Institute for Food Safety and Health  
Department of Food Science and Nutrition – SAT  
Illinois Institute of Technology  
Ninth Annual Graduate Student Seminar Day  
*Day Two, Tuesday, April 17th, 2018*  
Moffett Campus, Building 91- Room 216

**PROGRAM**

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Sargun Malik  
Master of Science Degree Candidate, Food Process Engineering  
Department of Food Science and Nutrition  
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Characterization of a Novel Pulsed Light System for Inactivation of  
Listeria monocytogenes ATCC 35152

ABSTRACT: Pulsed light processing can effectively inactivate microorganisms from the surface of foods or in transparent liquid foods. Pulsed light systems currently available in the market operate at a fixed pulse duration and frequency and are not optimized for microbial inactivation. A novel pulsed light system (Model X-1100; Xenon Corporation, USA) enables the researchers to adjust various parameters including pulse duration (100-7000 µsec), voltage (1000-3000 V), frequency (0.1-20 Hz), % of energy (0-100%), and energy (up to 9 J/cm²/pulse of optical energy or 2433 J/pulse of electrical energy). This study evaluated the effect of various parameters (treatment time, voltage, frequency, energy/pulse) on inactivation of Listeria monocytogenes in buffered peptone water (BPW), apple juice, and apple surface. For liquids, a 4-mL of sample (4-mm depth) artificially inoculated with Listeria monocytogenes was treated in a quartz Petri dish (5.5-cm diameter). For solid food, the top surface (skin side) of a slice of apple (1×1×0.5 cm) was inoculated and exposed to various pulsed light treatment conditions. The results indicated that the impact of these factors vary as many of these factors are interrelated. In general, increasing the frequency, input voltage, pulse duration, and percentage of energy, increased the microbial reduction at the tested conditions. For instance, reductions of 1.21 and 5.47 log₁₀ CFU/mL were obtained in BPW and reductions of 1.35 and 4.70 log₁₀ CFU/mL was acquired in apple juice, at 0.1 and 0.82 Hz, respectively, for a 20-sec treatment at 2500 V (50% energy, 700 µsec pulse width). Increased energy per pulse resulted in increased microbial reduction. For example, reductions of 2.30, 5.59, 6.69, and 6.69 log₁₀ CFU/mL were obtained at 645, 1241, 1837, and 2433 J/pulse of electrical energy, respectively, in apple juice. Similarly, reductions of 5.34, 6.45, 6.02, and 6.56 log₁₀ CFU/mL were obtained at 645, 1241, 1837, and 2433 J/pulse, respectively in BPW. Lower reduction was obtained from the skin surface of the apple, for instance, reductions of 0.70 and 1.19 log₁₀ CFU/slice were obtained at 0.10 and 0.82 Hz, respectively, after a 10 seconds treatment at 2500 V (50% energy). Similarly, reductions of 2.44, 2.43, 3.39, and 3.48 log₁₀ CFU/slice were obtained at 645, 1241, 1837, and 2433 J/pulse of electrical energy, respectively, after a 15 seconds treatment at 3000 V (0.2 Hz). Absorption of pulsed light energy resulted in temperature increase in the products. For instance, temperature increase of up to 11°C was observed at the treated conditions. Currently, whole genome sequencing and scanning electron microscopy analysis are being conducted to further understand the effect of various parameters on microbial inactivation. The results suggest that this novel pulsed light system can potentially assist the researchers in optimizing the pulsed light treatment for effective inactivation of target microorganism in different foods.
Suxiao Leng  
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Evaluating the Inactivation of Norovirus and Hepatitis A Virus on Raspberries by Sanitizer Spray

ABSTRACT: Human norovirus and Hepatitis A virus (HAV) have been involved in foodborne illness outbreaks associated with the consumption of contaminated berry products. Interventions such as sanitizer spray washing are applied by the berry industry to minimize the safety risks. The objective of this study was to investigate the effect of sanitizers on inactivation of murine norovirus (MNV-1), a surrogate for human norovirus, and HAV on raspberries. A lab-scale spray bar device was fabricated for this study to simulate industrial settings. Fresh raspberries (25 g) were spot-inoculated with the virus to a level of approximately 10⁴ PFU/g on the surface and dried for 1 h in a biosafety cabinet to allow attachment. Samples were exposed to 50 ppm sodium hypochlorite (chlorine) or 80 ppm peroxycetic acid (PAA) sanitizing spray and held for 20 s. The berries were stored at -20 °C for 1 and 24 hrs after sanitizer exposure. In comparison, virus inoculated raspberries were also washed by submerging in 200 ml of 50 ppm chlorine or 80 ppm PAA solution for 20 s. After treatments, the virus was extracted and recovered from the raspberries, and quantified by viral plaque assay. MNV-1 was reduced by less than 0.5 log PFU/g while the HAV load did not change after chlorine or PAA spray. Post-treatment storage at -20 °C for 1 or 24 hrs did not significantly expedite virus inactivation on raspberries. Dip washing of raspberries with 50 ppm chlorine and 80 ppm PAA were able to reduce the virus on raspberry surface by 1.1-1.7 log PFU/g which was significantly higher than the spray treatment. MNV showed significant reduction by sanitizer dip washing when compared to the wash with water only. However, similar log reduction of HAV was observed in dip washing with or without sanitizer. The results indicate that MNV is moderately more sensitive to sanitizer treatments than HAV. While type of sanitizer (chlorine vs PAA) did not make significant difference, choosing sanitizing methodology (spray vs emersion) is important for reducing virus load on raspberries.
Jian Ding
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Current Assessment of Food-grade Lubricant Transfer into Foods
by Volumetric Piston Filler

