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XVII 19-03 **EFFECT OF SOMATIC CELL COUNT ON PROTEOLYSIS AND LIPOLYSIS IN PASTEURIZED FLUID MILK DURING SHELF-LIFE STORAGE**

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The general goal of this research was to provide fluid milk processors with data to enable them to estimate the economic benefits they might derive from longer fluid milk shelf-life or new marketing opportunities due to a reduction in raw milk SCC. The study objectives were: 1) to measure the time in days for pasteurized homogenized 2% milk to achieve a level of lipolysis and proteolysis caused by native milk enzymes present in milks of different somatic cell count (SCC) at 0.5 and 6°C that would be sufficient to produce an off-flavor, 2) to determine whether milk fat content (i.e., 1, 2, and 3.25%) influences the level of proteolysis or lipolysis caused by native milk enzymes at 6°C, and 3) to determine the time in days for milks containing 2% fat with different SCC to undergo sufficient lipolysis or proteolysis to produce an off-flavor due to the combination of the action of native milk enzymes and microbial growth at 0.5 and 6°C. In experiment 1, pasteurized, homogenized milks, containing 2% fat were prepared from raw milk containing four different SCC levels from <100,000 to >1,000,000 cells/ml. Each of the four milks was stored at 0.5 and 6°C for 61 d. In experiment 2, pasteurized, homogenized milks containing 1, 2, and 3.25% fat were prepared starting from two raw milks containing two different SCC levels, one <100,000 and the other >1,000,000 cells/ml. In experiment 3, pasteurized, homogenized 2% fat milks were prepared starting from raw milks containing two different SCC levels, one <100,000 and the other >1,000,000 cells/ml. For experiments 1 and 2, all milks were preserved with potassium dichromate to prevent microbial growth but to allow the activity of native milk proteases and lipases during storage. For experiment 3, one set of milk was preserved with potassium dichromate to prevent microbial growth but to allow the activity of native milk proteases and lipases, and a second set of milk was unpreserved during storage at 0.5 and 6°C for 29 d. Based on previous work, an off-flavor due to proteolysis was detected by 50% of panelists when the decrease in casein as a percentage of true protein (CN/TP) was > 4.76%. The data indicated that pasteurized milk containing 2% fat would develop an off-flavor at a time long after 61 and at 54 d for the low SCC milk, and at about 54 and 19 d for the high SCC milk, at 0.5 and 6°C, respectively. Previous research reported that 34% of panelists could detect an off-flavor in milk containing 2% fat due to lipolysis at a (free fatty acid) FFA concentration of 0.25 meq/kg of milk. Based on these results, it was estimated in the present study that 34% of panelists would detect an

off-flavor in a 2% fat pasteurized milk with low SCC at a time long after 61 and just after 61 d at 0.5 and 6°C, respectively, while for milk with high SCC, an off-flavor would be detected by 34% of panelists at slightly longer than 61 and 35 d at 0.5 and 6°C, respectively. The combination of low SCC milk and low storage temperature when coupled with processing technology to produce very low initial bacteria count in fluid milk could produce fluid milk that will maintain flavor quality for more than 61 d of storage at temperatures < 6°C.

XVII 20-03 PRODUCTION OF A NOVEL INGREDIENT FROM BUTTERMILK

M. Corredig, R. R. Roesch and D. G. Dalgleish
J. Dairy Sci. 86 (9): 2744. 2003.

The presence of material derived from the milk fat globule membrane (MFGM) makes buttermilk distinct from any other dairy product. Membrane filtration of commercial buttermilk was carried out to obtain isolates rich in MFGM material. The separation of MFGM from the skim milk proteins present in commercial buttermilk was carried out by the addition of sodium citrate followed by microfiltration through a membrane of 0.1-µm nominal pore size. The sodium citrate caused the dissociation of casein micelles and allowed permeation of a large proportion of the skim-milk derived proteins through the membrane. This process successfully concentrated MFGM material in the retentate, and demonstrated that membrane filtration can be employed to produce MFGM fractions from commercial buttermilk. The utilization of MFGM isolates from buttermilk is of increasing importance in light of recent studies suggesting the role of phospholipids in many health-related functions: buttermilk is an untapped resource of these functional components.

