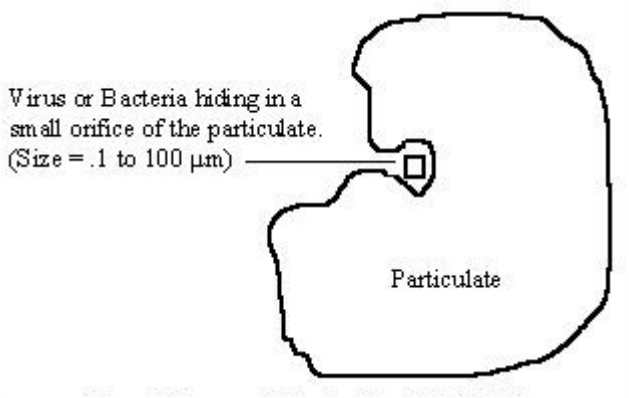
Ozone Disinfection

Ozone Disinfection / Ozone Contact Time Kinetics
Water is disinfected but never completely sterilized in the water treatment process. This disinfection is a two part process that includes:

Figure 1:
Simplified Diagram of a Pathogen Encapsulated by a Particulate



Courtesy of *Eric Karch and David Loftis*

- Removal of particulate matter by filtration. A rule of thumb is that high turbidity in the effluent is a potential health risk, because viruses and bacteria can hide within the rough texture of particulates. Therefore, removal of the particulates reduces the chance of pathogenic microorganisms in the effluent. (Refer to Figure 1)
- Inactivation of pathogenic microorganisms by chlorine, chlorine dioxide, ozone, or other disinfectants: Contact time and kinetics are simply a measure of the inactivation due to time and concentration of the disinfectant. The USEPA has developed regulations for the minimum kill percentages (inactivation) necessary for public water to be considered potable. These regulations include a minimum disinfection of:
    - Three log (99.9%) for Giardia lamblia cysts
    - Four log (99.99%) for enteric viruses

In "water treatment terms" 1 log inactivation is referred to as 1 credit inactivation. Different types of filtration are assigned certain removal credits. For example, conventional filtration is worth 2.5 credits for Giardia cysts. Since the EPA requires 3 log (credit) removal, an additional 0.5 credit inactivation from disinfection must be attained.

Varying degrees of disinfection can be attained by altering the type and concentration of disinfectant, as well as the time water is in contact with the disinfectant. The decision to use one type of disinfectant versus another will set the precedence for the remainder of the values needed to attain the proper disinfection. The time untreated water is exposed to the disinfectant and the concentration of that disinfectant are the main factors in the equation that will be discussed in the next section. [Notice that the units of contact time are (mg/l)(min).]

Relationship Between Kill Efficiency and Contact Time

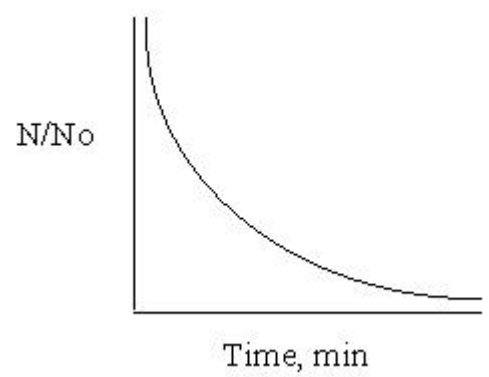


Figure 2: Graphical Representation of Chick's Law Edit Heading Taken from R.C. Hoen's CE 4104 Spring Notes.

A relationship between kill efficiency and contact time, was developed by Harriet Chick while she was a Fellow in the Pasteur institute in Paris, France. The research yielded data supporting her relationship that is shown in Figure 2. (No) represents the initial number of organisms and N is the number of organisms at time t. As contact time between water and disinfectant increases, the ratio of No/N decreases as Chick's Law predicts.

$$\ln\left(\frac{N_t}{N_0}\right) = -\lambda c' t$$

where,
N_o = initial number of organisms
N_t = number of organisms at time t
C = concentration of disinfectant (mg/l)
t = contact time (min)
λ = coefficient of specific lethality
n = coefficient depending on disinfectant type and pH

Factors Affecting C*t Values

- As pH increases the value of C*t also needs to be increased. This can be explained by examining the effects of pH on free chlorine. As the pH increases, more of the weak disinfectant (OCl-) exists than the strong disinfectant (HOCl-), thus increasing the C*t value. Refer to Table 1 below.
- The greater log removal needed, the greater the C*t needs to be, as can be seen in Table 1.

