

## Nanotechnology

### **Nanotechnology Research: Applications in Nutritional Sciences**

P.R. Srinivas, M. Philbert, T.Q. Vu, Q. Huang, J.L. Kokini, E. Saos, et al.

*Journal of Nutrition*, Vol. 140, No. 1; pp.119-24, 2010

**Significance:** Emerging applications of nanotechnology to the fields of food and nutrition science were presented at this 2009 Experimental Biology symposium.

This review highlights the Experimental Biology 2009 symposium entitled "Nanotechnology Research: Applications in Nutritional Sciences," which was organized to emphasize emerging applications of nanotechnology to the food and nutrition sciences, as well as to suggest ways for further integration of these emerging technologies into nutrition research. Speakers focused on topics that included the problems and possibilities of introducing nanoparticles in clinical or nutrition settings, nanotechnology applications for increasing bioavailability of bioactive food components in new food products, nanotechnology opportunities in food science, and the basic research applications. Nutrition scientists are encouraged to leverage ongoing efforts in nanomedicine through collaborations. These efforts could facilitate exploration of previously inaccessible cellular compartments and intracellular pathways and thus uncover strategies for new prevention and therapeutic modalities.

## Ochratoxin A

### **Removal of Ochratoxin A from Contaminated Red Wines by Repassage over Grape Pomaces**

M. Solfrizzo, G. Avantaggiato, G. Panzarini, A. Visconti

*Journal of Agricultural and Food Chemistry*, Vol. 58, No. 1; pp 317–23, 2010

**Significance:** The proposed decontamination procedure to remove ochratoxin A can be applied in a modern winery provided that contaminated grapes are identified early and processed separately from uncontaminated grapes.

An innovative and environmentally friendly corrective measure to reduce ochratoxin A levels by repassage of contaminated musts or wines over grape pomaces having no or little ochratoxin A contamination was proposed. Time course experiments showed that ochratoxin A adsorption by pomaces is a rapid process, reaching equilibrium in <10 h. Repassage of wine from Primitivo grapes spiked with 2–10 µg/kg ochratoxin A over pomaces obtained from the same grapes removed up to 65% ochratoxin A within 24 h. Similar results were obtained with Primitivo or Negroamaro wines repassed over pomaces from different grape varieties. Grape pomaces maintained a good efficacy in removing ochratoxin A after being reused four times. The use of grape pomaces to adsorb ochratoxin A

from red wines of the same grape variety did not affect relevant wine quality parameters, including color intensity and health-promoting phenolic content (trans-resveratrol, quercetin, total polyphenols). These quality parameters were instead positively or negatively affected when contaminated wines were repassed over grape pomaces from other grape varieties.

## Norovirus

### Effects of Technological Processes on the Tenacity and Inactivation of Norovirus Genogroup II in

#### Experimentally Contaminated Foods

S. Mormann, M. Dabisch, B. Becker

*Journal of Applied and Environmental Microbiology*, Vol. 76, No. 2; pp. 536-45, 2010

**Significance:** The technological processes described in this study might be used for other noncultivable enteric RNA viruses that are connected to food-borne diseases.

This study determined the effect of physicochemical treatments on the tenacity of infective human norovirus genogroup II in selected foods. Artificially contaminated produce was subjected to a number of processes used by the food industry for preservation and by the consumer for storage and preparation. Norovirus was quantified by using monoplex one-step TaqMan real-time reverse transcription (RT)-PCR and an external standard curve based on recombinant RNA standards. Significant reductions in titers were obtained with heat treatments usually applied by consumers for food preparation (baking, cooking, roasting). Generally, processes used for preservation and storage, such as cooling, freezing, acidification ( $\geq$ pH 4.5), and moderate heat treatments (pasteurization), appear to be insufficient to inactivate norovirus within a food matrix or on the surface of food. Data for individual matrix-specific protective effects, recovery rates, and inhibitory effects on the PCRs were obtained.

### Manure- and Biosolids-Resident Murine Norovirus 1 Attachment to and Internalization by Romaine Lettuce

J. Wei, Y. Jin, T. Sims, K.E. Kniel

*Journal of Applied and Environmental Microbiology*, Vol. 76, No. 2; pp. 578-83, 2010

**Significance:** The presence of murine norovirus 1 (MNV) in biosolids may increase the risk of fresh produce contamination and that the MNV in open cuts and stomata is likely to be protected from sanitization.

The attachment of murine norovirus 1 (MNV) in biosolids, swine manure, and dairy manure to Romaine lettuce and internalization of this virus were evaluated. The MNV in animal manures had behavior similar to that of pure MNV; however, MNV in biosolids had significantly higher levels of attachment and internalization than pure MNV or MNV in manures. The incubation time did not affect the attachment of MNV in biosolids or manure. Confocal microscopy was used to observe MNV on lettuce after SYBR gold-labeled MNV was added directly to lettuce or after lettuce was submerged in labeled virus. MNV was observed on the lettuce surface, inside open cuts, and

occasionally within stomata. Lettuce pieces with a long cut on the edge and short cuts on the stem were more likely to contain internalized MNV than intact lettuce pieces.

