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XVIII 1-04 EFFECT OF TEMPERATURE AND PORE SIZE ON THE FRACTIONATION OF FRESH AND RECONSTITUTED BUTTERMILK BY MICROFILTRATION

P. Morin, R. Jiménez-Flores and Y. Pouliot
J. Dairy Sci. 87 (2): 267. 2004.

The objective of this research was to evaluate the effect of temperature (7, 25, and 50°C) and pore size (0.1, 0.8, and 1.4 μm) on the separation of proteins and lipids (neutral lipids and phospholipids) during microfiltration (MF) of fresh or reconstituted buttermilk. Buttermilk was subjected to MF using a pilot-scale unit mounted with ceramic membranes. The MF runs were carried out in a uniform transmembrane pressure (UTP) mode. Changes in processing temperature had no significant impact on protein transmission, whereas increasing temperature reduced both lipid and phospholipid transmission. A maximum concentration factor (CF) for lipids was reached at 25°C, as protein CF remained essentially unaffected by temperature. The use of the smaller pore size (0.1 μm) resulted in low lipid (10%) and protein (≅20%) transmission. Larger pore sizes (0.8 and 1.4 μm) resulted in higher levels of protein, lipid, and phospholipid transmission (>50%), but gave high permeation fluxes. Transmission of both proteins and lipids was markedly different when using fresh buttermilk as opposed to reconstituted buttermilk. This study showed that MF temperature, pore size, and buttermilk type influence fractionation but that MF alone cannot achieve optimal separation of lipids and proteins for the production of novel ingredients from buttermilk

XVIII 2-04 THE EFFECT OF LACTOCOCCUS LACTIS STARTER CULTURES ON THE OXIDATIVE STABILITY OF LIQUID WHEY

R. M. Tomaino, L. G. Turner and D. K. Larick
J. Dairy Sci. 87 (2): 300. 2004.

The oxidative stability of liquid Cheddar cheese whey was evaluated using 2 Lactococcus lactis starter cultures in combination and alone along with a control, utilizing glucono-δ-lactone for acid development. Fresh and stored whey were evaluated for volatile composition, free fatty acids, and flavor by descriptive sensory analysis. A significant increase in volatile lipid oxidation products, most notably, hexanal, occurred during storage, and a corresponding decline in the free fatty acid linoleic acid was found. The flavor and aroma characteristic, cardboardy, was correlated to the increase in volatile lipid oxidation products and the decline in linoleic acid. Evidence strongly suggested that lipid oxidation was initiated during whey production and escalated during storage and that the starter cultures significantly influenced the level of volatile lipid oxidation products. Further under-

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

G. E. Bledsoe and B. A. Rasco
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

P. Y. Y. Wong and D. D. Kitts
J. of Dairy Sci. 86 (5): 1541. 2003.

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 peroxyl 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

A. Papadatos, M. Neocleous, A. M. Berger and D. M. Barbano
J. of Dairy Sci. 86 (5): 1564. 2003.

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

standing of the impact of starter cultures on whey may allow for the production of higher quality whey ingredients with wider food applications.

XVIII 3-04 MINIMIZING VARIATIONS IN FUNCTIONALITY OF WHEY PROTEIN CONCENTRATES FROM DIFFERENT SOURCES

C. I. Onwulata, R. P. Konstance and P. M. Tomasula
J. Dairy Sci. 87 (3): 749. 2004.

Enhancement in processing technology has improved the nutritional and functional properties of whey protein concentrates by increasing the content and quality of the protein, leading to their increased use in different food products. The extent of heat treatment affects the quality of the whey protein concentrate, and wide variation in product quality exists due to the various means of manufacture and from the whey product history from farm to factory. The study was carried out with 6 commercial whey protein concentrates with 80% protein (WPC80) to determine variations in physical properties, particle size and density, and functional properties—solubility, gel strength, foam volume, and stability. Significant differences were observed among all the products for every property compared. Particulate size was the most important determinant of functional characteristics. Larger particulate WPC80 had significantly higher fat content and were less soluble with poor foam stability; but narrowing the particle size distribution through sieving, minimized variations. We determined that sieving all products within the particle size distribution range of 100 to 150 microns minimized variation in physical composition, making functionality uniform. WPC80 from different manufacturers can be made to perform uniformly within a narrow functionality range by reducing the particle size distribution through sieving.

XVIII 4-04 EFFECTS OF MILK POWDERS IN MILK CHOCOLATE

B. Liang and R. W. Hartel
J. Dairy Sci. 87 (1): 20. 2004.

The physical characteristics of dry milks used in chocolate can have significant impact on the processing conditions needed to make that chocolate and the physical and organoleptic properties of the finished product. Four dry milks with different particle characteristics (size, shape, density) and "free" milk fat levels (easily extracted with organic solvent) were evaluated for their effect on the processing conditions and characteristics of chocolates in which they were used. Many aspects of chocolate manufacture and storage (tempering conditions, melt rheology, hardness, bloom stability) were dependent on the level of free milk fat in the dry milk. However, particle characteristics of the dry milk also influenced the physical and sensory properties of the final products.

XVIII 5-04 COMPARISON OF CHROMATOGRAPHIC PROFILE OF GLYCOMACROPEPTIDE FROM CHEESE WHEY ISOLATED USING DIFFERENT METHODS

Esther W. Y. Li and Yoshinori Mine
J. Dairy Sci. 87 (1): 174. 2004.