Table 1: C*t for Removal of Giardia Cysts in Relation to Log Removal and pH

Log Removal	pH <6	pH 6.5	pH 7.0	pH 7.5
1.0	46	54	65	79
1.5	69	82	98	119
2.0	91	109	130	158
2.5	114	136	163	198

Information from the *Virginia Department of Health Waterworks Regulations*

- The strength of a disinfectant directly affects the C*t. For a weak disinfectant, the C*t will have to be higher than for a strong disinfectant. As Table 2 below shows, ozone is the strongest disinfectant, thus the C*t value required is less when compared to chlorine and chlorine dioxide.
- Different organisms have different resistances to disinfectants. If an organism has a strong resistance to a certain disinfectant, the C*t will be higher than for an organism with a weaker resistance. Refer to Table 2 below.

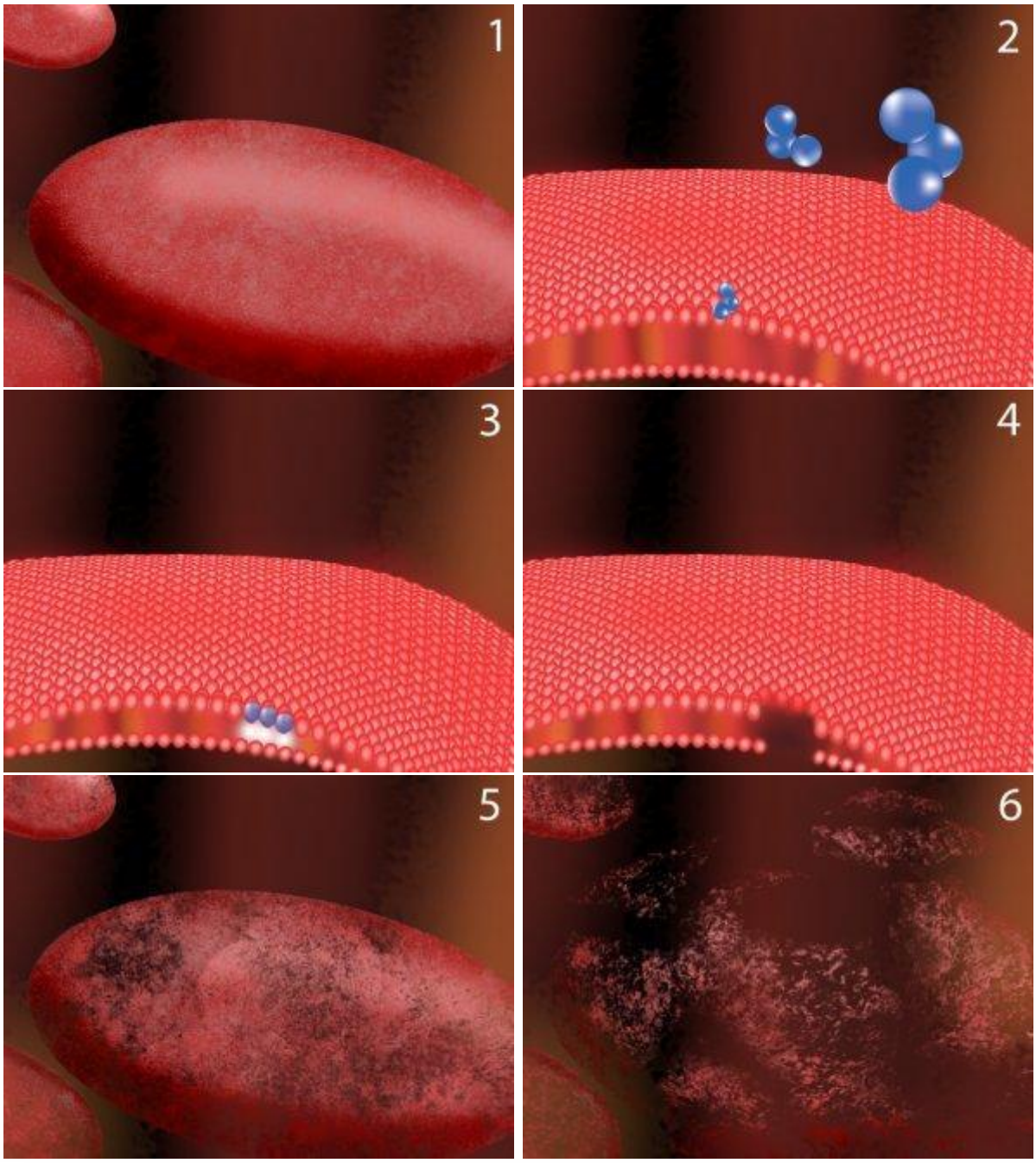
Table 2: C*t Values for the 99% Inactivation at 5 Degrees Celsius of Organisms Using Various Disinfectants

