The 2021 Annual Meeting of the International Association for Food Protection (IAFP) took place in Phoenix, Arizona, USA from 18-21st July. International Food & Meat Topics takes a look at some of the current research being undertaken.

Each year the IAFP hosts a meeting which provides attendees with information on current and emerging food safety issues, the latest science, innovative solutions to new and recurring problems, and the opportunity to network with thousands of food safety professionals. Held in various locations throughout North America, this meeting has grown over the years to become the leading food safety conference worldwide.

Antimicrobial efficacy of photosensitiser curcumin on food contact surfaces in the cold-smoked fish industry

Karl Matthews, Rutgers, The State University of New Jersey, USA.

Listeria monocytogenes is the number one cause for recall of cold-smoked fish. In addition, 58% of foodborne illnesses are caused by norovirus closely followed by salmonella. These pathogens are transferred by infected individuals or through contact with contaminated products and surfaces. The aim of the study was to evaluate the antimicrobial efficiency of water-soluble photosensitiser curcumin (PSC) against Listeria monocytogenes (six strains), salmonella (three strains), and MS2 (surrogate for norovirus) on food-contact surfaces typical of the smoked seafood industry.

The absorption maximum of photosensitiser curcumin was found to be 414.98nm. A LED light source of wavelength 430nm was constructed and was found to have a wavelength of 111W/m^2. The salmonella strains had a 3-log reduction at 200ppm when it was incubated in curcumin for five minutes and exposed to light at an intensity of 66.6KJ/m^2.

Further studies are being done to determine the best combination of incubation time versus light exposure. Photosensitiser curcumin has shown to be a strong antimicrobial agent.

Furthermore, it is a naturally occurring compound making it an attractive method of sanitation. ■

Impact of antimicrobial application sequence on destruction of salmonella and campylobacter in raw poultry

Robert Ames and Garrett McCoy, Corbion.

Despite numerous interventions throughout processing, Salmonella spp. and Campylobacter spp. continue to proliferate in raw poultry products, leading to illnesses and recalls. New application methodologies may alleviate this challenge.

The purpose of this study was to determine reductions of Salmonella enterica or Campylobacter spp. following sequential or individual dip application of common antimicrobials.

Chicken breasts were trimmed to 5cm^2 surface area with even thickness and inoculated with a cocktail containing Salmonella enterica subsp. enteritidis (ATCC 13076 and 31194), typhimurium (ATCC 13311 and 14028), and heidelberg (ATCC 8326), or a cocktail containing Campylobacter jejuni (ATCC 33560) and Campylobacter coli (ATCC 43483) to achieve a starting population of ca. 5 log CFU/g.

Cells were permitted to attach for 30 minutes post-inoculation in a biosafety cabinet.

Post-attachment, samples were dipped (30 seconds dip with agitation by forceps) in one of the following treatments: 5% buffered lactic acid (BLA; pH 3.5) alone, 200ppm lauric arginate ethyl ester (LAE) alone, BLA followed by LAE, or LAE followed by BLA (15 seconds each application).

Samples were placed on a clean wire rack to dry in a biosafety cabinet for 10 minutes.

Samples were then transferred to sterile bags, diluted 1:1 in Dey-Engley neutralising buffer, and stomached (230 rpm; 30 seconds).

Dilutions were performed in Butterfield's buffer and plated on xylose-lysine-tergitol 4 agar (XLT-4; 35˚C for 24 hours) or Campy-Cefex agar (41˚C for 48 hours).

Samples were enumerated and reductions were compared to the control.

For salmonella and campylobacter, application order of BLA and LAE was not significant ($P>0.05$); however, the co-application of antimicrobials resulted in lower ($P<0.05$) counts than untreated control (average 1.3 and 2.3 log CFU/g reduction compared to control in salmonella and campylobacter, respectively).

Application sequence of two common antimicrobials may not impact destruction of salmonella and campylobacter. ■

Rapid quantification of enterobacteria in raw milk using real-time PCR methods

Matthias Giese, Florian Priller, Cordt Grönewald and Kornelia Berghof-Jäger, BIOTECON Diagnostics.

Raw milk can be contaminated with Enterobacteriaceae and these organisms are often used as microbial hygiene and quality indicators during the production of milk. Challenges for Entero-bacteriaceae quantification is ensuring reagents are free of any contaminating foreign DNA that can result in a high false-positive signal.

By developing a new method for decontaminating the reagents, it can significantly reduce this contamination while preserving quality, stability, and efficiency at the level more sensitive than traditional microbiology.

In this study DNA extraction and amplification was based on the foodproof StarPrep Three Kit and foodproof Enterobacteriaceae plus Salmonella Detection LyoKit.

Reagent D was used during extraction to bind extracellular DNA to discriminate live cells from dead cells.

They spiked matrices (for example growing up milk and BPW) with 10^6 cells/mL of Cronobacter to compare Cq values of untreated and reagent D treated samples and also spiked raw milk with live Escherichia coli (DSM 3008310) to test for sensitivity and recovery.

