bacterial load on melons.

Oranges. Washing oranges with high pH solutions (pH 11.8) was reported to reduce surface bacterial contamination of oranges (*162*). Hot water washing, washing with sodium bicarbonate and biocontrol with yeast antagonists reduced spoilage organisms on citrus fruits (*172*). These treatments may reduce populations of potential pathogens and diminish contamination of citrus juices.

Vegetables

Cabbage. Acidified sodium chlorite reduced populations of several bacterial pathogens on Chinese cabbage by 2–3 logs (*92;93*). Peroxyacetic acid and H_2O_2 reduced *E. coli* populations, but not virus levels, on cabbage (*5*).

Carrots. Sanitizing treatments reported to reduce bacteria on carrots include lemon juice and lemon juice vinegar (*193;195*) and anolyte water and chlorinated water (*245*). Chlorine dioxide, ozone, and thyme essential oil have also been used to decontaminate carrots (*204*).

Celery. Ozonated water was reported to reduce microbial populations on celery (*249*).

Cilantro. Low-dose irradiation (*99*) and low-dose irradiation combined with chlorination (*74*) reduced bacterial levels on fresh cilantro while maintaining its quality. Aqueous ozone also reduced aerobic bacteria on fresh cilantro while preserving quality (*233*).

Cucumber. Sodium hypochlorite solution combined with emulsifiers disinfected shredded cucumber (*146*). Acidic electrolyzed water also reduced bacterial levels on cucumbers (*112*).

Lettuce. Chlorinated water has been reported to have modest effects on bacterial populations in several studies (*18;19;22;23;30;54;119;139;147;153;170;231*). Electrolyzed water and acidic electrolyzed water reduced bacterial populations on lettuce by 2–3 logs (*110;111;113;114;246*). Other sanitizers gave mixed results in decontaminating lettuce: peroxyacetic acid (*132;154;179;222*), H_2O_2 (*222*), chlorine dioxide (*121;179;204*), ozone (*179;204*), and other commercial sanitizers (*147;207*). Other compounds tested include: thyme oil (*204*), NaCl-sodium bicarbonate (*223*), grapefruit seed extract (*132*), and chlorinated trisodium phosphate (*179*).

UV light (*247*) and gamma irradiation (*148*) were also reported to decrease populations of bacteria on lettuce. Tests demonstrated that neither commercial disinfectants (*86*) nor peroxyacetic acid and H_2O_2 (*5*) reduced virus levels on lettuce.

Other greens. A variety of sanitizing treatments have been reported to have some effect on bacterial populations on other salad greens. These include: (a) acidic electrolyzed water on green onions (*248*); (b) lemon juice and vinegar on rocket and green onion (*194*); (c) warm water with H_2O_2 on field salad (*235*); (d) chlorinated water on parsley (*119*); and (e) oils of eucalyptus, tea tree, and clove on Swiss chard (*171*).

Peppers. Decontamination of peppers was accomplished by heating to 220ºC for 15 minutes but this treatment destroyed the freshness of the vegetable. Rinsing in 70% ethanol partially reduced mold spore levels on peppers (*79*). Chlorine dioxide significantly reduced pathogen levels on green peppers but some bacteria survived in parts of the fruit that were injured (*89*).

Potatoes. Ozone alone did not control microbes on potato strips but ozone plus a commercial sanitizer containing peroxyacetic acid in combination with vacuum packaging did reduce levels of some bacteria by 3 logs (*20*).

Tomatoes. Spraying of tomato fruit with acidic electrolyzed water or 200 ppm Cl (*15*) was reported to reduce pathogens by 7.8 and 4.7 logs, respectively. Neutral electrolyzed water used to rinse tomatoes decreased pathogens by 5 logs (*58*) An alkaline ionic washing fluid (GC-100X) decreased pathogen levels by 4 logs (*118*) while aqueous chlorine reduced populations of yeasts and molds (*135*). UV light was also reported to decrease populations of bacteria on tomatoes (*247*).

Nuts and Seeds

Over 15 outbreaks of illness due to *Salmonella* or *E. coli* O157:H7 contamination of sprouts have occurred in the past decade. Bacterial contaminants are present on seeds and inadequate disinfection of seeds is responsible for such outbreaks (*225;226;241*). Some seeds are more difficult to disinfect than others (*14;42*); bacteria which survive on treated seeds may multiply during germination (*203*) or become internalized in sprouts (*234*). Disinfection procedures for seeds to be used for sprouts must be a balance between killing a sufficient number of pathogens without significantly reducing germination of the seeds. Currently recommended methods include the use of

8% H_2O_2, 20,000 ppm Cl, and 1% calcium hydroxide (*143*).

Recent research described the effects of: electrolyzed oxidizing water (*14;199;200;211*), sonication (*14*), irradiation (*14;174*), chlorinated water (*42;202;203;234*), hot water (*68;236;237*), ozonated water (*200;203*), Salmonella bacteriophages (*163*), thyme oil (*203*), vinegar (*202*), sulfuric acid scarification (*161*), and commercial citrus products (*73*).

References

1. Aarnisalo K, Salo S, Miettinen H, Suihko ML, Wirtanen G, Autio T, Lunden J, Korkeala H, and Sjoberg AM. 2000. Bactericidal efficiencies of commercial disinfectants against *Listeria monocytogenes* on surfaces. J Food Safety 20:237-250.

2. Achiwa N and Nishio T. 2003. The use of electrolyzed water for sanitation control of eggshells and GP center. Food Sci Technol Res 9:100-103.

3. Al-Haddad KSH, Al-Qassemi RAS, and Robinson RK. 2005. The use of gaseous ozone and gas packaging to control populations of *Salmonella infantis* and *Pseudomonas aeruginosa* on the skin of chicken portions. Food Control 16:405-410.

4. Allan JT, Yan Z, Genzlinger LL, and Kornacki JL. 2004. Temperature and biological soil effects on the survival of selected foodborne pathogens on a mortar surface. J Food Prot 67:2661-2665.

5. Allwood PB, Malik YS, Hedberg CW, and Goyal SM. 2004. Effect of temperature and sanitizers on the survival of feline calicivirus, *Escherichia coli*, and F-specific coliphage MS2 on leafy salad vegetables. J Food Prot 67:1451-1456.

6. Antoniou K and Frank JF. Removal of *Pseudomonas putida* biofilm and associated extracellular polymeric substances from stainless steel by alkali cleaning. J Food Prot 68(2), 277-281. 2005.

7. Ariyapitipun T, Mustapha A, and Clarke AD. 2000. Survival of *Listeria monocytogenes* Scott A on vacuum-packaged raw beef treated with polylactic acid, lactic acid, and nisin. J Food Prot 63:131-136.

8. Augustin M, Ali-Vehmas T, and Atroshi F. 2004. Assessment of enzymatic cleaning agents and disinfectants against bacterial biofilms. J Pharm Pharmaceut Sci 7:55-64.

9. Avens JS, Albright SN, Morton AS, Prewitt BE, Kendall PA, and Sofos JN. 2002. Destruction of microorganisms on chicken carcasses by steam and boiling water immersion. Food Control 13:445-450.

10. Ayebah B, Hung YC, and Frank JF. 2005. Enhancing the bactericidal effect of electrolyzed water on *Listeria monocytogenes* biofilms formed on stainless steel. J Food Prot 68(7):1375-1380.

11. Badr HM. 2005. Elimination of *Escherichia coli* O157:H7 and *Listeria monocytogenes* from raw beef sausage by gamma-irradiation. Molec Nutr Food Res 49:343-349.

12. Bagge Ravn D, Gardshodn K, Gram L, and Vogel BF. 2003. Comparison of sodium hypochlorite-based foam and peroxyacetic acid-based fog sanitizing procedures in a salmon smokehouse: survival of the general microflora and *Listeria monocytogenes*. J Food Prot 66:592-598.