## Listeria

### Bacteriophage Significantly Reduces *Listeria monocytogenes* on Raw Salmon Fillet Tissue

K.A. Soni, R. Nannapaneni

*Journal of Food Protection*, Vol. 73, No. 1; pp. 32-8, 2010

**Significance:** The Generally Recognized as Safe (GRAS) bacteriophage LISTEX P100 is listericidal on raw salmon fillets and is useful in quantitatively reducing *Listeria monocytogenes*.

This study demonstrated the antilisterial activity of Generally Recognized as Safe bacteriophage LISTEX P100 (phage P100) on the surface of raw salmon fillet tissue (RSFT) against *Listeria monocytogenes* serotypes 1/2a and 4b. In a broth model system, phage P100 completely inhibited *L. monocytogenes* growth at 4°C for 12 days, at 10°C for 8 days, and at 30°C for 4 days, at all three phage concentrations of 10<sup>4</sup>, 10<sup>6</sup>, and 10<sup>8</sup> PFU/ml. On RSFT, a higher phage concentration of 10<sup>8</sup> PFU/g was required to yield 1.8-, 2.5-, and 3.5-log CFU/g reductions of *L. monocytogenes* from its initial loads of 2, 3, and 4.5 log CFU/g at 4 or 22°C. Over the 10 days of storage at 4°C, *L. monocytogenes* growth was inhibited by phage P100 on the RSFT to as low as 0.3 log CFU/g versus normal growth of 2.6 log CFU/g in the absence of phage. Phage P100 remained stable on the RSFT over a 10-day storage period, with only a marginal loss of 0.6 log PFU/g from an initial phage treatment of 8 log PFU/g.

## E. Coli

### Characteristics of Shiga Toxin-Producing *Escherichia coli* Isolated from Swiss Raw Milk Cheese within a 3-Year Monitoring Program

C. Zweifel, N. Giezendanner, S. Corti, G. Krause, L. Beutin, J. Danuser, et al.

*Journal of Food Protection*, Vol. 73, No. 1; pp. 88-91, 2010

**Significance:** Semihard and hard raw milk cheese may be a potential source of Shiga toxin-producing *E. coli* (STEC), and a proportion of the isolated non-O157 STEC strains belonged to serotypes or harbored Shiga toxin gene variants associated with human infections.

This study assessed the impact of Shiga toxin-producing *Escherichia coli* (STEC) in 1422 samples of semihard or hard cheese and 80 samples from soft cheese produced from cow's, goat's, and ewe's milk. By PCR, STEC was detected after enrichment in 5.7% of the 1,502 raw milk cheese samples collected at the producer level. STEC-positive samples comprised 76 semihard, 8 soft, and 1 hard cheese. By colony hybridization, 29 STEC strains were isolated from 24 semihard and 5 soft cheeses. Thirteen of the 24 strains typeable with O antisera belonged to the serogroups O2, O22, and O91. More than half (58.6%) of the 29 strains belonged to O:H serotypes previously isolated from humans, and STEC O22:H8, O91:H10, O91:H21, and O174:H21 have also been identified as agents

of hemolytic uremic syndrome. Typing of Shiga toxin genes showed that stx<sub>1</sub> was only found in 2 strains, whereas 27 strains carried genes encoding for the Stx<sub>2</sub> group, mainly stx<sub>2</sub> and stx<sub>2vh-a/b</sub>. Nine strains harbored hlyA (enterohemorrhagic *E. coli* hemolysin).

## Foodborne Disease

### Effect of $\alpha$ -Cyclodextrin-Cinnamic Acid Inclusion Complexes on Populations of *Escherichia coli* O157:H7 and *Salmonella enterica* in Fruit Juices

V.T. Truong, R.R. Boyer, J.M. McKinney, S.F. O'Keefe, R.C. Williams

*Journal of Food Protection*, Vol. 73, No. 1; pp. 92-6, 2010

**Significance:**  $\alpha$ -cyclodextrin-cinnamic acid inclusion complexes may provide an alternative to traditional heat processes.

Cinnamic acid (CA), a naturally occurring organic acid found in fruits and spices, has antimicrobial activity against spoilage and pathogenic bacteria, but low aqueous solubility limits its use. This study determined the effectiveness of solubility-enhancing  $\alpha$ -cyclodextrin-cinnamic acid (CA) inclusion complexes against *Escherichia coli* O157:H7 and *Salmonella enterica* serovars suspended in apple cider or orange juice at two different incubation temperatures (4 and 26°C). Two concentrations (400 and 1,000 mg/liter) of  $\alpha$ -cyclodextrin-CA inclusion complex were aseptically added to apple cider inoculated with *E. coli* O157:H7 (7 log CFU/ml) and orange juice inoculated with a cocktail of six *Salmonella enterica* serovars (7 log CFU/ml). Populations of *E. coli* O157:H7 in apple cider were significantly reduced ( $P \leq 0.05$ ) during the 7-day sampling period in all solutions regardless of temperature. Compared with the controls, populations were significantly reduced by the addition of 400 and 1,000 mg/liter inclusion complex, but reductions were not significantly different between the two treatment groups (400 and 1,000 mg/liter). *Salmonella* was significantly reduced in all solutions regardless of temperature. There were significant differences between the control and each inclusion complex concentration at 4 and 26°C.