PCR mix had significantly more positive signals from extracellular DNA templates contaminating the reagents compared to treated and reduced detection of up to > 6 log (approx. ΔCq 20) dead cells.

The Limit of Detection (LOD 95) for Enterobacteriaceae in raw milk samples was 0.8 genome copies (GE) per reaction. ■

Efficacy of disinfectants against human norovirus on food contact surfaces

Clyde Manuel, James Arbogast and Rachel Leslie, GOJO Industries, Inc. Rebecca M. Goulter and Lee-Ann Jaykus, North Carolina State University, Department of Food, Bioprocessing and Nutrition Sciences, USA.

Human Norovirus (HuNoV) is particularly difficult to inactivate with commonly used disinfectants at concentrations appropriate for food contact surfaces. Recently, two new surface disinfectants, Purell Surface Sanitizer (PSS) and Sink & Surface Cleaner Sanitizer (S&S), have come to market with 30 second label claims for HuNoV based on using murine norovirus (MNV) or feline calicivirus (FCV) surrogates.

The purpose of this study was to characterise the viricidal efficacy of PSS (28.5% ethanol) and S&S (0.55 fl.oz/gal dilution, 0.06% dodecylbenzenesulphonic acid and 0.15% lactic acid), in comparison to 400ppm QAC and 200ppm hypochlorite, at 30 and 60 seconds using HuNoV GII.4 Sydney, and the cultivable HuNoV surrogate, Tulane Virus (TuV).

For GII.4 Sydney, PSS produced a 3.55 ± 0.72 and 4.03 ± 0.47 log reduction in genome equivalent copies (GEC), while S&S showed a 0.05 ± 0.14 and 0.23 ± 0.26 log reduction, after 30 and 60 seconds, respectively. In comparison 400ppm QAC produced a 0.22 ± 0.05 and 0.13 ± 0.12 log reduction in GEC, while 200ppm hypochlorite showed a 0.23 ± 0.06 and 0.31 ± 0.10 log reduction, after 30 and 60 seconds, respectively.

Similar inactivation patterns were observed using infectivity assay with TuV, with PSS performing at a level matching the label claim, while S&S showed only minimal log reduction. These data highlight the importance of using relevant surrogates and supplementing data with HuNoV studies to produce a more comprehensive picture of product efficacy in disinfection studies. ■

Salmonella spp. and Listeria monocytogenes behaviour with chitosan application on pig carcase samples

Maria Ciríaco and Rui Silva – Department of Veterinary Sciences, School of Agrarian and Veterinary Sciences (ECAV), University of Trás-os-Montes e Alto Douro (UTAD), Isabel Pinto, Seara, SA, Cristina Saraiva, and Alexandra Esteves, Veterinary and Animal Research Center (CECAV), University of Trás-os-Montes e Alto Douro (UTAD).

Contamination of pig carcases by pathogenic micro-organisms often occurs during the slaughter process. This study aimed to evaluate the behaviour of Salmonella spp. and Listeria monocytogenes by chitosan application as a decontaminant in pig carcase samples.

For Salmonella spp., significant differences were observed between control samples without and with chitosan for both suspensions and chitosan concentrations, particularly after 24 hours.

During the 48 hours, a bacteriostatic effect was observed for Salmonella spp. mix for chitosan 0.2%, and a bactericidal effect at 0.5%, decreasing approximately 0.49 and 1.46 log CFU/cm^2 for suspension A and B, respectively.

Listeria monocytogenes was able to grow at 0.2 and 0.5% chitosan.

However, compared with control samples, chitosan showed better results with significant differences observed during time. During 48 hours at 0.2%, counts were 0.94 and 2.23 log CFU/cm^2 lower for suspension C and D, respectively. At 0.5%, counts were 1.29 and 2.66 log CFU/cm^2 lower for suspension C and D, respectively.

Chitosan has good bioactive properties that can be used in the food industry.

The behaviour of Salmonella spp. and Listeria monocytogenes demonstrates the possibility of using this compound in meat preservation. ■

Effect of extended storage on the survivability and thermal resistance of Listeria monocytogenes in dry and hydrated milk powders

Amninder Singh Sekhon, Arshdeep Singh, Phoebe Unger, Monipel Babb and Minto Michael, Washington State University, USA.

Listeria monocytogenes (LM) has a unique ability to survive in low water activity (aw) conditions for prolonged time periods and can cause severe health concerns if post-pasteurisation contamination occurs in milk powders.

The purpose of this study was to determine survivability and thermal resistance of LM in dry and hydrated non-fat dry milk (NFDM) and whole milk powder (WMP) during storage of four months.

This study was designed as a two factorial (storage and powder type) randomised complete block design with three replications.

Milk powders were inoculated with a 3-strain cocktail of LM and dried back to original aw levels.

The D- and z-values study were conducted every 30th day, starting on day one for both dry and hydrated powders. Five (g or mL) respective samples were transferred into thermal-death-time (TDT) disks, sealed, and placed in the water baths set at 75, 80, and 85˚C for NFDM and WMP, and 54, 57, and 60˚C for hydrated NFDM and WMP. Samples were heat treated from 0 to 40 minutes and then taken out at predetermined time intervals and transferred immediately to an ice water bath.