Organism	Free Chlorine (pH 6-7)	Chlorine Dioxide (pH 6-7)	Ozone (pH 6-7)
E.Coli	0.034-0.05	0.4-0.75	0.02
Rotavirus	0.01-0.05	0.2-2.1	0.006-0.06
Giardia lamblia cysts	47-150	-	0.5-0.6
Crytosporidium parvum	7200*	79*	5-10*

* 99% inactivation at 25 degrees C

Hoff, J.C., Inactivation of Microbial Agents by Chemical Disinfectants, EPA/600/2-86/067, 1986

Effect of Ozone on Bacteria



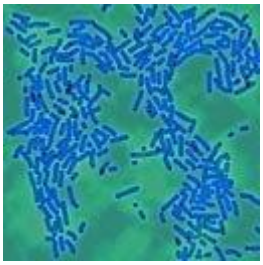
1. A healthy bacillus bacterial cell (waiting to ruin your day).
2. Zooming in closer, an ozone molecule (blue) comes into contact with the cell wall. The cell wall is vital to the bacteria because it ensures the organism can maintain its shape.
3. As ozone molecules make contact with the cell wall, a reaction called an oxidative burst occurs which literally creates a tiny hole in the cell wall.
4. A newly created hole in the cell wall has injured the bacterium.
5. The bacterium begins to loose its shape while ozone molecules continue creating holes in the cell wall.
6. After thousands of ozone collisions over only a few seconds, the bacterial wall can no longer maintain its shape and the cell dies.

As a comparison based on 99.99% of bacterial concentration being killed and time taken, ozone is:

- **25** times that of **HOCl** (Hypochlorous Acid)
- **2,500** times that of **OCl** (Hypochlorite)
- **5,000** times that of **NH_2Cl** (Chloramine)

Furthermore, ozone is at least **ten times stronger than chlorine** as a disinfectant. Chlorine reacts with meat forming highly toxic and carcinogenic compounds called THMs or tri-halomethanes - rendering meats lesser quality products. THMs were also implicated as carcinogens related to kidney, bladder, and colon cancers. Chlorine also results in the production of chloroform, carbon tetrachloride, and chloromethane besides THMs. On the other hand, ozone does not leave any trace of residual product after its oxidative reaction.

Ozone Effects on Pathogens



Ozone Effects on Specific Bacteria, Viruses and Molds
Bacteria are microscopically small, single-cell creatures having a primitive structure. The bacteria body is sealed by a relatively solid-cell membrane. Ozone interferes with the metabolism of bacterium-cells, most likely through inhibiting and blocking the operation of the enzymatic control system. A sufficient amount of ozone breaks through the cell membrane, and this leads to the destruction of the bacteria.

Viruses are small, independent particles, built of crystals and macromolecules, Unlike bacteria, they multiply only within the host cell. They transform protein of the host cell into proteins of their own. Ozone destroys viruses by diffusing through the protein coat into the nucleic acid core, resulting in damage of the viral RNA. At higher concentrations, ozone destroys the capsid, or exterior protein shell by oxidation so DNA (deoxyribonucleic acid), or RNA (ribonucleic acid) structures of the microorganism are affected.

* 1 mg/l = 1 PPM

Pathogen	Dosage
Aspergillus Niger (Black Mount)	Destroyed by 1.5 to 2 mg/I
Bacillus Bacteria	Destroyed by 0.2 m/I within 30 seconds
Bacillus Anthracis (causes anthrax in	Ozone susceptible

Pathogen	Dosage
sheep, cattle and pigs. Also a human pathogen)	
Bacillus cereus	99% destruction after 5-min at 0.12 mg/l in water
B. cereus (spores)	99% destruction after 5-min at 2.3 mg/l in water
Bacillus subtilis	90% reduction at 0.10-PPM for 33 minutes
Bacteriophage f2	99.99% destruction at 0.41 mg/l for 10-seconds in water
Botrytis cinerea	3.8 mg/l for 2 minutes
Candida Bacteria	Ozone susceptible
Clavibacter michiganense	99.99% destruction at 1.1 mg/l for 5 minutes
Cladosporium	90% reduction at 0.10-PPM for 12.1 minutes
Clostridium Bacteria	Ozone susceptible
Clostridium Botulinum Spores. Its toxin paralyzes the central nerve system, being a poison multiplying in food and meals.	0.4 to 0.5 mg/l threshold value
Coxsackie Virus A9	95% destruction at 0.035 mg/l for 10-seconds in water
Coxsackie Virus B5	99.99% destruction at 0.4 mg/l for 2.5-minutes in sludge effluent
Diphtheria Pathogen	Destroyed by 1.5 to 2 mg/l