13. Barak JD, Chue B, and Mills DC. 2003. Recovery of surface bacteria from and surface sanitization of cantaloupes. J Food Prot 66:1805-1810.

14. Bari ML, Nazuka E, Sabina Y, Todoriki S, and Isshiki K. 2003. Chemical and irradiation treatments for killing *Escherichia coli* O157:H7 on alfalfa, radish, and mung bean seeds. J Food Prot 66:767-774.

15. Bari ML, Sabina Y, Isobe S, Uemura T, and Isshiki K. 2003. Effectiveness of electrolyzed acidic water in killing *Escherichia coli* O157:H7, Salmonella Enteritidis, and *Listeria monocytogenes* on the surfaces of tomatoes. J Food Prot 66:542-548.

16. Bashor MP, Curtis PA, Keener KM, Sheldon BW, Kathariou S, and Osborne JA. 2004. Effects of carcass washers on *Campylobacter* contamination in large broiler processing plants. Poultr Sci 83:1232-1239.

17. Bastos MD, Soares ND, de Andrade NJ, Arruda AC, and Alves RE. 2005. The effect of the association of sanitizers and surfactant in the microbiota of the Cantaloupe (*Cucumis melo* L.) melon surface. Food Control 16:369-373.

18. Baur S, Klaiber R, Hammes WP, and Carle R. 2004. Sensory and microbiological quality of shredded, packaged iceberg lettuce as affected by pre-washing procedures with chlorinated and ozonated water. Innovative Food Sci Emerging Technol 5:45-55.

19. Baur S, Klaibe, R, Hua W, Hammes WP, and Carle R. 2005. Effect of temperature and chlorination of pre-washing water on shelf-life and physiological properties of ready-to-use iceberg lettuce. Innovative Food Sci Emerging Technol 6(2):171-182.

20. Beltran D, Selma MV, Tudela JA, and Gil MI. 2005. Effect of different sanitizers on microbial and sensory quality of fresh-cut potato strips stored under modified atmosphere or vacuum packaging. Postharvest Biol Technol 37(1):37-46.

21. Bermudez O and Forciniti D. 2004. Decontamination of surfaces by lysozyme encapsulated in reverse micelles. J Chromatogr B: Anal Technol Biomed Life Sci 807:95-103.

22. Beuchat LR, Adler BB, and Lang MM. 2004. Efficacy of chlorine and a peroxyacetic acid sanitizer in killing *Listeria monocytogenes* on iceberg and Romaine lettuce

using simulated commercial processing conditions. J Food Prot 67:1238-1242.

23. Beuchat LR, Pettigrew CA, Tremblay ME, Roselle BJ, and Scouten AJ. 2004. Lethality of chlorine, chlorine dioxide, and a commercial fruit and vegetable sanitizer to vegetative cells and spores of *Bacillus cereus* and spores of *Bacillus thuringiensis*. J Food Prot 67:1702-1708.

24. Bialka KL, Demirci A, Knabel SJ, Patterson PH, and Puri VM. 2004. Efficacy of electrolyzed oxidizing water for the microbial safety and quality of eggs. Poultr Sci 83:2071-2078.

25. Bore E and Langsrud S. 2005.Characterization of micro-organisms isolated from dairy industry after cleaning and fogging disinfection with alkyl amine and peracetic acid. J Appl Microbiol 98(1):96-105.

26. Bosilevac JM, Nou X, Osborn MS, Allen DM, and Koohmaraie M. 2005. Development and evaluation of an on-line hide decontamination procedure for use in a commercial beef processing plant. J Food Prot 68:265-272.

27. Bosilevac JM, Shackelford SD, Fahle R, Biela T, and Koohmaraie M. 2004. Decreased dosage of acidified sodium chlorite reduces microbial contamination and maintains organoleptic qualities of ground beef products. J Food Prot 67:2248-2254.

28. Boyd RD, Cole D, Rowe D, Verran J, Paul AJ, and West RH. 2001. Cleanability of soiled stainless steel as studied by atomic force microscopy and time of flight secondary ion mass spectrometry. J Food Prot 64:87-93.

29. Bremer PJ, Monk I, and Butler R. 2002. Inactivation of *Listeria monocytogenes*/*Flavobacterium* spp. biofilms using chlorine: impact of substrate, pH, time and concentration. Lett Appl Microbiol 35:321-325.

30. Burnett AB, Iturriaga MH, Escartin EF, Pettigrew CA, and Beuchat LR. 2004. Influence of variations in methodology on populations of *Listeria monocytogenes* recovered from lettuce treated with sanitizers. J Food Prot 67:742-750.

31. Burnett SL and Beuchat LR. 2000. Human pathogens associated with raw produce and unpasteurized juices, and difficulties in decontamination. J Industr Microbiol Biotechnol 25:281-287.

32. Capita R, Alonso-Calleja C, del Camino Garcia-Fernandez M, and Moreno B. 2002. Activity of trisodium phosphate compared with sodium hydroxide wash solutions against *Listeria monocytogenes* attached to chicken skin during refrigerated storage. Food Microbial 19:57-63.

33. Capita R, Alonso-Calleja C, Garcia-Fernandez C, and Moreno B. 2001. Efficacy of trisodium phosphate solutions in reducing *Listeria monocytogenes* populations on chicken skin during refrigerated storage. J Food Prot 64:1627-1630.

34. Capita R, Alonso-Calleja C, Garcia-Fernandez MC, and Moreno B. 2001. Influence of strain and trisodium phosphate concentration on growth parameters of *Listeria monocytogenes* in vitro. Lett Appl Microbiol 32:428-432.

35. Capita R, Alonso-Calleja C, Garcia-Fernandez MC, and Moreno B. 2002. Review: Trisodium phosphate (TSP) treatment for decontamination of poultry. Food Sci Technol Int 8:11-24.

36. Capita R, Alonso-Calleja C, Rodriguez-Perez R, Moreno B, and Garcia-Fernandez MD. 2002. Influence of poultry carcass skin sample site on the effectiveness of trisodium phosphate against *Listeria monocytogenes*. J Food Prot 65:853-856.

37. Castillo A, Lucia LM, Mercado I, and Acuff GR. 2001. In-plant evaluation of a lactic acid treatment for reduction of bacteria on chilled beef carcasses. J Food Prot 64:738-740.

38. Castillo A, Lucia LM, Roberson DB, Stevenson TH, Mercado I, and Acuff GR. 2001. Lactic acid sprays reduce bacterial pathogens on cold beef carcass surfaces and in subsequently produced ground beef. J Food Prot 64:58-62.

39. Castillo A, McKenzie KS, Lucia LM, and Acuff GR. 2003. Ozone treatment for reduction of *Escherichia coli* O157:H7 and Salmonella serotype typhimurium on beef carcass surfaces. J Food Prot 66:775-779.

40. Castillo LA, Meszaros L, and Kiss IF. 2005. Effect of trisodium phosphate on the microbial contamination of chicken meat. Acta Alimentaria 34:5-11.

41. Chantarapanont W, Berrang ME, and Frank JF. 2004. Direct microscopic observation of viability of *Campylobacter jejuni* on chicken skin treated with selected chemical sanitizing agents. J Food Prot 67:1146-1152.

42. Charkowski AO, Sarreal CZ, and Mandrell RE. 2001. Wrinkled alfalfa seeds harbor more aerobic bacteria and are more difficult to sanitize than smooth seeds. J Food Prot 64(9):1292-1298.

43. Chen L, Ingham BH, and Ingham SC. 2004. Survival of *Penicillium expansum* and patulin production on stored apples after wash treatments. J Food Sci 69:C669-C675.

44. Cloete TE. 2003. Resistance mechanisms of bacteria to antimicrobial compounds. Internat Biodeterioration Biodegradation 51:277-282.

45. Corantin H, Quessy S, Gaucher ML, Lessard L, Leblanc D, and Houde A. 2005. Effectiveness of steam pasteurization in controlling microbiological hazards of cull cow carcasses in a commercial plant. Can J Vet Res 69:200-207.