XVII 21-03 INFLUENCE OF PROTEOLYSIS OF MILK ON THE WHEY PROTEIN TO TOTAL PROTEIN RATIO AS DETERMINED BY CAPILLARY ELECTROPHORESIS

B. Miralles, M. Ramos and L. Amigo
J. Dairy Sci. 86 (9): 2813. 2003.

Capillary electrophoresis (CE) was used to determine the whey protein to total protein ratio in raw and UHT milk samples with different degrees of proteolysis caused by storage. In raw milks, the analysis of samples taken at regular times demonstrated the influence of proteolysis in the whey protein to total protein determination, which was overestimated after 4 d of storage. In UHT milks, the overestimation of the whey protein to total protein ratio took place after 30 or 60 d of storage. However, the ratios αS1-CN/ß-CN and αs1-CN/κ-CN permitted detection of the samples of raw or UHT milk with degraded proteins. The distorted capillary electrophoretic pattern obtained for UHT milks made necessary an integration of the electropherograms in a "valley-to-valley" way. Results for raw milk samples were identical when "valley-to-valley" was compared to standard integration techniques. This CE method could be considered an alternative method to derivative spectroscopy for the determination of the whey protein to total protein of milk and could be used to detect samples with proteolysis.

XVII 22-03 PROCESS FOR CALCIUM RETENTION DURING SKIM MILK ULTRAFILTRATION

H. K. Vyas and P. S. Tong
J. Dairy Sci. 86 (9): 2761. 2003.

In this study, a process was developed in which first the lactose reduction in skim milk was achieved by ultrafiltration (4x volumetric concentration) using a 10-kDa membrane. Then, the calcium present in permeate was precipitated using one of three methods: 1) heat treatment, 2) pH adjustment, or 3) a combination of pH adjustment and heat treatment to permeate, then recovered by refiltering permeate. The process was first developed at laboratory scale, and then its applicability was tested at the pilot scale. Skim milk, retentates, permeates, and the treated permeates were analyzed for total solids, ash, protein, or total nitrogen, calcium, and lactose content. About 76% of the total lactose and about 16% of the calcium present in skim milk permeated through the membrane during ultrafiltration. The three treatments applied produced white precipitates and turned the clear permeates turbid. On refiltering the treated permeates ~42, ~50, and ~70% of the total calcium present could be recovered from 1) heat-treated, 2) pH-adjusted, and 3) pH-adjusted and heat-treated permeates, respectively. There was no marked change in the lactose content due to any of the three treatments and subsequent refiltering of the treated permeates.

XVII 23-03 FORMATION CONDITIONS, WATER-VAPOR PERMEABILITY, AND SOLUBILITY OF COMPRESSION-MOLDED WHEY PROTEIN FILMS

R. Sothornvit, C.W. Olsen, T.H. McHugh, and J.M. Krochta
J. of Food Sci. 68 (6): 1985. 2003.

Films based on whey protein isolate (WPI) were formed using compression molding. Compression molded films could be formed using 30% to 50% moisture content or glycerol content WPI at 104°C to 160°C for 2 min. Films made from water-WPI mixtures were brittle and insoluble and had water-vapor permeability values independent of starting water-WPI mixture moisture content, molding temperature, or molding pressure. Gly-WPI films produced at 104°C were flexible and partially soluble. Gly-WPI films produced at 140°C were also flexible but nearly insoluble. Glycerol content and molding temperature and pressure had little effect on water-vapor permeability values of Gly-WPI films over the range of conditions studied.

XVII 24-03 GROWTH OF PROBIOTIC AND TRADITIONAL YOGURT CULTURES IN MILK SUPPLEMENTED WITH WHEY PROTEIN HYDROLYSATE

K.A. McComas Jr. and S.E. Gilliland
J. of Food Sci. 68 (6): 2090. 2003.