Pathogen	Dosage
Eberth Bacillus (Typhus abdomanalis). Spreads typically by aqueous infection and causes typhoid.	Destroyed by 1.5 to 2 mg/l
Echo Virus 29: The virus most sensitive to ozone.	After a contact time of 1 minute at 1 mg/l of ozone, 99.999% killed.
Enteric virus	95% destruction at 4.1 mg/l for 29 minutes in raw wastewater
Escherichia Coli Bacteria (from feces)	Destroyed by 0.2 mg/l within 30 seconds in air
E-coli (in clean water)	99.99% destruction at 0.25 mg/l for 1.6 minutes
E-coli (in wastewater)	99.9% destruction at 2.2 mg/l for 19 minutes
Encephalomyocarditis Virus	Destroyed to zero level in less than 30 seconds with 0.1 to 0.8 mg/l.
Endamoebic Cysts Bacteria	Ozone susceptible
Enterovirus Virus	Destroyed to zero level in less than 30 seconds with 0.1 to 0.8 mg/l.
Fusarium oxysporum f.sp. lycopersici	1.1 mg/l for 10 minutes
Fusarium oxysporum f.sp. melonogea	99.99 % destruction at 1.1 mg/l for 20 minutes
GDVII Virus	Destroyed to zero level in less than 30 seconds with 0.1 to 0.8 mg/l.
Hepatitis A virus	99.5% reduction at 0.25

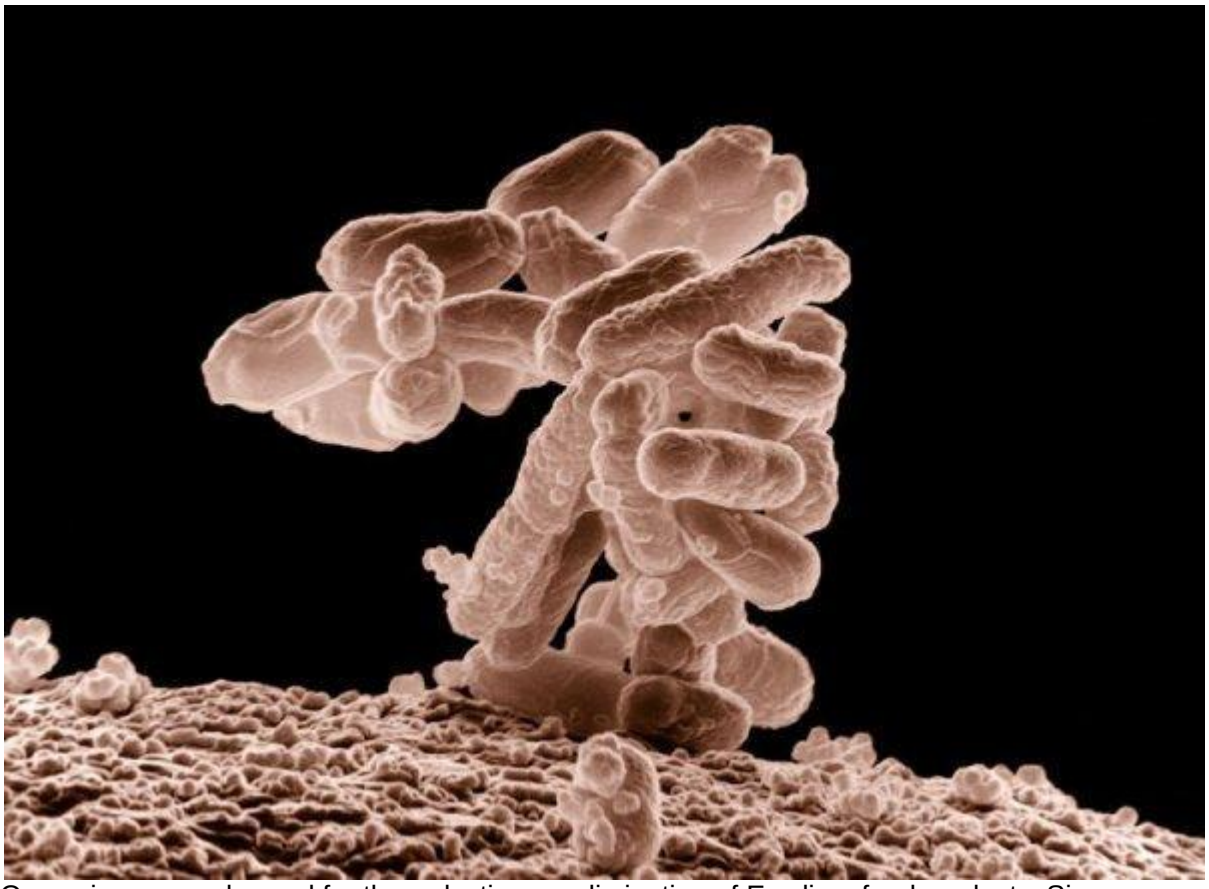
Pathogen	Dosage
	mg/l for 2-seconds in a phosphate buffer
Herpes Virus	Destroyed to zero level in less than 30 seconds wit 0.1 to 0.8 mg/l.
Influenza Virus	0.4 to 0.5 mg/l threshold value
Klebs-Loffler Bacillus	Destroyed by 1.5 to 2 mg/l
Legionella pneumophila	99.99% destruction at 0.32 mg/l for 20 minutes in distilled water
Luminescent Basidiomycetes (species having no melanin pigment).	Destroyed in 10 minutes at 100-PPM
Mucor piriformis	3.8 mg/l for 2 minutes
Mycobacterium avium	99.9% with a CT value of 0.17 in water(scientifically reviewed document)
Mycobacterium foruitum	90% destruction at 0.25 mg/l for 1.6 minutes in water
Penicillium Bacteria	Ozone susceptible
Phytophthora parasitica	3.8 mg/l for 2 minutes
Poliomyelitis Virus	99.99% kill with 0.3 to 0.4 mg/l in 3-4 minutes
Poliovirus type 1	99.5% destruction at 0.25 mg/l for 1.6 minutes in water
Proteus Bacteria	Very susceptible
Pseudomonas Bacteria	Very susceptible