46. Crapo, C, Himelbloom B, Vitt S and Pedersen L. 2004. Ozone efficacy as a bactericide in seafood processing. J Aquatic Food Prod Technol 13:111-123.

47. Cutter CN and Rivera-Betancourt M. 2000. Interventions for the reduction of Salmonella Typhimurium

DT 104 and non-O157:H7 enterohemorrhagic *Escherichia coli* on beef surfaces. J Food Prot 63:1326-1332.

48. D'Souza NM and Mawson AJ. 2005. Membrane cleaning in the dairy industry: a review. Crit Rev Food Sci Nutr 45:125-134.

49. Davidson PM, Sofos JN, and Branen AL. 2005. *Antimicrobials in Food*. Taylor & Francis, New York.

50. Davies RH and Breslin M. 2003. Investigation of *Salmonella* contamination and disinfection in farm egg-packing plants. J Appl Microbiol 94(2):191-196.

51. Davies RH and Breslin M. 2003. Investigations into possible alternative decontamination methods for *Salmonella enteritidis* on the surface of table eggs. J Vet Med Ser B-Infect Dis Vet Publ Health 50:38-41.

52. Dawson DJ, Paish A, Staffell LM, Seymour IJ, and Appleton H. 2005. Survival of viruses on fresh produce, using MS2 as a surrogate for norovirus. J Appl Microbiol 98:203-209.

53. De Martinez YB, Ferrer K, and Salas EM. 2002. Combined effects of lactic acid and nisin solution in reducing levels of microbiological contamination in red meat carcasses. J Food Prot 65:1780-1783.

54. Delaquis PJ, Fukumoto LR, Toivonen PMA, and Cliff MA. 2004. Implications of wash water chlorination and temperature for the microbiological and sensory properties of fresh-cut iceberg lettuce. Postharvest Biol Technol 31:81-91.

55. Delmore RJ, Sofos JN, Schmidt GR, Belk KE, Lloyd WR, and Smith GC. 2000. Interventions to reduce microbiological contamination of beef variety meats. J Food Prot 63:44-50.

56. Derrickson Tharrington E, Kendall PA, and Sofos JN. 2005. Inactivation of *Escherichia coli* O157:H7 during storage or drying of apple slices pretreated with acidic solutions. Int J Food Microbiol 99:78-89.

57. Deumier F. 2004. Pulsed-vacuum immersion of chicken meat and skin in acid solutions. Effects on mass transfers, colour and microbial quality. Int J Food Sci Technol 39:277-286.

58. Deza MA, Araujo M, and Garrido MJ. 2003. Inactivation of *Escherichia coli* O157:H7, *Salmonella enteritidis* and *Listeria monocytogenes* on the surface of tomatoes by neutral electrolyzed water. Lett Appl Microbiol 37:482-487.

59. Deza MA, Araujo M, and Garrido MJ. 2005. Inactivation of *Escherichia coli*, *Listeria monocytogenes*, *Pseudomonas aeruginosa* and *Staphylococcus aureus* on stainless steel and glass surfaces by neutral electrolysed water. Lett Appl Microbiol 40:341-346.

60. Dickens JA and Ingram KD. 2001. Efficacy of an herbal extract, at various concentrations, on the microbiological quality of broiler carcasses after simulated chilling. J Appl Poultr Res 10:194-198.

61. Dincer AH and Baysal T. 2004. Decontamination techniques of pathogen bacteria in meat and poultry. Crit Rev Microbiol 30:197-204.

62. Dormedy ES, Brashears MM, Cutter CN, and Burson DE. 2000. Validation of acid washes as critical control points in hazard analysis and critical control point systems. J Food Prot 63:1676-1680.

63. Dosti B, Guzel Seydim Z, and Greene AK. 2005. Effectiveness of ozone, heat and chlorine for destroying common food spoilage bacteria in synthetic media and biofilms. Int J Dairy Technol 58:19-24.

64. Dubal ZB, Paturkar AM, Waskar VS, Zende RJ, Latha C, Rawool DB, and Kadam MM. 2004. Effect of food grade organic acids on inoculated *S aureus*, *L monocytogenes*, *E coli* and *S Typhimurium* in sheep/goat meat stored at refrigeration temperature. Meat Sci 66:817-821.

65. Dufour M, Simmonds RS, and Bremer PJ. 2004. Development of a laboratory scale clean-in-place system to test the effectiveness of "Natural" antimicrobials against dairy Biofilms. J Food Prot 67(7):1438-1443.

66. Eggenberger-Solorzano L, Niebuhr SE, Acuff GR, and Dickson JS. 2002. Hot water and organic acid interventions to control microbiological contamination on hog carcasses during processing. J Food Prot 65:1248-1252.

67. Ellebracht JW, King DA, Castillo A, Lucia LM, Acuff GR, Harris KB, and Savell JW. 2005. Evaluation of peroxyacetic acid as a potential pre-grinding treatment for control of *Escherichia coli* O157:H7 and Salmonella Typhimurium on beef trimmings. Meat Sci 70:197-203.

68. Enomoto K, Takizawa T, Ishikawa N, and Suzuki T. 2002. Hot-water treatments for disinfecting alfalfa seeds inoculated with *Escherichia coli* ATCC 25922. Food Sci Technol Res 8:247-251.

69. Escudero ME, Velazquez L, Favier G, and Guzman A M S de. 2003. Effectiveness of chlorine, organic acids and UV treatments in reducing *Escherichia coli* O157:H7 and *Yersinia enterocolitica* on apples. Centr Eur J Pub Health 11:68-72.

70. Fabrizio KA and Cutter CN. 2004. Comparison of electrolyzed oxidizing water with other antimicrobial interventions to reduce pathogens on fresh pork. Meat Sci 68:463-468.

71. Faille C, Jullien C, Fontaine F, Bellon-Fontaine MN, Slomianny C, and Benezech T. 2002. Adhesion of *Bacillus* spores and *Escherichia coli* cells to inert surfaces: role of surface hydrophobicity. Can J Microbiol 48:728-738.

72. Fallie C, Fontaine F, Lelievre C, and Benezech T. 2003. Adhesion of *Escherichia coli*, *Citrobacter freundii* and *Klebsiella pneumoniae* isolated from milk: consequence on the efficiency of sanitation procedures. Water Sci Technol 47:225-231.

73. Fett WF and Cooke PH. 2003. Reduction of *Escherichia coli* O157:H7 and *Salmonella* on laboratory-inoculated alfalfa seed with commercial citrus-related

products. J Food Prot 66:1158-1165.

74. Foley D, Euper M, Caporaso F, and Prakash A. 2004. Irradiation and chlorination effectively reduces *Escherichia coli* O157:H7 inoculated on cilantro (*Coriandrum sativum*) without negatively affecting quality. J Food Prot 67:2092-2098.

75. Foschino R, Picozzi C, Civardi A, Bandini M, and Faroldi P. Comparison of surface sampling methods and cleanability assessment of stainless steel surfaces subjected or not to shot peening. J Food Engin 60(4), 375-381. 2003.

76. Frank JF and Chmielewski R. 2001. Influence of surface finish on the cleanability of stainless steel. J Food Prot 64:1178-1182.

77. Frank JF, Ehlers J, and Wicker L. 2003. Removal of *Listeria monocytogenes* and poultry soil-containing biofilms using chemical cleaning and sanitizing agents under static conditions. Food Prot Trends 23:654-663.

78. Fukuzaki S, Hiratsuka H, Takehara A, Takahashi K, and Sasaki K. 2004. Efficacy of electrolyzed water as a primary cleaning agent. Biocontr Sci 9:105-109.

79. Gangneux JP, Noussair L, Bouakline A, Roux N, Lacroix C, and Derouin F. 2004. Experimental assessment of disinfection procedures for eradication of *Aspergillus fumigatus* in food. Blood 104:2000-2002.