## Salmonella

### Control of *Salmonella* on Sprouting Mung Bean and Alfalfa Seeds by Using a Biocontrol Preparation Based on Antagonistic Bacteria and Lytic Bacteriophages

J. Ye, M. Kostrzynska, K. Dunfield, K. Warriner, Keith

*Journal of Food Protection*, Vol. 73, No. 1; pp. 9-17, 2010

**Significance:** The combination of *Enterobacter asburiae* and bacteriophages represents a promising, chemical-free approach for controlling the growth of *Salmonella* on sprouting seeds.

A combination of antagonistic bacteria and lytic bacteriophages to control the growth of Salmonella on sprouting mung beans and alfalfa seeds is reported. An *Enterobacter asburiae* strain (labeled "JX1") exhibited stable antagonistic activity against a broad range of Salmonella serovars. A bacteriophage cocktail prepared from six isolates was coinoculated with *E. asburiae* JX1 along with Salmonella in broth culture. The combination of *E. asburiae* JX1 and bacteriophage cocktail reduced the levels of Salmonella by 5.7-6.4 log CFU/ml. Mung beans inoculated with Salmonella and sprouted over a 4-day period attained levels of  $6.72 \pm 0.78$  log CFU/g. Levels of Salmonella were reduced to  $3.31 \pm 2.48$  or  $1.16 \pm 2.14$  log CFU/g when the pathogen was coinoculated with bacteriophages or *E. asburiae* JX1, respectively. By using a combination of *E. asburiae* JX1 and bacteriophages, the levels of Salmonella associated with mung bean sprouts were only detected by enrichment. The biocontrol preparation was effective at controlling the growth of Salmonella under a range of sprouting temperatures (20-30°C) and was equally effective at suppressing the growth of Salmonella on sprouting alfalfa seeds.

## Cryptosporidium

### **Spinacia oleracea L. Leaf Stomata Harboring Cryptosporidium parvum Oocysts: a Potential Threat to Food Safety**

D. Macarisin, G. Bauchan, R. Fayer

*Applied and Environmental Microbiology*, Vol. 76, No. 2; pp. 555-9, 2010

**Significance:** The pathogenic parasite, *Cryptosporidium parvum* resists washing and disfection and, therefore, it raises safety concerns regarding food safety.

*Cryptosporidium parvum* is a cosmopolitan microscopic protozoan parasite that causes severe diarrheal disease (cryptosporidiosis) in mammals, including humans and livestock. There is growing evidence of *Cryptosporidium* persistence in fresh produce that may result in food-borne infection, including sporadic cases as well as outbreaks. Drinking and recreational waters are still considered the major sources of *Cryptosporidium* infection in humans, which has resulted in prioritization of studies of parasite etiology in aquatic environments, while the mechanisms of transmission and parasite persistence on edible plants remain poorly understood. Using laser scanning confocal microscopy together with fluorescein-labeled monoclonal antibodies, *C. parvum* oocysts were found to strongly adhere to spinach plants after contact with contaminated water, to infiltrate through the stomatal openings in spinach leaves, and to persist at the mesophyll level.

## Peanut Allergy

### Allergy or tolerance in children sensitized to peanut: Prevalence and differentiation using component-resolved diagnostics

N. Nicolaou, M. Poorafshar, C. Murray, A. Simpson, H. Winell, G. Kerry, et al.  
*Journal of Allergy and Clinical Immunology*, Vol. 125, No. 1; pp. 191-7

**Significance:** The majority of children considered peanut-sensitized on the basis of standard tests do not have peanut allergy.

This study established, by oral food challenge, the proportion of children with clinical peanut allergy among those considered peanut-sensitized by using skin prick tests and/or IgE measurement at age 8, and investigated whether component-resolved diagnostics using microarray could differentiate peanut allergy from tolerance. Among sensitized children, peanut allergy versus tolerance by oral food challenges was observed. An open challenge among children consuming peanuts (n=45) was used; others underwent double-blind placebo-controlled challenge (n=34). Of 933 children, 110 were peanut-sensitized. Nineteen were not challenged. Twelve with a convincing history of reactions on exposure, IgE  $\geq 15$  kUA/L and/or skin test  $\geq 8$ mm were considered allergic without challenge. Of the remaining 79 children who underwent challenge, 7 had  $\geq 2$  objective signs and were designated as having peanut allergy. The prevalence of clinical peanut allergy among sensitized subjects was estimated at 22.4% (95% CI, 14.8% to 32.3%). Marked differences in the pattern of component recognition between children with peanut allergy were detected (n=29; group enriched with 12 children with allergy) and peanut-tolerant children (n=52).