Pathogen	Dosage
Rhabdovirus virus	Destroyed to zero level in less than 30 seconds with 0.1 to 0.8 mg/l
Salmonella Bacteria	Very susceptible
Salmonella typhimurium	99.99% destruction at 0.25 mg/l for 1.67 minutes in water
Schistosoma Bacteria	Very susceptible
Staph epidermidis	90% reduction at 0.1-ppm for 1.7 min
Staphylococci	Destroyed by 1.5 to 2.0 mg/l
Stomatitis Virus	Destroyed to zero level in less than 30 seconds with 0.1 to 0.8 mg/l
Streptococcus Bacteria	Destroyed by 0.2 mg/l within 30 seconds
Verticillium dahliae	99.99 % destruction at 1.1 mg/l for 20 minutes
Vesicular Virus	Destroyed to zero level in less than 30 seconds with 0.1 to 0.8 mg/l
Virbrio Cholera Bacteria	Very susceptible
Vicia Faba progeny	Ozone causes chromosome aberration and its effect is twice that observed by the action of X-rays

The effect of ozone below a certain critical concentration value is small or zero. Above this level all pathogens are eventually destroyed. This effect is called all-or-none response and the critical level the "threshold value".

Last Updated: April 4, 2012

Ozone and E.coli Papers



Ozone is commonly used for the reduction, or elimination of E.coli on food products. Since achieving GRAS approval for the use of ozone for direct contact with food in 2001 the use of ozone for the elimination of E.coli has increased significantly. The specific strain of E.coli most frequently targeted is E.coli O157:H7.

We have assembled some research on the use of ozone specifically for E.coli O157:H7. This research is below, we have provided the white paper title, author, and abstract for your review, along with a link to the full paper for your use.

If you have any further questions on the use of ozone for the inactivation of E.coli O157:H7, or any other pathogen, please contact our application engineers today .

Utilization of Ozone for the Decontamination of Small Fruits

Published by the American Society of Agricultural and Biological Engineers, St. Joseph, Michigan
www.asabe.org

Citation: Paper number 056147, 2005 ASAE Annual Meeting . @2005
Authors: Katherine L. Bialka, Ali Demirci
Keywords: E. coli O157:H7, Salmonella, strawberry, gaseous ozone