80. Gelman A, Sachs O, Khanin Y, Drabkin V, and Glatman L. 2005. Effect of ozone pretreatment on fish storage life at low temperatures. J Food Prot 68:778-784.

81. Gill CO and Badoni M. 2004. Effects of peroxyacetic acid, acidified sodium chlorite or lactic acid solutions on the microflora of chilled beef carcasses. Int J Food Microbiol 91:43-50.

82. Gill CO and Bryant J. 2000. The effects on product of a hot water pasteurizing treatment applied routinely in a commercial beef carcass dressing process. Food Microbiol 17:495-504.

83. Gill CO and Landers C. 2003. Microbiological effects of carcass decontaminating treatments at four beef packing plants. Meat Sci 65:1005-1011.

84. Gogus U, Bozoglu F, and Yurdugul S. 2004. The effects of nisin, oil-wax coating and yogurt on the quality of refrigerated chicken meat. Food Control 15:537-542.

85. Goncalves AC, Almeida RCC, Alves MAO, and Almeida PF. 2005. Quantitative investigation on the effects of chemical treatments in reducing *Listeria monocytogenes* populations on chicken breast meat. Food Control 16:617-622.

86. Gulati BR, Allwood PB, Hedberg CW, and Goyal SM. 2001. Efficacy of commonly used disinfectants for the inactivation of calicivirus on strawberry, lettuce, and a food-contact surface. J Food Prot 64:1430-1434.

87. Guzel-Seydim ZB, Greene AK, and Seydim AC. 2004. Use of ozone in the food industry. Lebensm Wissensch 37:453-460.

88. Hajmeer MN, Marsden JL, Fung DYC, and Kemp GK. 2004. Water, sodium chloride and acidified sodium chlorite effects on *Escherichia coli* O157:H7 and *Staphylococcus aureus* on beef briskets. Meat Sci 68:277-283.

89. Han Y, Linton RH, Nielsen SS, and Nelson PE. 2000. Inactivation of *Escherichia coli* O157:H7 on surface-uninjured and -injured green pepper (*Capsicum annuum* L.) by chlorine dioxide gases demonstrated by confocal laser scanning microscopy. Food Microbial 17:643-655.

90. Han Y, Selby TL, Schultze KK, Nelson PE, and Linton RH. 2004. Decontamination of strawberries using batch and continuous chlorine dioxide gas treatments. J Food Prot 67:2450-2455.

91. Hegerding L, Wilhelm R, Muller U, and Stiebing A. 2005. Decontamination of meat surfaces by a short-time saturated-steam-process. Fleischwirtschaft 85:119-123.

92. Inatsu Y, Bari ML, Kawasaki S, Isshiki K, and Kawamoto S. 2005. Efficacy of acidified sodium chlorite treatments in reducing *Escherichia coli* O157:H7 on Chinese cabbage. J Food Prot 68:251-255.

93. Inatsu Y, Maeda Y, Bari ML, Kawasaki S, and Kawamoto S. 2005. Prewashing with acidified sodium chlorite reduces pathogenic bacteria in lightly fermented Chinese cabbage. J Food Prot 68:999-1004.

94. James C, Thornton JA, Ketteringham L, and James SJ. 2000. Effect of steam condensation, hot water or chlorinated hot water immersion on bacterial numbers and quality of lamb carcasses. J Food Engin 43:219-225.

95. Jean J, Vachon JF, Moroni O, Darveau A, Kukavica-Ibrulj I, and Fliss I. 2003. Effectiveness of commercial disinfectants for inactivating hepatitis A virus on agri-food surfaces. J Food Prot 66(1):115-119.

96. Jessen B and Lammert L. 2003. Biofilm and disinfection in meat processing plants. Internat Biodeterioration Biodegradation 51(4):265-269.

97. Johnston MD, Lawson S, and Otter JA. 2005. Evaluation of hydrogen peroxide vapour as a method for the decontamination of surfaces contaminated with *Clostridium botulinum* spores. J Microbiol Meth 60:403-411.

98. Joseph B, Otta SK, and Karunasagar I. 2001. Biofilm formation by *Salmonella* spp. on food contact surfaces and their sensitivity to sanitizers. Int J Food Microbiol 64:367-372.

99. Kamat A, Pingulkar K, Bhushan B, Gholap A, and Thomas P. 2003. Potential application of low dose gamma irradiation to improve the microbiological safety of fresh coriander leaves. Food Control 14:529-537.

100. Kang DH, Koohmaraie M, Dorsa WJ, and Siragusa GR. 2001. Development of a multiple-step process for the microbial decontamination of beef trim. J Food Prot 64:63-71.

101. Kang DH, Koohmaraie M, and Siragusa GR. 2001. Application of multiple antimicrobial interventions for microbial decontamination of commercial beef trim. J Food Prot 64:168-171.

102. Khadre MA and Yousef AE. 2001. Decontamination of a multilaminated aseptic food packaging material and stainless steel by ozone. J Food Safety 21:1-13.

103. Khadre MA and Yousef AE. 2001. Sporicidal action of ozone and hydrogen peroxide: a comparative study. Int J Food Microbiol 71:131-138.

104. Kim BH, Jang AR, Lee SO, Min JS, and Lee MH. 2004. Combined effect of electron-beam (beta) irradiation and organic acids on shelf life of pork loins during cold storage. J Food Prot 67:168-171.

105. King DA, Lucia LM, Castillo A, Acuff GR, Harris KB, and Savell JW. 2005. Evaluation of peroxyacetic acid as a post-chilling intervention for control of *Escherichia coli* O157:H7 and Salmonella Typhimurium on beef carcass surfaces. Meat Sci 69:401-407.

106. Knape KD, Carey JB, and Ricke SC. 2001. Response of foodborne *Salmonella* spp. marker strains inoculated on egg shell surfaces to disinfectants in a commercial egg washer. J Environ Sci Health - Part B: Pesticides Food Contam Agric Wastes 36:219-227.

107. Knowles J and Roller S. 2001. Efficacy of chitosan, carvacrol, and a hydrogen peroxide-based biocide against foodborne microorganisms in suspension and adhered to stainless steel. J Food Prot 64:1542-1548.

108. Knowles JR, Roller S, Murray DB, and Naidu AS. 2005. Antimicrobial action of carvacrol at different stages of dual-species biofilm development by *Staphylococcus aureus* and *Salmonella enterica* serovar Typhimurium. Appl Environ Microbiol 71:797-803.

109. Koohmaraie M, Arthur TM, Bosilevac JM, Guerini M, Shackelford SD, and Wheeler TL. 2005. Post-harvest interventions to reduce/eliminate pathogens in beef. Meat Sci 71:79-91.

110. Koseki S, Isobe S, and Itoh K. 2004. Efficacy of acidic electrolyzed water ice for pathogen control on lettuce. J Food Prot 67:2544-2549.

111. Koseki S, Yoshida K, Isobe S, and Itoh K. 2001. Decontamination of lettuce using acidic electrolyzed water. J Food Prot 64:652-658.

112. Koseki S, Yoshida K, Isobe S, and Itoh K. 2004. Efficacy of acidic electrolyzed water for microbial decontamination of cucumbers and strawberries. J Food Prot 67:1247-1251.

113. Koseki S, Yoshida K, Kamitani Y, Isobe S, and Itoh K. 2004. Effect of mild heat pre-treatment with alkaline electrolyzed water on the efficacy of acidic electrolyzed water against *Escherichia coli* O157:H7 and *Salmonella* on lettuce. Food Microbiol 21:559-566.

114. Koseki S, Yoshida K, Kamitani Y, and Itoh K. 2003. Influence of inoculation method, spot inoculation site, and inoculation size on the efficacy of acidic electrolyzed water against pathogens on lettuce. J Food Prot 66:2010-2016.

