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**XVII 10-03 AN INTEGRATED SCIENCE-BASED APPROACH TO DAIRY FOOD SAFETY:
LISTERIA MONOCYTOGENES AS A MODEL SYSTEM**

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This article summarizes the studies on transmission, ecology, pathogenesis and population genetics of *Listeria monocytogenes*, which were used as a model for food- and milkborne pathogens that infect multiple hosts and also has considerable ability to survive and multiply in nonhost environments. Application of molecular subtyping tools in conjunction with phenotypic characterization of selected strains has allowed for the definition of distinct *L. monocytogenes* subtypes and clonal groups that appear to differ in relevant phenotypic characteristics that may affect their abilities to be transmitted through food systems. These findings are consistent with the fact that while genetically diverse strains may be classified to one bacterial species, these strains often differ from one another in important genetic and phenotypic characteristics. This shows that evolutionary- and molecular subtyping-based definitions of bacterial subtypes and clonal groups will provide critical insight into the microbial ecology of dairy food systems, including not only foodborne pathogens, but also organisms important for dairy fermentation and spoilage.

**XVII 11-03 UNDERSTANDING THE ROLE OF CALCIUM IN FUNCTIONALITY OF PART
SKIM MOZZARELLA CHEESE**

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The impact of calcium on softening, melting, and flow characteristics of part skim Mozzarella cheese was evaluated. Four cheese containing different calcium levels (viz. 0.65, 0.48, 0.42, and 0.35%) were manufactured by direct acidification using glucono-lactone on four different occasions. Preacidification of milk was done to alter the calcium content of the cheeses. Cheeses were made with uniform composition. Lowering of calcium to 25, 35, and 45% levels increased the melt by 1.4, 2.1, and 2.6 times, respectively, 1 day after manufacture. Low calcium cheeses softened and melted at lower time and temperatures. These cheeses also flowed faster. Higher proteolysis at a faster rate was observed in low calcium cheeses. Refrigerated storage up to 30 d also increased melt

area, flow rate, extent of flow, and soluble protein and lowered softening and melting times in all the cheeses. The effect of calcium reduction was more noticeable as compared to the effect of storage on functionality of Mozzarella cheese. Improved softening, melting, and flow properties of low calcium part skim Mozzarella cheese is a clear advantage to cheese manufacturers and end users as they may not have to wait 15 to 20 d for proteolysis of cheese to obtain desired melt properties.

XVII 12-03 Effective Food Security Plans for Production Agriculture and Food Processing

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Food Protection Trends 23 (1): 130. 2003.

A model for developing a food security program derived from Hazard Analysis Critical Control Point (HACCP) principles, along with implementation strategies and developmental approaches, is presented. Models applicable to production agriculture, food processing, food distribution, or food service that interface with current HACCP (e.g., for fishery products: 21 Code of Federal Regulations Part 123), good manufacturing practices (GMP) (21 CFR Part 110) and recall programs (21 CFR Part 7) are presented

XVII 13-03 Chemistry of Buttermilk Solid Antioxidant Activity

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Antioxidant activity of buttermilk solids was assessed by analyzing for relative reducing activity, sulfhydryl content, and ferrous and ferric iron binding affinity. These experiments were followed by monitoring the affinity of buttermilk solids to scavenge both hydroxyl and peroxy radicals in vitro. Notable relative reducing activity of buttermilk solids to L-ascorbic acid (43.80 to 85.85% over a range of 5.0 to 10.0 mg) was attributed in part to the sulfhydryl content (28.8 μ M). Buttermilk solids sequestering activity was greater for ferrous than ferric ion. These chemical properties of buttermilk solids corresponded to a significant affinity to scavenge Fenton-induced hydroxyl radical over a range of 5 to 10 mg. A significant affinity of buttermilk solids to protect against lipid peroxidation, tested using an in vitro model lipid system, was also observed at both 0.1 and 0.2% (wt/vol). These findings demonstrated that buttermilk solids possess significant antioxidant activity, thereby suggesting potential use as a value-added ingredient for stabilizing food matrixes against lipid peroxidation reactions.

XVII 14-03 ECONOMIC FEASIBILITY EVALUATION OF MICROFILTRATION OF MILK PRIOR TO CHEESEMAKING

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A nonlinear programming optimization model was used to evaluate the net revenues

and potential profitability of microfiltration (MF) prior to cheesemaking in the 3-year period 1998 to 2000, using monthly milk price and composition data. The model identifies the optimal mix of milk resources and determines if MF cheesemaking produces a higher net revenue than conventional cheesemaking that uses NDM and condensed milk for fortification. This study demonstrates the potential of this model to evaluate new technologies in cheese manufacture and improve decision making in the cheese industry. The use of MF produced higher net revenues in 30 out of the 36 mo for both Cheddar and low-moisture, part-skim mozzarella, leading to an appreciable increase in net revenue (vs. conventional cheesemaking) for both cheeses. The benefit from MF in net revenue was greater when the cream price was high. The use of 3X MF yielded the same net revenue as 2X MF. An estimate of manufacturing costs of MF vs. conventional cheesemaking was also made. To this end, the yields of products were calculated by the optimization model, while the production cost of each product was estimated from data of two economic engineering studies and a MF cheesemaking trial. The manufacturing cost of MF Cheddar was slightly higher than the manufacturing cost of conventional Cheddar. However, the benefit in net revenue from the use of MF was estimated to be higher than the difference in manufacturing costs. Moreover, some advantages in the new coproducts of MF Cheddar could outweigh its higher manufacturing cost. The relationships between prices and recoveries of coproducts required to render MF profitable were identified.