Abstract

Each year there are approximately 76 million foodborne illnesses and fresh produce is the second most common vehicle for such illnesses. Small fruits have been implicated in several outbreaks although none have been bacterial. Prior to market small fruits are not washed or

treated in any manner so as to extend their shelf life. Washing alone is not a viable option and the use of novel technologies needs to be investigated. One such technology is ozone which has been used to treat drinking water since the late nineteenth century. The efficacy of gaseous ozone to decontaminate pathogens on strawberries, which were used as a model for small fruits, was investigated in this study. Strawberries were artificially contaminated with 5 strains of E. coli O157:H7 and Salmonella. Fruits were treated with 4 ozone treatments; i) continuous ozone flow for 2, 4, 8, 16, 32, and 64 min, ii) pressurized ozone (83 kPa) for 2, 4, 8, 16, 32, and 64 min, iii) continuous ozone (64 min) followed by pressurized ozone (64 min). Maximum reductions of 1.81, 2.32, and 2.96 log10 CFU/g of E. coli O157:H7 were achieved for continuous, pressurized, and continuous followed by pressurized ozone, respectively. For Salmonella reductions of 0.97, 2.18, and 2.60 log10 CFU/g were achieved for continuous, pressurized, and continuous followed by pressurized ozone, respectively. It was concluded that continuous ozone was the least effective treatment, and that there was no significant difference between pressurized ozone treatment and continuous followed by pressurized ozone treatment. These results demonstrate that gaseous ozone has the potential to be used a decontamination method for small fruits.

http://asae.frymulti.com/abstract.asp?aid=19588&t=2

Effectiveness of ozone for inactivation of Escherichia coli and Bacillus cereus in pistachios

Authors: Meltem Yesilcimen Akbas[1] & Murat Ozdemir[2*]

1Department of Biology, Gebze Institute of Technology, PO Box 141, 41400 Gebze, Kocaeli, Turkey
2 Department of Chemical Engineering, Section of Food Technology, Gebze Institute of Technology,
PO Box 141, 41400 Gebze, Kocaeli, Turkey
Correspondence to *Fax: +90 262 653 8490;
e-mail: ozdemirm@gyte.edu.tr
Copyright 2005 Institute of Food Science and Technology Trust Fund

Abstract
The effectiveness of ozone for the decontamination of Escherichia coli and Bacillus cereus in kernels, shelled and ground pistachios was investigated. Pistachios were inoculated with known concentrations of E. coli and B. cereus. Pistachio samples were exposed to gaseous ozone in a chamber at three different concentrations (0.1, 0.5 and 1.0 ppm) for various times (+/- "360 min) at 20°C and 70% relative humidity. The effectiveness of ozone against E. coli and B. cereus increased with increasing exposure time and ozone concentration. The physico-chemical properties including: pH, free fatty acids and peroxide values, colour and fatty acid composition of pistachios did not change significantly after the ozonation treatments, except for the peroxide value of ground pistachios ozonized at 1.0 ppm for 360 min. Ozone concentration of 1.0 ppm was effective in reducing E. coli and B. cereus counts in kernels and shelled pistachios, while ozone concentrations <1.0 ppm were found to be appropriate in reducing the number of both bacteria in ground pistachios without having any change in their physico- chemical properties.

Application of Ozone for Inactivation of Escherichia Coli O157:H7 on Inoculated Alfalfa Sprouts

Journal Of Food Processing And Preservation Research, 27 (2003) 51-64

Authors: Sharma, Demirci, Beuhat, Fett

Interpretive Summary
Alfalfa sprouts contaminated with the bacterial pathogens Salmonella and Escherichia coli O157:H7 have been the source of several foodborne outbreaks in the US and other countries. New, more effective antibacterial treatments are required to ensure the microbial safety of

sprouts for the consuming public. In this study, we tested the ability of ozone in water to eliminate E. coli O157:H7 from inoculated alfalfa sprouts. Treatments (from 2 to 64 minutes in durations) with ozone in water (up to 21 ppm) were tested. In some experiments the ozone was continuously fed into the water solution during treatment with or without pressurization. Immersion of sprouts into ozone in water reduced bacterial populations by less than 90%. With continuous feeding of ozone, reductions increased to 99%. The use of pressure during ozone treatments did not increase efficacy. The use of ozone alone will not ensure the microbial safety of sprouts, but ozone in combination with other antibacterial treatments may be able to achieve that goal.

Technical Abstract

Chemical treatments to eliminate pathogens on inoculated sprouts have shown little success. This study investigated the antimicrobial potential of ozone on alfalfa sprouts. Alfalfa sprouts inoculated with a five strain cocktail of Escherichia coli O157:H7 were immersed in water containing 21 ppm ozone for 2, 4, 8, 16, 32, 64 min at 4 C. To increase accessibility of ozone into sprout crevices alternative treatments with continuous ozone sparging with and without pressurization were evaluated. Immersion of inoculated alfalfa sprouts in water containing 21-ppm ozone reduced the population of E. coli O157:H7 by 85.8% at 64 min. There was no significant difference (P > 0.05) between treatment and control and also between different time intervals. Continuous ozone sparging resulted in 85.0 to 99.4% reduction, which was significantly higher (P 0.05) than reduction by sparging with air. Application of low hydrostatic pressure of 12 psi for 5 min subsequent to continuous ozone sparging for 2 - 64 min reduced E. coli O157:H7 populations by 99.0%. Pressurized ozone treatments did not differ significantly from un-pressurized ozone treatments except at 32 min. Ozone treatment did not have any visible detrimental effect on sprouts quality. Further investigation is required to develop methods for ozone introduction for decontaminating sprouts to reduce health risk. However ozone has the potential to replace chemical treatments being used.