115. Koutsoumanis KP, Ashton LV, Geornaras I, Belk KE, Scanga JA, Kendall PA, Smith GC, and Sofos JN. 2004. Effect of single or sequential hot water and lactic acid decontamination treatments on the survival and growth of *Listeria monocytogenes* and spoilage microflora during aerobic storage of fresh beef at 4, 10, and 25 degrees C. J Food Prot 67:2703-2711.

116. Kumudavally KV, Padmini S, Radhakrishna K, and Bawa AS. 2005. Effect of surface treatment of fresh mutton with spices on lipolytic bacteria, Enterobacteriaceae and their degradation products during storage. J Food Sci Technol -Mysore 42:249-253.

117. Kusumaningrum HD, Riboldi G, Hazeleger WC, and Beumer RR. 2003. Survival of foodborne pathogens on stainless steel surfaces and cross-contamination to foods. Int J Food Microbiol 85:227-236.

118. Kwon NH, Kim SH, Kim JY, Lim JY, Kim JM, Jung WK, Park KT, Bae WK, Noh KM, Choi JW, Hur J, and Park YH. 2003. Antimicrobial performance of alkaline ionic fluid (GC-100X) and its ability to remove *Escherichia coli* O157:H7 from the surface of tomatoes. J Food Prot 66:1604-1610.

119. Lang MM, Harris LJ, and Beuchat LR. 2004. Survival and recovery of *Escherichia coli* O157:H7, *Salmonella*, and *Listeria monocytogenes* on lettuce and parsley as affected by method of inoculation, time between inoculation and analysis, and treatment with chlorinated water. J Food Prot 67:1092-1103.

120. Laroussi M. 2005. Low temperature plasma-based sterilization: Overview and state-of-the-art. Plasma Processes Polymers 2:391-400.

121. Lee SY, Costello M, and Kang DH. 2004. Efficacy of chlorine dioxide gas as a sanitizer of lettuce leaves. J Food Prot 67:1371-1376.

122. Leverentz B, Conway WS, Alavidze Z, Janisiewicz WJ, Fuchs Y, Camp MJ, Chighladze E, and Sulakvelidze A. 2001. Examination of bacteriophage as a biocontrol method for *Salmonella* on fresh-cut fruit: A model study. J Food Prot 64:1116-1121.

123. Liao CH and Sapers GM. 2000. Attachment and growth of Salmonella Chester on apple fruits and in vivo response of attached bacteria to sanitizer treatments. J Food Prot 63:876-883.

124. Liao CH, Shollenberger LM, and Phillips JG. 2003. Lethal and sublethal action of acetic acid on *Salmonella* in vitro and on cut surfaces of apple slices. J Food Sci 68:2793-2798.

125. Lim K and Mustapha A. 2003. Reduction of *Escherichia coli* O157:H7 and *Lactobacillus plantarum* numbers on fresh beef by polylactic acid and vacuum packaging. J Food Sci 68:1422-1427.

126. Lim K and Mustapha A. 2004. Effects of cetylpyridinium chloride, acidified sodium chlorite, and potassium sorbate on populations of *Escherichia coli* O157:H7, *Listeria monocytogenes*, and *Staphylococcus aureus* on fresh beef. J Food Prot 67:310-315.

127. Lim YH, Hamdy MK, and Toledo RT. 2003. Combined effects of ionizing-irradiation and different environments on *Clostridium botulinum* type E spores. Int J Food Microbiol 89:251-263.

128. Lin KW and Chuang CH. 2001. Effectiveness of dipping with phosphate, lactate and acetic acid solutions on the quality and shelf-life of pork loin chop. J Food Sci 66:494-499.

129. Lindsay D, Brozel VS, Mostert JF, and von Holy A. 2002. Differential efficacy of a chlorine dioxide-containing sanitizer against single species and binary biofilms of a dairy-associated *Bacillus cereus* and a *Pseudomonas fluorescens* isolate. J Appl Microbiol 92:352-361.

130. Logue CM, Sheridan JJ, and Harrington D. 2005. Studies of steam decontamination of beef inoculated with *Escherichia coli* O157:H7 and its effect on subsequent storage. J Appl Microbiol 98:741-751.

131. Lomander A, Schreuders P, Russek Cohen E, and Ali L. 2004. Evaluation of chlorines' impact on biofilms on scratched stainless steel surfaces. Bioresource Technol 94:275-283.

132. Lopez L, Romero J, and Ureta F. 2001. Disinfection treatments for lettuces (*Lactuca sativa*) and strawberries (*Fragaria chiloensis*). Arch Latinoamer Nutr 51:376-381.

133. Lunden JM, Autio TJ, and Korkeala HJ. 2002. Transfer of persistent *Listeria monocytogenes* contamination between food-processing plants associated with a dicing machine. J Food Prot 65(7):1129-1133.

134. Materon LA. 2003. Survival of *Escherichia coli* O157:H7 applied to cantaloupes and the effectiveness of chlorinated water and lactic acid as disinfectants. World J Microbiol Biotechnol 19:867-873.

135. May BK and Fickak A. 2003. The efficacy of chlorinated water treatments in minimizing yeast and mold growth in fresh and semi-dried tomatoes. Dry Technol 21:1127-1135.

136. McEvoy JM, Doherty AM, Sheridan JJ, Bailey DG, Blair IS, and McDowell DA. 2003. The effects of treating bovine hide with steam at subatmospheric pressure on bacterial numbers and leather quality. Lett Appl Microbiol 37:344-348.

137. McEvoy JM, Doherty AM, Sheridan JJ, Blair IS, and McDowell DA. 2001. Use of steam condensing at subatmospheric pressures to reduce *Escherichia coli* O157:H7 numbers on bovine hide. J Food Prot 64:1655-1660.

138. McGlynn WG, Bellmer DD, and Reilly SS. 2003. Effect of precut sanitizing dip and water jet cutting on quality and shelf-life of fresh-cut watermelon. J Food Qual 26:489-498.

139. McKellar RC, Odumeru J, Zhou T, Harrison A, Mercer DG, Young JC, Lu X, Boulter J, Piyasena P, and Karr S. 2004. Influence of a commercial warm chlorinated water treatment and packaging on the shelf-life of ready-to-use lettuce. Food Res Int 37:343-354.

140. Midelet G and Carpentier B. 2004. Impact of cleaning and disinfection agents on biofilm structure and on microbial transfer to a solid model food. J Appl Microbiol 97(2):262-270.

141. Mies PD, Covington BR, Harris KB, Lucia LM, Acuff GR, and Savell JW. 2004. Decontamination of cattle hides prior to slaughter using washes with and without antimicrobial agents. J Food Prot 67:579-582.

142. Minihan D, Whyte P, O'Mahony M, and Collins JD. 2003. The effect of commercial steam pasteurization on the levels of Enterobacteriaceae and *Escherichia coli* on naturally contaminated beef carcasses. J Vet Med Series B 50:352-356.

143. Montville R and Schaffner DW. 2004. Analysis of published sprout seed sanitization studies shows treatments are highly variable. J Food Prot 67:758-765.

144. Moore G, Griffith C, and Peters A. 2000. Bactericidal properties of ozone and its potential application as a terminal disinfectant. J Food Prot 63:1100-1106.

145. Mustapha A, Ariyapitipun T, and Clarke AD. 2002. Survival of *Escherichia coli* O157:H7 on vacuum-packaged raw beef treated with polylactic acid, lactic acid, and nisin. J Food Sci 67:262-267.

146. Nakagawa R, Yabuuchi H, Yasokawa D, Nagashima K, Watanabe Y, Otomo N, and Emoto N. 2004. Pretreatment effect of surfactans for food on the disinfection of shredded cucumber by sodium hypochlorite solution. J Japan Soc Food Sci Technol 51:367-369.

147. Nascimento MS, Silva N, Catanozi MPLM, and Silva KC. 2003. Effects of different disinfection treatments on the natural microbiota of lettuce. J Food Prot 66:1697-1700.

148. Niemira BA. 2003. Radiation sensitivity and recoverability of *Listeria monocytogenes* and *Salmonella* on 4 lettuce types. J Food Sci 68:2784-2787.