XVII 15-03 EFFECTS OF STANDARDIZATION OF WHOLE MILK WITH DRY MILK PROTEIN CONCENTRATE ON THE YIELD AND RIPENING OF REDUCED-FAT CHEDDAR CHEESE

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Commercial milk protein concentrate (MPC) was used to standardize whole milk for reduced-fat Cheddar cheesemaking. Four replicate cheesemaking trials of three treatments (control, MPC1, and MPC2) were conducted. The control cheese (CC) was made from standardized milk (casein-to-fat ratio, C/F ~1.7) obtained by mixing skim milk and whole milk (WM); MPC1 and MPC2 cheeses were made from standardized milk (C/F ~1.8) obtained from mixing WM and MPC, except that commercial mesophilic starter was added at the rate of 1% to the CC and MPC1 and 2% to MPC2 vats. The addition of MPC doubled cheese yields and had insignificant effects on fat recoveries (~94% in MPC1 and MPC2 vs. ~92% in CC) and total solids recoveries (~63% in CC vs. 63% in MPC1 and MPC2). Although minor differences were noted in the gross composition of the cheeses, both MPC1 and MPC2 cheeses had lower lactose contents (0.25 or 0.32%, respectively) than in CC (0.60%) 7 d post manufacture. Cheeses from all three treatments had ~10⁹ cfu/g initial starter bacteria count. The nonstarter lactic acid bacteria (NSLAB) grew slowly in MPC1 and MPC2 cheeses during ripening compared to CC, and at the end of 6 mo of ripening, numbers of NSLAB in the CC were 1 to 2 log cycles

higher than in MPC1 and MPC2 cheeses. Primary proteolysis was markedly slower in MPC1 and MPC2 cheeses compared to CC. The concentrations of total free amino acids were in decreasing order CC > MPC2 > MPC1 cheeses, suggesting slower secondary proteolysis in the MPC cheeses than in CC. Sensory analysis showed that MPC cheeses had lower brothy and bitter scores than CC. Increasing the amount of starter bacteria improved maturity in MPC cheese.

XVII 16-03 A COMPARISON OF THE BUTTERMILK SOLIDS FUNCTIONAL PROPERTIES TO NONFAT DRIED MILK, SOY PROTEIN ISOLATE, DRIED EGG WHITE, AND EGG YOLK POWDERS

P. Y. Y. Wong and D. D. Kitts

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Physicochemical (i.e., sulfhydryl group, protein, and total solubility) as well as functional properties (i.e., water-holding and fat-absorption capacity, foaming and emulsification capacity, and stability) of commercial buttermilk solids (BMS) were compared to nonfat dried milk, soy protein isolate, and dried egg yolk and egg white powders on an equivalent protein basis. BMS showed limited functional properties in water-holding capacity (0.75 g water/g protein) and fat-absorption capacity (1.2 g of oil/g of protein), and foaming capacity (0.5 ml of foam/ml of solution) and stability. However, emulsifying capacity and stability of BMS was not significantly different from other dried protein powders. Results indicated that 0.9 g of protein (approximately 0.45%, wt/vol, concentration) from BMS was needed to emulsify a maximum oil concentration of 50% in water at temperatures up to 50°C. Denaturation of protein, quantified by free sulfhydryl groups, was a critical factor affecting the functionality of BMS and all other protein powders tested. The milk fat globule membrane present in BMS did not enhance either emulsifying capacity or stability.

XVII 17-03 EXTRACTION OF IMMUNOGLOBULIN-G FROM COLOSTRAL WHEY BY REVERSE MICELLES

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Separation of immunoglobulin G (IgG) from the other colostrum whey proteins was carried out by reversed micellar extraction. The colostrum whey was diluted to 5 times its original volume with 50 mM phosphate buffer at pH 6.35 containing 100 mM of sodium chloride. The aqueous solution was then mixed with an equal volume of isooctane containing 50 mM bis-(2-ethylhexyl) sodium sulfosuccinate (AOT), and shaken at 200 rpm and 25°C for 10 min. After extraction, the mixture was separated to the aqueous phase and the reversed micellar phase by centrifugation. This procedure extracted most of the non-IgG proteins to the reversed micellar phase and recovered more than 90% of the IgG in the aqueous phase. The IgG in the aqueous phase had a purity of 90%, and still possessed immunological activity. AOT was not detectable in the aqueous phase.

XVII 18-03 SIX QUESTIONS TO HELP YOU SELECT METAL SEPARATORS AND DETECTORS

M. Wilks

Powder and Bulk Engineering 17 (4):43. 2003.

Metal debris is a common source of bulk material contamination. Tramp iron and other metal debris can damage or shut down your handling and processing equipment and reduce your product's quality and value. Using the right separation equipment is a sound financial decision that helps protect your machinery investment, your product's marketability, and your company's reputation. But how do you decide what metal separator or detector will best suit your needs? Answering the six questions in this article will help you make a good choice.