http://www.sproutnet.com/Research/application_of_ozone.htm

Efficacy of Ozone Against Escherichia coli O157:H7 on Apples

Authors: M. Achen and 1 A.E. Yousef 1 Authors are with the Department of Food Science and Technology, The Ohio State University, Parker Hall, 2015Fyffe Rd., Columbus, Ohio 43210. Direct inquiries to author Yousef (E-mail: yousef.1@osu.edu).

This research was supported by a grant from the Ohio Agricultural Research and Development Center. The authors to thank J.G. Kim for his valuable advice and technical support.

Copyright 2001 by the Institute of Food Technologists

Abstract

Apples were inoculated with *Escherichia coli O157:H7* and treated with ozone. Sanitization treatments were more effective when ozone was bubbled during apple washing than by dipping apples in preozonated water. The corresponding decreases in counts of *E. coli O157:H7* during 3-min treatments were 3.7 and 2.6 $\log_{10}$ CFU on apple surface, respectively, compared to < 1 $\log_{10}$ CFU decrease in the stem-calyx region in both delivery methods. Optimum conditions for decontamination of whole apples with ozone included a pretreatment with a wetting agent, followed by bubbling ozone for 3 min in the wash water, which decreased the count of E. coli O157:H7 by 3.3 $\log_{10}$CFU/g.

Source: http://www3.interscience.wiley.com/journal/119015309/abstract

Full Paper: Efficacy of Ozone Against Escherichia coli O157:H7 on Apples

Efficacy of aqueous ozone for the decontamination of Escherichia coli O157:H7 and Salmonella on raspberries and strawberries.

Authors: Bialka KL, Demirci A

Department of Agricultural and Biological Engineering, Pennsylvania State University, University Park, Pennsylvania 16802, USA.
J Food Prot. 2007 May;70(5):1088-92.

Abstract
The efficacy of ozone as a water additive for washing raspberries and strawberries was investigated. Pathogen-inoculated fruits were treated with aqueous ozone concentrations of 1.7 to 8.9 mg/liter at 20 degrees C for 2 to 64 min, with an aqueous ozone concentration of 21 mg/liter at 4 degrees C for 64 min, or with water as a control. Maximum pathogen reductions on raspberries were 5.6 and 4.5 log CFU/g for Escherichia coli O157:H7 and Salmonella, respectively, at 4 degrees C, whereas reductions on strawberries were 2.9 and 3.3 log CFU/g for E. coli O157:H7 and Salmonella, respectively, at 20 degrees C after 64 min. Washing with water (sparging with air as control) resulted in reductions of approximately 1 log CFU/g. The results presented here indicate that aqueous ozone may be useful as a decontaminant for small fruits.

http://www.ncbi.nlm.nih.gov/pubmed/17536665

Inactivation of E. coli O157:H7 in apple cider by ozone at various temperatures and concentrations

Authors: STEENSTRUP Lotte Dock; FLOROS John D.
Authors' Affiliations: BioCentrum-DTU, Technical University of Denmark, Soltofts Plods Bldg. 221, 2800 Lyngby, DANEMARK
Department of Food Science, 111 Borland Laboratory, Penn State University, University Park, PA 16802, ETATS-UNIS

Abstract
The effect of temperature (5-20C) at 860 ppm (v/v) ozone and different gaseous ozone concentrations above 1,000 ppm on inactivation of E. coli O157:H7 in apple cider was studied. Lag times ranged from 3.5 min at 20C to 6.7 min at 10C before the on-set of E. coli O157:H7 inactivation. D-values ranged from 0.6 to 1.5 min at 20C and 5C, respectively. After ozone treatment of cider for 14 min, dissipation of ozone from cider was slow, decreasing to about 5 mg/L after 2 h at 5C. At high gaseous ozone concentration, lag time was shortest and D-value lowest. There was a critical concentration of dissolved ozone of about 5-6 mg/L at 20C, before the on-set of E. coli O157:H7 inactivation in the cider. Total processing times, based on lag time plus 5D, ranged from about 4 to 14 min depending on temperature and ozone concentration. Overall, inactivation of E. coli O157:H7 by ozone was fast enough to allow practical applications in cider production, and it should be considered as an alternative to thermal pasteurization.