ABSTRACT: The machinery used to prepare and process food products needs grease and oil for lubrication of machine parts. H1 (food-grade) lubricants commonly used in the food industry are regulated as indirect additives by the FDA because they may become components of food through migration due to incidental contact between lubricants and foods. The maximum level of H1 lubricants currently permitted in foods is 10 ppm, which was derived from FDA data gathered over 50 years ago. Although modern equipment has been designed to minimize transfer of lubricants during processing and packaging, incidental food contact can still occur resulting from leaks in lubrication systems or over-lubrication. However, there is a lack of data for FDA to re-evaluate and determine whether safety issues in the aspect of chemical migration should be addressed concerning the use of food-grade lubricants in the production of foods. This research was conducted to determine the transfer of an H1 lubricant into two model food systems (50% ethanol and Miglyol) from a volumetric piston filler at worst-case operating conditions. Petrol-Gel food-grade lubricant with a viscosity grade of 70 cSt at 40°C was selected and the aluminum (Al) in the lubricant was targeted as a tracer compound. Analytical methods to quantify Al in both Petrol-Gel and 50% ethanol were successfully developed and validated by using ICP-MS combined with microwave digestion technique. The concentration of Al in the Petrol-Gel was 3103.5 ± 21.8 μg/g. A total 1.35 g of Petrol-gel was applied to four ring gaskets in the filler, and each 50 ml of 50% ethanol was collected into an 80-ml quartz tube at frequent intervals during 80 filling cycles. Results showed that the concentrations of Petrol-Gel transferred into 50% ethanol at each filling cycle ranged from 0.32 to 7.73 ppm, which was less than the current regulation level of 10 ppm. The transfer of Petrol-Gel did not increase over filling cycles. This research will help FDA to calculate more realistic limits of the H1 lubricants permissible in foods at modern food processing conditions as well as estimate consumer dietary exposure to these indirect food additives.
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Effect of Shipping Time, Temperature, and Transport Media on Recovery of *Listeria monocytogenes* from Environmental Swabs

**ABSTRACT:** Environmental sampling is an important tool for monitoring pathogens in food production environments. Sampling is often completed using swabs rehydrated with a transport media to neutralize sanitizers and ensure recovery after transport to a lab. Shipment is recommended at 4 °C for up to 48 h, however the effect of sub-optimal temperatures and extended times is not understood. In the following research the effect of standard (4 °C) and abuse (15 °C) shipping temperatures and extended storage time (up to 72 h) on recovery of *Listeria monocytogenes* (LM) from swabs rehydrated with four transport media with and without a food matrix was assessed. Sanitized surfaces were simulated using stainless steel coupons inoculated with LM at ~10^6 CFU/ 4” x 4” area, dried for 3 h followed by a dip in 10 ppm sodium hypochlorite and additional drying for 1 h. Coupons were sampled with swabs rehydrated with Dey-Engley Neutralizing Broth (D/E), Neutralizing Buffer (NB), BPB, or Letheen Broth (LB) and stored for 0, 24, 48 and 72 h at either 4 or 15 °C prior to quantitation and enrichment. To simulate swabbing on surfaces contaminated with food matrix, melted vanilla ice cream or raw milk cheese whey was added to the swabs prior to storage. LM in swabs were quantitated on MOX agar and enriched with UVM and Fraser broth followed by MOX confirmation. The results depicted that shipping time, temperature, and transport media influences LM detection. Without a food matrix, all transport media allowed detection of LM in swabs stored at 4 and 15 °C, with LM outgrowth seen at 15 °C. Swabs with ice cream at 4 and 15 °C showed reduced detection from all transport media except LB. After 72 h storage at 4 °C, the transport media having the highest % positives were LB>NB=BPB>D/E. In the presence of the cheese whey, LM recovered better in NB and LB than D/E and BPB at 4 °C after 48 and 72 h storage, and was positive in all media at 15 °C after 24h.