Samples were enumerated using injury-recovery media, and D- and z-values were calculated. Two-way ANOVA at $P \leq 0.05$ was used for statistical analysis.

D-values of LM in NFDM for day one were 13.1, 6.0, and 4.0 minutes at 75, 80, and 85˚C, respectively, whereas D-values of LM in WMP for day one were 12.0, 6.3, and 3.3 minutes at 75, 80, and 85˚C, respectively.

There was no significant interaction of the main effects for D- and z-values of LM in dry and hydrated milk powders.

However, the main effect (storage-day) was significant for D-values at 75, 80 and 85˚C where it increased with time.

D- and z-values from this study provide basic information about the effect of storage time and milk powder type on heat resistance of LM in milk powders. ■

In plant validation study of peracetic acid intervention on whole beef carcases using Escherichia coli surrogates

Diego Casas, Alejandro Echeverry, Marcos X. Sanchez-Plata and Mark Miller, Texas Tech University, USA.

The efficacy of antimicrobials intervention during the slaughter process shall be finally validated under in plant conditions. The levels of natural Escherichia coli on beef carcases are very low in order to determine the real efficacy under commercial operation conditions.

The use of Escherichia coli surrogates opens a great opportunity to validate beef carcase interventions in commercial facilities.

The purpose of this study was to determine the antimicrobial efficacy of different levels of peracetic acid (PAA) on whole beef carcases using proven Escherichia coli surrogates in a commercial beef processing plant environment.

On each repetition, 21 carcases were railed off the processing line and sprayed on three different areas (100cm^2) of the shank with an E. coli surrogate cocktail (BAA-1427, 1428, 1429, 1430 and 1431) targeting 6 log CFU/cm^2 of attachment. Samples were taken using 25mL buffered peptone water (BPW) EZ-Reach swabs after 30 minutes for cell attachment, immediately after intervention, and 24 hours after intervention.

Treatments evaluated were PAA at 400, 600 and 800ppm.

Flow rate, pressure, concentration, and temperature were recorded for each treatment. TEMPO system was used for E. coli enumeration.

A total of three repetitions were conducted and a two-way ANOVA was performed using R (Version 4.0.3).

For all tested concentrations, interventions significantly reduced ($P<0.05$) Escherichia coli counts immediately after intervention and after 24 hours. For 400, 600, and 800ppm of PAA interventions, reductions were, on average, 4.62, 5.63, and 5.3 log CFU/cm^2 after intervention, respectively. There was no significant difference ($P>0.05$) of attachment level between PAA concentrations.

The use of E. coli surrogate strains can become an alternative for obtaining more precise results in the effect of interventions on validation studies in commercial beef processing facilities, as well to represent more accurately the behaviour of E. coli O157:H7 and salmonella. ■

Natural disinfectant to reduce Listeria monocytogenes contamination on food contact surfaces

Jaya Sundaram and Jasdeep Saini, WTI, Inc.

Listeria monocytogenes has been implicated in several outbreaks linked to consumption of ready-to-eat (RTE) sliced deli meats. Food contact surfaces like meat slicers in retail delis provide ideal conditions for the bacteria to colonise and grow.

Sliced meats can become contaminated with Listeria monocytogenes during slicing and may pose a serious public health concern.

Effective interventions are needed to control this pathogen and prevent cross-contamination on food contact surfaces.

The purpose of this study was to evaluate the effect of natural surface spray disinfectant at reducing Listeria monocytogenes population on food contact surfaces.

Combined vinegar and citrus extract emulsion was evaluated for its antimicrobial effect as natural disinfectant by direct exposure of surface inoculated stainless-steel coupons (n=30) with a five-strain L. monocytogenes cocktail at 6 log CFU/mL into the emulsion for 30 seconds.

Polyethylene surfaces (n=3) were inoculated with L. monocytogenes cocktail, with an attachment of 3-4.5 log CFU/cm^2 on the surfaces and treated with antimicrobial emulsion using spray method for 10 seconds, three minutes and 60 minutes of exposure time.

Stainless steel surfaces (n=5) were inoculated, treated and reinoculated for three times to mimic potential re-contamination at a deli slicer.

Pathogen enumeration was performed before and after treatments by dislodging attached cells from surfaces in a solution using sponge sampling method and plated using selective media.

Direct exposure of antimicrobial to inoculum showed efficacy at 30 seconds ($P<0.001$).

Treated, inoculated polyethylene surface showed the reduction of 1.21, 1.36 and 1.98 log CFU/ for 10 seconds, three minutes and 60 minutes of exposure time, respectively.

The effect of natural disinfectant on polyethylene surface was significant at 90% confidence level compared to control.

Stainless steel surfaces showed significant reduction at each level with $P<0.05$.

Natural surface spray disinfectant showed positive reduction of Listeria monocytogenes on selected surfaces under various simulated conditions. ■