Journal Title: Journal of food processing and preservation ISSN 0145-8892 CODEN JFPPDL

Source: 2004, vol. 28, no2, pp. 103-116 [14 page(s) (article)] (1 p.3/4)

http://cat.inist.fr/?aModele=afficheN&cpsidt=15974211

Inactivation of Escherichia coli O157:H7 and Natural Microbiota on Spinach Leaves Using Gaseous Ozone during Vacuum Cooling and Simulated Transportation

Authors: Vurma, Mustafa(1); Pandit, Ram B.(2); Sastry, Sudhir K.(2); Yousef, Ahmed E.(1)
Source: Journal of Food Protection®, Volume 72, Number 7, July 2009, pp. 1538-1546(9)
Publisher: International Association for Food Protection

Abstract
The aim of this study was to integrate an ozone-based sanitization step into existing processing practices for fresh produce and to evaluate the efficacy of this step against Escherichia coli O157:H7. Baby spinach inoculated with E. coli O157:H7 (+/-10^7 CFU/g) was treated in a pilot-scale system with combinations of vacuum cooling and sanitizing levels of ozone gas (SanVac). The contribution of process variables (ozone concentration, pressure, and treatment time) to lethality was investigated using response-surface methodology. SanVac processes decreased E. coli O157:H7 populations by up to 2.4 log CFU/g. An optimized SanVac process that inactivated 1.8 log CFU/g with no apparent damage to the quality of the spinach had the following parameters: O_3 at 1.5 g/kg gas-mix (935 ppm, vol/vol), 10 psig of holding pressure, and 30 min of holding time. In a separate set of experiments, refrigerated spinach was treated with low ozone levels (8 to 16 mg/kg; 5 to 10 ppm, vol/vol) for up to 3 days in a system that simulated sanitization during transportation (SanTrans). The treatment decreased E. coli populations by up to 1.4 log CFU/g, and the optimum process resulted in a 1.0-log inactivation with minimal effect on product quality. In a third group of experiments, freshly harvested unprocessed spinach was inoculated with E. coli O157:H7 and sequentially subjected to optimized SanVac and SanTrans processes. This double treatment inactivated 4.1 to +/-5.0 log CFU/g, depending on the treatment time. These novel sanitization approaches were effective in considerably reducing the E. coli O157:H7 populations on spinach and should be relatively easy to integrate into existing fresh produce processes and practices.

http://www.ingentaconnect.com/content/iafp/jfp/2009/00000072/00000007/art00026

Decontamination of Escherichia coli O157:H7 and Salmonella enterica on blueberries using ozone and pulsed UV-light

Authors: K L Bialka; A Demirci
Publication Detail: Type: Evaluation Studies; Journal Article; Research Support, Non-U.S. Gov't; Research Support, U.S. Gov't, Non-P.H.S.
Journal Detail:
Title: Journal of Food Science Volume: 72 ISSN: 1750-3841 ISO Abbreviation: J. Food Sci. Publication Date: 2007 Nov
Created Date: 2007-11-23 Completed Date: 2008-03-24

Abstract
Efficacy of gaseous ozone, aqueous ozone, and pulsed UV-light was evaluated for the purpose of decontaminating blueberries artificially contaminated with either *Escherichia coli O157:H7* or Salmonella. Blueberries were exposed to 4 different gaseous ozone treatments: continuous ozone exposure, pressurized ozone exposure, and 2 combined treatments. Maximum reductions of Salmonella and *E. coli O157:H7* after 64-min pressurized or 64-min continuous exposure were 3.0 and 2.2 log(10) CFU/g, respectively. Aqueous ozone experiments were conducted at 20 degrees C and 4 degrees C and zero plate counts were observed for *E. coli O157:H7* and *Salmonella* after 64 min of ozone exposure at 20 degrees C. Finally, pulsed UV-light was evaluated at 3 different distances from the light. Maximum reductions of 4.3 and 2.9 log(10) CFU/g were observed at 8 cm from the light after 60 s of treatment for Salmonella and *E. coli O157:H7*, respectively. A sensory analysis as well as color analysis was performed on blueberries from each treatment agent; neither analysis detected a difference between treated and untreated blueberries. The results presented in this study indicate that ozone and pulsed UVlight are good candidates for decontamination of blueberries.

http://www.biomedsearch.com/nih/Decontamination-Escherichia-coli-O157H7-Salmonella/18034733.html