149. Niemira BA and Solomon EB. 2005. Sensitivity of planktonic and biofilm-associated *Salmonella* spp. to ionizing radiation. Appl Environ Microbiol 71:2732-2736.

150. Nissen H, Maugesten T, and Lea P. 2001. Survival and growth of *Escherichia coli* O157:H7, *Yersinia enterocolitica* and *Salmonella enteritidis* on decontaminated and untreated meat. Meat Sci 57:291-298.

151. Norwood DE and Gilmour A. 2000. The growth and resistance to sodium hypochlorite of *Listeria monocytogenes* in a steady-state multispecies biofilm. J Appl Microbiol 88:512-520.

152. Nyeleti C, Cogan TA, and Humphrey TJ. 2004.

Effect of sunlight on the survival of *Salmonella* on surfaces. J Appl Microbiol 97:617-620.

153. Odumeru JA, Boulter J, Knight K, Lu X, and McKellar R. 2003. Assessment of a wash treatment with warm chlorinated water to extend the shelf-life of ready-to-use lettuce. J Food Qual 26:197-209.

154. Oh SW, Dancer GI, and Kang DH. 2005. Efficacy of aerosolized peroxyacetic acid as a sanitizer of lettuce leaves. J Food Prot 68(8):1743-1747.

155. Okolocha EC and Ellerbroek L. 2005. The influence of acid and alkaline treatments on pathogens and the shelf life of poultry meat. Food Control 16:217-225.

156. Okull DO and LaBorde LF. 2004. Activity of electrolyzed oxidizing water against *Penicillium expansum* in suspension and on wounded apples. J Food Sci 69:FMS23-FMS27.

157. Oulahal-Lagsir N, Martial-Gros A, Boisiter E, Blum LJ, and Bonneau M. 2000. The development of an ultrasonic apparatus for the noninvasive and repeatable removal of fouling in food processing equipment. Lett Appl Microbiol 30:47-52.

158. Oulahal-Lagsir N, Martial-Gros A, Bonneau M, and Blum LJ. 2000. Ultrasonic methodology coupled to ATP bioluminescence for the non-invasive detection of fouling in food processing equipment - validation and application to a dairy factory. J Appl Microbiol 89:433-441.

159. Oyarzabal OA, Hawk C, Bilgili SF, Warf CC, and Kemp GK. 2004. Effects of postchill application of acidified sodium chlorite to control *Campylobacter* spp. and *Escherichia coli* on commercial broiler carcasses. J Food Prot 67:2288-2291.

160. Palekar MP, Cabrera-Diaz E, Kalbasi-Ashtari A, Maxim JE, Miller RK, Cisneros-Zevallos L, and Castillo A. 2004. Effect of electron beam irradiation on the bacterial load and sensorial quality of sliced cantaloupe. J Food Sci 69:M267-M273.

161. Pandrangi S, Elwell MW, Anantheswaran RC, and LaBorde LF. 2003. Efficacy of sulfuric acid scarification and disinfectant treatments in eliminating *Escherichia coli* O157:H7 from alfalfa seeds prior to sprouting. J Food Science 68:613-618.

162. Pao S, Davis CL, and Kelsey DF. 2000. Efficacy of alkaline washing for the decontamination of orange fruit surfaces inoculated with *Escherichia coli*. J Food Prot 63:961-964.

163. Pao S, Randolph SP, Westbrook EW, and Shen H. 2004. Use of bacteriophages to control *Salmonella* in experimentally contaminated sprout seeds. J Food Sci 69:M127-M130.

164. Park CM, Hung YC, Lin CS, and Brackett RE. 2005. Efficacy of electrolyzed water in inactivating *Salmonella* Enteritidis and *Listeria monocytogenes* on shell eggs. J Food Prot 68:986-990.

165. Park YS, Yoo IJ, Jeon KH, Kim HK, Chang EJ, and Oh HI. 2003. Effects of various eggshell treatments on the egg quality during storage. Asian Austral J Anim Sci 16:1224-1229.

166. Parkar SG, Flint SH, and Brooks JD. 2003. Physiology of biofilms of thermophilic bacilli - potential consequences for cleaning. J Indust Microbiol Biotechnol 30:553-560.

167. Parkar SG, Flint SH, and Brooks JD. 2004. Evaluation of the effect of cleaning regimes on biofilms of thermophilic bacilli on stainless steel. J Appl Microbiol 96(1):110-116.

168. Parnell TL, Harris LJ, and Suslow TV. 2005. Reducing *Salmonella* on cantaloupes and honeydew melons using wash practices applicable to postharvest handling, foodservice, and consumer preparation. Int J Food Microbiol 99:59-70.

169. Pipek P, Houska A, Jelenikova J, Kyhos K, Hoke K, and Sikulova M. 2005. Microbial decontamination of beef carcasses by combination of steaming and lactic acid spray. J Food Engin 67:309-315.

170. Pirovani M, Piagentini A, Guemes D, and Arkwright S. 2004. Reduction of chlorine concentration and microbial load during washing-disinfection of shredded lettuce. Int J Food Sci Technol 39:341-347.

171. Ponce AG, Valle C del, and Roura SI. 2004. Shelf life of leafy vegetables treated with natural essential oils. J Food Sci 69:FMS50-FMS56.

172. Porat R, Daus A, Weiss B, Cohen L, and Droby S. 2002. Effects of combining hot water, sodium bicarbonate and biocontrol on postharvest decay of citrus fruit. J Horticult Sci Biotechnol 77:441-445.

173. Purnell G, Allen V, James S, and Ketteringham L. 2005. The effects of surface steam treatment on bacterial reduction and storage of beef primals and retail cuts. J Food Engin 68:419-427.

174. Rajkowski KT and Thayer DW. 2001. Alfalfa seed germination and yield ratio and alfalfa sprout microbial keeping quality following irradiation of seeds and sprouts. J Food Prot 64:1988-1995.

175. Ramirez AJ, Acuff GR, Lucia LM, and Savell JW. 2001. Lactic acid and trisodium phosphate treatment of lamb breast to reduce bacterial contamination. J Food Prot 64:1439-1441.

176. Reinemann DJ, Wolters GMVH, Billon P, Lind O, and Rasmussen MD. 2003. Review of practices for cleaning and sanitation of milking machines. Bull Int Dairy Fed 381:4-18.

177. Retzlaff D, Phebus R, Nutsch A, Riemann J, Kastner C, and Marsden J. 2004. Effectiveness of a laboratory-scale vertical tower static chamber steam pasteurization unit against *Escherichia coli* O157:H7, *Salmonella* Typhimurium, and *Listeria innocua* on prerigor beef tissue. J Food Prot 67:1630-1633.

178. Robbins JB, Fisher CW, Moltz AG, and Martin SE. 2005. Elimination of *Listeria monocytogenes* biofilms by ozone, chlorine, and hydrogen peroxide. J Food Prot 68:494-498.

179. Rodgers SL, Cash JN, Siddiq M, and Ryser ET. 2004. A comparison of different chemical sanitizers for inactivating *Escherichia coli* O157:H7 and *Listeria monocytogenes* in solution and on apples, lettuce, strawberries and cantaloupe. J Food Prot 67:721-731.

180. Rodgers SL and Ryser ET. 2004. Reduction of microbial pathogens during apple cider production using sodium hypochlorite, copper ion and sonication. J Food Prot 67:766-771.

181. Rodriguez Romo LA and Yousef AE. 2005. Inactivation of *Salmonella enterica* serovar Enteritidis on shell eggs by ozone and UV radiation. J Food Prot 68:711-717.

182. Rossoni EMM and Gaylarde CC. 2000. Comparison of sodium hypochlorite and peracetic acid as sanitising agents for stainless steel food processing surfaces using epifluorescence microscopy. Int J Food Microbiol 61:81-85.