Growth of some probiotic bacteria was significantly improved in milk supplemented with whey protein hydrolysate (WPH). However, WPH had no effect on the growth of Lactobacillus delbrueckii ssp. bulgaricus 18, L. delbrueckii ssp. bulgaricus 10442, and Streptococcus thermophilus 1. When the probiotic bacteria were grown in combination with different yogurt cultures in milk, WPH caused significant increases in growth of Bifidobacterium longum S9, L. acidophilus O16, and L. acidophilus L-1. However, by day 28 of refrigerated

storage, the populations of the probiotic cultures that had been grown in samples supplemented with WPH were similar or below those in the control samples.

XVII 25-03 AROMA-ACTIVE COMPONENTS OF LIQUID CHEDDAR WHEY
Y. Karagül-Yüceer, M.A. Drake, K.R. Cadwallader
J. of Food Sci. 68 (4): 1215. 2003.

Fresh Cheddar cheese whey batches from 2 processing plants and 4 starter culture rotations were extracted with diethyl ether followed by isolation of volatiles by high-vacuum distillation. Odorants were evaluated by gas chromatography-olfactometry (GCO) and aroma extract dilution analysis (AEDA). 2,3-butanedione (buttery), hexanal (green), 2-acetyl-1-pyrroline (popcorn), methional (potato), (E,E)-2,4-decadienal (frying oil) and (E,E)-2,4-nonadienal (frying oil) were potent neutral/basic aroma-active compounds identified in all whey samples. Odor intensities of hexanal, (E,E)-2,4-nonadienal, 2,3-butanedione, and (E,E)-2,4-decadienal were variable. Short-chain volatile acids were predominant in acidic fractions and their intensities differed among the whey samples. GCO findings agreed with quantitation results. Liquid whey aroma components are influenced by starter culture rotation.

XVII 26-03 WHEY PROTEIN ISOLATE AND GLYCO-MACROPEPTIDE RECOVERY FROM WHEY USING ION EXCHANGE CHROMATOGRAPHY
S. Doultani, K.N. Turhan, and M.R. Etzel
J. of Food Sci. 68 (4): 1389. 2003.

Cation exchange was used to recover whey protein isolate (WPI) from sweet whey, and the effluent was fed to an anion exchanger to recover glycomacropeptide (GMP). Nearly all of the major whey proteins and about half of the total Kjeldahl nitrogen (TKN) were recovered by the cation exchanger. No GMP was recovered by the cation exchanger. The anion exchanger recovered nearly all of the GMP from the effluent of the cation exchanger, accounting for about half of the remaining TKN. This process is the first to simultaneously manufacture WPI and GMP from a single stream of whey, increasing the value obtained from whey.

NEW AND REVISED 3-A STANDARDS

3-A Sanitary Standard for Tubular Heat Exchangers, Number 12-07. Effective November 16, 2003.

3-A Sanitary Standard for Farm Milk Cooling and Holding Tanks, Number 13-10. Effective November 16, 2003.

3-A Sanitary Standard for Blending Equipment, Number 35-01. Effective November 16, 2003.

3-A Sanitary Standard for Roto-Stator Mixers, Number 36-01. Effective November 16, 2003.

3-A Sanitary Standard for Pneumatic Conveyors for Dry Products, Number 39-01. Effective November 16, 2003.

3-A Sanitary Standard for Bag Collectors, Number 40-03. Effective November 16, 2003.

3-A Sanitary Standard for Cross Flow Membrane Modules, Number 45-01. Effective November 16, 2003.

3-A Sanitary Standard for Spray Cleaning Devices Intended to Remain in Place, Number 78-01. Effective November 16, 2003.

3-A Sanitary Standard for Closed Cheese Vats, Number 83-00. Effective November 16, 2003.

3-A Sanitary Standard for Personnel Access Ports for Wet Applications, Number 84-00. Effective November 16, 2003.

3-A Sanitary Standard for Double-Seat Mixproof Valves, Number 85-00. Effective November 16, 2003.

3-A Accepted Practice for the Construction, Installation and Cleaning of Membrane Processing Systems, Number 610-01. Effective November 16, 2003.