Glycomacropeptide (GMP) has heterogeneous carbohydrates, and this attributes to its various biological activities. This study compared the chromatographic profiles of GMP isolated by three methods (trichloracetic acid fractionation, ethanol precipitation, and ultrafiltration) from whey protein isolate (WPI). Seven sharp heterogeneous GMP peaks were eluted from GMP prepared by ethanol precipitation and ultrafiltration using Mono Q anionic chromatography, while only 5 peaks were seen in TCA treated sample. The TCA pretreatment recovered only sialo-GMP (glycosylated) and eliminated all contaminated proteins; however, the recovery rate was the lowest (6.7% of the initial WPI). Ethanol precipitation recovered 20.4% of GMP from WPI and 75.7% was glycosylated, but the heating process might lead to degradation of glycosidic residues. Ultrafiltration was found to be the most effective in recovering GMP. The recovery rate was 33.9% with 81.6% sialo-GMP. We concluded that carbohydrate profile of GMP varied widely and depended on the isolation method. Based on the high recovery of sialo-GMP, the combination of ultrafiltration and anionic chromatography might be a suitable and practical approach on an industrial scale.

XVIII 6-04 CHANGES IN GALACTOSE AND LACTIC ACID CONTENT OF SWEET WHEY DURING STORAGE

R. D. Rao, W. L. Wendorff and K. Smith
J. of Food Protection 67 (2): 403. 2004.

This study surveyed industry samples of Cheddar and mozzarella cheese whey streams to determine how galactose and lactic acid concentrations changed with storage at appropriate (4°C) and abuse (37.8°C) temperatures. Samples stored at 4°C did not exhibit significant increases in levels of lactic acid or galactose. Mozzarella whey accumulated the greatest amount of galactose and lactic acid with storage at 37.8°C. Whey samples derived from cheese made from single strains of starter culture were also evaluated to determine each culture's contribution to galactose and lactic acid production. Starter cultures evaluated included *Streptococcus salivarius* ssp. *thermophilus, Lactobacillus helveticus, Lactobacillus delbrueckii* ssp. *bulgaricus, Lactococcus lactis* ssp. *cremoris,* and *Lactococcus lactis* ssp. *lactis.* Whey derived from *L. helveticus* accumulated a significantly greater amount of lactic acid upon storage at 37.8°C as compared with the other cultures. Galactose accumulation was significantly decreased in whey from *L. lactis* ssp. *lactis* stored at 37.8°C in comparison with the other cultures. Results from this study indicate that proper storage conditions (4°C) for whey prevent accumulation of galactose and lactic acid while the extent of accumulation during storage at 37.8°C varies depending on the culture(s) used in cheese production.

XVIII 7-04 COMPARISON OF THREE MEDIA USED TO ESTIMATE PSYCHROTROPHIC BACTERIAL COUNTS IN MILK

A. A. Glueck-Chaloupka and C. H. White
Food Protection Trends 24 (2): 77. 2004.

This study was designed to evaluate the suitability of violet red bile agar without an overlay for the accurate and rapid enumeration of psychrotrophs in milk. A survey of 36 reduced-fat milk samples was conducted. Samples were plated and evaluated on the day they were collected and on the day following a preliminary incubation (PI) of 18 hr. at 21°C. Psychrotrophic bacteria counts were determined after incubation at 32°C and 21°C, on violet red bile agar without an overlay, on standard plate count agar and on crystal violet tetrazolium agar. Bacterial enumerations were compared among the 3 media and the 2 temperatures. A correlation ($r^2 = 0.73$) was noted between violet red bile agar counts without an overlay and standard plate counts incubated at 21°C for 18 hr. In addition, a strong correlation ($r^2 = 0.87$) was found between the violet red bile agar counts without an overlay and crystal violet tetrazolium counts incubated at 21°C for 18 hr. Violet red bile agar without an overlay is a viable alternative method for enumerating psychrotrophic bacteria in fluid milk.

XVIII 8-04 ENUMERATION OF YEASTS IN DAIRY PRODUCTS: A COMPARISON OF IMMUNOLOGICAL AND GENETIC TECHNIQUES

T. Garcia, B. Mayoral, I. Gonzalez, I. Lopez-Calleja, A. Sanz, P. E. Hernandez, and R. Martin
J. of Food Protection 67 (2): 357. 2004.

Enzyme-linked immunosorbent assay (ELISA) and PCR techniques have been developed for the detection of spoilage yeast species in dairy products. Polyclonal antibodies against live yeast cells (AY) were raised in rabbits by inoculation of a mixture of 10 yeast species frequently associated with dairy products spoilage. AY antibodies were used for the development of two ELISA formats (indirect and double-antibody sandwich ELISA) for the detection of yeast species in milk and yogurt. A PCR assay was also developed for yeast detection in dairy products, using primers designed to amplify a conserved 250-base pair fragment of the 18S rRNA of the yeast species. The results obtained in this work show that ELISA techniques using polyclonal antibodies against viable yeast cells are of limited value for the detection and enumeration of spoilage yeast species in dairy products. On the contrary, PCR amplification of a conserved region of the 18S rRNA of the yeast species allows the homogeneous detection of all the yeast species tested and, combined with an overnight enrichment of samples, could be used for the detection of low levels of viable spoilage yeast species in dairy products.