183. Russell SM. 2003. The effect of electrolyzed oxidative water applied using electrostatic spraying on pathogenic and indicator bacteria on the surface of eggs. Poultr Sci 82:158-162.

184. Russell SM. 2003. Effect of sanitizers applied by electrostatic spraying on pathogenic and indicator bacteria attached to the surface of eggs. J Appl Poultr Res 12:183-189.

185. Russell SM and Axtell SP. 2005. Monochloramine versus sodium hypochlorite as antimicrobial agents for reducing populations of bacteria on broiler chicken carcasses. J Food Prot 68:758-763.

186. Ryu JH and Beuchat LR. 2005. Biofilm formation by *Escherichia coli* O157:H7 on stainless steel: Effect of exopolysaccharide and curli production on its resistance to chlorine. Appl Environ Microbiol 71:247-254.

187. Ryu JH, Kim H, and Beuchat LR. 2004. Attachment and biofilm formation by *Escherichia coli* O157:H7 on stainless steel as influenced by exopolysaccharide production, nutrient availability, and temperature. J Food Prot 67(10):2123-2131.

188. Saftner RA, Bai JH, Abbott JA, and Lee YS. 2003. Sanitary dips with calcium propionate, calcium chloride or a calcium amino acid chelate maintain quality and shelf stability of fresh-cut honeydew chunks. Postharv Biol Technol 29:257-269.

189. Sagripanti JL and Bonifacino A. 2000. Resistance of *Pseudomonas aeruginosa* to liquid disinfectants on contaminated surfaces before formation of biofilms. J AOAC Int 83:1415-1422.

190. Sapers GM, Miller RL, Jantschke M, and Mattrazzo AM. 2000. Factors limiting the efficacy of hydrogen peroxide washes for decontamination of apples containing *Escherichia coli*. J Food Sci 65:529-532.

191. Scher K, Romling U, and Yaron S. 2005. Effect of heat, acidification, and chlorination on *Salmonella enterica* Serovar Typhimurium cells in a biofilm formed at the air-liquid interface. Appl Environ Microbiol 71:1163-1168.

192. Schneider KR, Warf CC, Baxter PL, Warren BR, and Kemp GK. 2004. Pilot-plant evaluation of acidified sodium chlorite for sanitizing beef trim. Food Protect Trend 24:492-497.

193. Sengun IY and Karapinar M. 2004. Effectiveness of lemon juice, vinegar and their mixture in the elimination of *Salmonella typhimurium* on carrots (*Daucus carota* L.). Int J Food Microbiol 96:301-305.

194. Sengun MY and Karapinar M. 2005. Effectiveness of household natural sanitizers in the elimination of *Salmonella typhimurium* on rocket (*Eruca sativa* Miller) and spring onion (*Allium cepa* L.). Int J Food Microbiol 98:319-323.

195. Sengun MY and Karapinar M. 2005. Elimination of *Yersinia enterocolitica* on carrots (*Daucus carota* L.) by using household sanitisers. Food Control 16:845-850.

196. Sharma M and Anand SK. 2002. Bacterial biofilm on food contact surfaces: A review. J Food Sci Technol-Mysore 39:573-593.

197. Sharma M and Beuchat LR. 2004. Sensitivity of *Escherichia coli* O157:H7 to commercially available alkaline cleaners and subsequent resistance to heat and sanitizers. Appl Environ Microbiol 70:1795-1803.

198. Sharma M, Ryu JH, and Beuchat LR. 2005. Inactivation of *Escherichia coli* O157:H7 in biofilm on stainless steel by treatment with an alkaline cleaner and a bacteriophage. J Appl Microbiol 99:449-459.

199. Sharma RR and Demirci A. 2003. Treatment of *Escherichia coli* O157:H7 inoculated alfalfa seeds and sprouts with electrolyzed oxidizing water. Int J Food Microbiol 86:231-237.

200. Sharma RR, Demirci A, Puri VM, Beuchat LR, and Fett WF. 2004. Modeling the inactivation of *Escherichia coli* O157:H7 on inoculated alfalfa seeds during exposure to ozonated or electrolyzed oxidizing water. Trans ASAE 47:173-181.

201. Sinde E and Carballo J. 2000. Attachment of *Salmonella* spp. and *Listeria monocytogenes* to stainless steel, rubber and polytetrafluorethylene: the influence of free energy and the effect of commercial sanitizers. Food Microbiol 17:439-447.

202. Singh BR, Chandra M, Agarwal R, and Babu N. 2005. Curing of *Salmonella enterica*, serovar typhimurium-contaminated cowpea seeds and sprouts with vinegar and chlorination. J Food Process Preserv 29:268-277.

203. Singh N, Singh RK, and Bhunia AK. 2003. Sequential disinfection of *Escherichia coli* O157:H7 inoculated alfalfa seeds before and during sprouting using aqueous chlorine dioxide, ozonated water, and thyme

essential oil. Lebensm Wissensch Technol 36:235-243.

204. Singh N, Singh RK, Bhunia AK, and Stroshine RL. 2002. Efficacy of chlorine dioxide, ozone, and thyme essential oil or a sequential washing in killing *Escherichia coli* O157:H7 on lettuce and baby carrots. Lebensm Wissensch Technol 35:720-729.

205. Sinhamahapatra M, Biswas S, Das AK, and Bhattacharyya D. 2004. Comparative study of different surface decontaminants on chicken quality. Brit Poultr Sci 45:624-630.

206. Small A, Wells-Burr B, and Buncic S. 2005. An evaluation of selected methods for the decontamination of cattle hides prior to skinning. Meat Sci 69(2):263-268.

207. Smith S, Dunbar M, Tucker D, and Schaffner DW. 2003. Efficacy of a commercial produce wash on bacterial contamination of lettuce in a food service setting. J Food Prot 66:2359-2361.

208. Soliva Fortuny RC and Martin Belloso O. 2003. New advances in extending the shelf-life of fresh-cut fruits: a review. Trend Food Sci Technol 14:341-353.

209. Soljour G, Assanta MA, Messier S, and Boulianne M. 2004. Efficacy of egg cleaning compounds on eggshells contaminated with *Salmonella enterica* serovar enteritidis. J Food Prot 67:706-712.

210. Somers EB and Wong ACL. 2004. Efficacy of two cleaning and sanitizing combinations on *Listeria monocytogenes* biofilms formed at low temperature on a variety of materials in the presence of ready-to-eat meat residue. J Food Prot 67(10):2218-2229.

211. Stan SD and Daeschel MA. 2003. Reduction of Salmonella enterica on alfalfa seeds with acidic electrolyzed oxidizing water and enhanced uptake of acidic electrolyzed oxidizing water into seeds by gas exchange. J Food Prot 66:2017-2022.

212. Stivarius MR, Pohlman FW, McElyea KS, and Apple JK. 2002. The effects of acetic acid, gluconic acid and trisodium citrate treatment of beef trimmings on microbial, color and odor characteristics of ground beef through simulated retail display. Meat Sci 60:245-252.

213. Stivarius MR, Pohlman FW, McElyea KS, and Apple JK. 2002. Microbial, instrumental color and sensory color and odor characteristics of ground beef produced from beef trimmings treated with ozone or chlorine dioxide. Meat Sci 60:299-305.

214. Stivarius MR, Pohlman FW, McElyea KS, and Waldroup AL. 2002. Effects of hot water and lactic acid treatment of beef trimmings prior to grinding on microbial, instrumental color and sensory properties of ground beef during display. Meat Sci 60:327-334.

215. Stopforth JD, Ashton LV, Skandamis PN, Scanga JA, Smith GC, Sofos JN, and Belk KE. 2005. Single and sequential treatment of beef tissue with lactic acid, ammonium hydroxide, sodium metasilicate, and acidic and basic oxidized water to reduce numbers of inoculated *Escherichia coli* O157:H7 and Salmonella Typhimurium. Food Protect Trends 25:14-22.

216. Stopforth JD, Ikeda JS, Kendall PA, and Sofos JN. 2004. Survival of acid-adapted or nonadapted *Escherichia coli* O157:H7 in apple wounds and surrounding tissue following chemical treatments and storage. Int J Food Microbiol 90:51-61.

217. Stopforth JD, Samelis J, Sofos JN, Kendall PA, and Smith GC. 2002. Biofilm formation by acid-adapted nonadaoted *Listeria monocytogenes* in fresh its beef decontamination washings and its subsequent inactivation with sanitizers. J Food Prot 65:1717-1727.

218. Stopforth JD, Samelis J, Sofos JN, Kendall PA, and Smith GC. 2003. Influence of extended acid stressing in fresh beef decontamination runoff fluids on sanitizer resistance of acid-adapted *Escherichia coli* O157:H7 in biofilms. J Food Prot 66:2258-2266.

219. Stopforth JD, Samelis J, Sofos JN, Kendall PA, and Smith GC. 2003. Influence of organic acid concentration on survival of *Listeria monocytogenes* and *Escherichia coli* O157:H7 in beef carcass wash water and on model equipment surfaces. Food Microbial 20:651-660.

220. Stopforth JD, Yoon Y, Belk KE, Scanga JA, Kendall PA, Smith GC, and Sofos JN. 2004. Effect of simulated spray chilling with chemical solutions on acid-habituated and non-acid-habituated *Escherichia coli* O157:H7 cells attached to beef carcass tissue. J Food Prot 67:2099-2106.

221. Su YC and Morrissey MT. 2003. Reducing levels of *Listeria monocytogenes* contamination on raw salmon with acidified sodium chlorite. J Food Prot 66:812-818.

222. Szabo EA, Simons L, Coventry MJ, and Cole MB. 2003. Assessment of control measures to achieve a food safety objective of less than 100 CFU of *Listeria monocytogenes* per gram at the point of consumption for fresh precut iceberg lettuce. J Food Prot 66:256-264.

223. Takeuchi K and Frank JF. 2001. Direct microscopic observation of lettuce leaf decontamination with a prototype fruit and vegetable washing solution and 1% NaCl-NaHCO3. J Food Prot 64:1235-1239.

224. Taormina PJ and Beuchat LR. 2002. Survival of *Listeria monocytogenes* in commercial food-processing equipment cleaning solutions and subsequent sensitivity to sanitizers and heat. J Appl Microbiol 92:71-80.

225. Taormina PJ, Beuchat LR, and Slutsker L. 1999. Infections associated with eating seed sprouts: An international concern. Emerg Infect Dis 5:626-634.

226. Thomas JL, Palumbo MS, Farrar JA, Farver TB, and Cliver DO. 2003. Industry practices and compliance with US food and drug administration guidelines among California sprout firms. J Food Prot 66(7):1253-1259.

227. Ukuku DO. 2004. Effect of hydrogen peroxide treatment on microbial quality and appearance of whole and fresh-cut melons contaminated with *Salmonella* spp.

Int J Food Microbiol 95:137-146.

228. Ukuku DO and Fett W. 2002. Behavior of *Listeria monocytogenes* inoculated on cantaloupe surfaces and efficacy of washing treatments to reduce transfer from rind to fresh-cut pieces. J Food Prot 65:924-930.

229. Ukuku DO and Fett WF. 2004. Effect of nisin in combination with EDTA, sodium lactate, and potassium sorbate for reducing *Salmonella* on whole and fresh-cut cantaloupe. J Food Prot 67:2143-2150.

230. Ukuku DO, Pilizota V, and Sapers G M. 2004. Effect of hot water and hydrogen peroxide treatments on survival of *Salmonella* and microbial quality of whole and fresh-cut cantaloupe. J Food Prot 67:432-437.

231. Wachtel MR and Charkowski AO. 2002. Cross-contamination of lettuce with *Escherichia coli* O157:H7. J Food Prot 65(3):465-470.

232. Wagenaar CL and Snijders JMA. 2004. Decontamination of broilers with hydrogen peroxide stabilised with glycerol during processing. Int J Food Microbiol 91:205-208.

233. Wang H, Hao Feng, and Yaguang Luo. 2004. Microbial reduction and storage quality of fresh-cut cilantro washed with acidic electrolyzed water and aqueous ozone. Food Res Int 37:949-956.

234. Warriner K, Spaniolas S, Dickinson M, Wright C, and Waites WM. 2003. Internalization of bioluminescent *Escherichia coli* and *Salmonella* Montevideo in growing bean sprouts. J Appl Microbiol 95:719-727.

235. Wei H, Wolf G, and Hammes WP. 2005. Combination of warm water and hydrogen peroxide to reduce the numbers of *Salmonella* Typhimurium and *Listeria innocua* on field salad (*Valerianella locusta*). Eur Food Res Technol 221:180-186.

236. Weiss A and Hammes WP. 2003. Thermal seed treatment to improve the food safety status of sprouts. J Appl Bot 77:152-155.

237. Weiss A and Hammes WP. 2005. Efficacy of heat treatment in the reduction of salmonellae and *Escherichia coli* O157:H– on alfalfa, mung bean and radish seeds used for sprout production. Eur Food Res Technol 221:187-191.

238. Whyte P, Collins JD, McGill K, Monahan C, and O'Mahony H. 2001. Quantitative investigation of the effects of chemical decontamination procedures on the microbiological status of broiler carcasses during processing. J Food Prot 64:179-183.

239. Whyte P, Mc Gill K, and Collins JD. 2004. An assessment of steam pasteurization and hot water immersion treatments for the microbiological decontamination of broiler carcasses (vol 20, pg 111, 2003). Food Microbial 21:247.

240. Whyte P, McGill K, and Collins JD. 2003. An assessment of steam pasteurization and hot water immersion treatments for the microbiological decontamination of broiler carcasses. Food Microbial 20:111-117.

241. Winthrop KL, Palumbo MS, Farrar JA, Mohle-Boetani JC, Abbott S, Beatty ME, Inami G, and Werner SB. 2003. Alfalfa sprouts and *Salmonella* Kottbus infection: A multistate outbreak following inadequate seed disinfection with heat and chlorine. J Food Prot 66(1):13-17.

242. Wirtanen G, Aalto M, Harkonen P, Gilbert P, and Mattila-Sandholm T. 2001. Efficacy testing of commercial disinfectants against foodborne pathogenic and spoilage microbes in biofilm-constructs. European Food Res Technol 213:409-414.

243. Wong ACL. 1998. Biofilms in food processing environments. J Dairy Sci 81:2765-2770.

244. Wong HC, Chung YC, and Yu JA. 2002. Attachment and inactivation of *Vibrio parahaemolyticus* on stainless steel and glass surface. Food Microbial 19:341-350.

245. Workneh TS, Osthoff G, Pretorius JC, and Hugo CJ. 2003. Comparison of anolyte and chlorinated water as a disinfecting dipping treatment for stored carrots. J Food Qual 26:463-474.

246. Yang H, Swem BL, and Li Y. 2003. The effect of pH on inactivation of pathogenic bacteria on fresh-cut lettuce by dipping treatment with electrolyzed water. J Food Sci 68:1013-1017.

247. Yaun BR , Sumner SS, Eifert JD, and Marcy JE. 2004. Inhibition of pathogens on fresh produce by ultraviolet energy. Int J Food Microbiol 90:1-8.

248. Yoshida K, Achiwa N, Katayose M, Kizawa Y, Koseki S, Isobe S, and Abe K. 2005. Enhancement of sterilization effect on pre-cut vegetable using electrolyzed water. Part I. Decontamination of pre-cut green onion using electrolyzed water and observations of its surface by confocal scanning laser microscope. J Japan Soc Food Sci Technol 52:266-272.

249. Zhang LK, Lu ZX, Yu ZF, and Gao X. 2005. Preservation of fresh-cut celery by treatment of ozonated water. Food Control 16:279-283.