Comparative environmental impact analysis of distilled whey spirit and white whiskey production. D. Risner, A. Shayevitz, L. Goddik, and P. Hughes, Oregon State University, Corvallis, OR.

Whey disposal can be an environmental and economic challenge for artisanal creameries. The biochemical demand of whey can be reduced via an ethanol producing fermentation. This fermentation creates a 2.5% alcohol by volume (ABV) wash which can be distilled to produce a potable spirit; Distilled Whey Spirit (DWS). The environmental impact of the distillation process for DWS and another novel spirit, white whiskey, was compared. This was done using a process-based life cycle analysis (LCA). The functional unit of 750 mL of 45% ABV spirit was chosen to compare the environmental impact of DWS and white whiskey. The LCA compared the differences in the production processes. To compare these differences a model 2 pot distillation was created. These differences were quantified via mass of CO₂ produced and water inputs and outputs. The differences measured included energy inputs, mass of water used and output, production byproducts, and CO₂ produced during the fermentation. The energy usage was quantified using thermodynamic calculations and converted to kilograms of CO₂e based upon the burning of natural gas. Conversion of waste material to mass or released from barley amylase activity. Samples were taken at 0 and 180 min and heated to 70°C for 5 min to stop further enzyme activity. Levels of glucose in the samples were analyzed via an enzymatic assay to indicate lactose hydrolysis. Triplicate samples were taken at each time point and the experiment was repeated 3 times. A student’s t-test was conducted to determine significant differences between mean glucose levels in the treatment and the control. At 0 min the control contained 0.03 ± 0.01 g/L glucose and increased to 0.63 ± 0.01 g/L glucose after 180 min. The treatment started at 0.14 ± 0.02 g/L glucose and increased to 4.65 ± 0.17 g/L glucose after 180 min. The level of glucose in the treatment after 180 min was significantly different (P < 0.05) from the control. These results indicate that indigenous enzymes in a barley mash can sufficiently hydrolyze lactose in acid whey. This gives opportunity for utilizing the yogurt byproduct as a raw material in the brewing industry. Further research will look into process development for optimal enzyme activity.

Key Words: acid whey, β-galactosidase, brewing

Production of whey protein-maltodextrin conjugates at a pilot plant scale. Y. Lu, Y. Gong, S. Khanal, M. Molitor, and J. Lucey, Center for Dairy Research, University of Wisconsin-Madison, Madison, WI. Department of Food Science, University of Wisconsin-Madison, Madison, WI.

Conjugation of whey proteins with dextran has been previously studied at a bench top level, and these conjugates had greatly improved functionality. We wanted to develop a process to produce whey protein conjugates at a pilot plant scale so that potential applications of these conjugates could be explored. For scale-up process, we switched from dextran to food grade maltodextrins (MD). We evaluated the impact of the different molecular weight (dextrose equivalent, DE) of MD. We studied the ratio of carbohydrate to protein and concentration of MD for conjugation reaction. The novel “wet” conjugation process developed at University of Wisconsin was used for conjugation. A mixture containing 20% total solids with a ratio of MD to protein = 3:1 was selected, and MD with DE values of 4, 10, 15, and 18 were tested. Mixtures were held at 62°C for 24 h to promote conjugation. The average molecular weight of the conjugates was around 22 - 96 kDa. We observed bacterial growth during the conjugation reaction, and the source of bacteria was identified as the heat stable spore former, Geobacillus stearothermophilus. Bacterial growth caused a significant decrease in pH, which negatively impacted the conjugation reaction. Microfiltration of the reaction mixture eliminated this bacteria from the raw material before conjugation. No further pH drop was observed in conjugation process. Nanofiltration was used to remove small sugars from MD before conjugation. A full scale up pilot plant trial that was completed that produced a spray dried conjugate powder. This powder had a protein content of ~12% and was tested to confirm presence of conjugates. We also confirmed that partially hydrolyzed whey proteins could react with MD to form conjugates. We are exploring options to produce conjugate powders with higher protein levels and enhanced functionality.

Key Words: maltodextrin, conjugation, whey proteins


Acid whey, a byproduct of Greek yogurt, is a significant disposal challenge for the dairy industry. Current acid whey utilization schemes include ethanol production. Since Saccharomyces cerevisiae cannot utilize lactose, the main sugar of acid whey, enzymes or non-traditional yeast strains need to be used. These methods are expensive, and therefore, an alternative approach is needed. A β-galactosidase (β-gal) with activity for lactose has been isolated from barley. Hydrolysis of lactose into glucose and galactose by β-gal would allow for the incorporation of acid whey as a fermentable sugar source in beer production. The objective of this study was to evaluate whether a barley mash at β-gal’s optimum temperature of 40°C, would result in detectable hydrolysis of lactose in acid whey. A mash containing 250 mL of acid whey and 65.9 g of barley meal was shaken constantly at 40°C for 3 h. A control mash consisting of barley meal and water, with no source of lactose added, was used to determine the amount of free glucose in the grain or released from barley amylase activity. Samples were taken at 0 and 180 min and heated to 70°C for 5 min to stop further enzyme activity. Levels of glucose in the samples were analyzed via an enzymatic assay to indicate lactose hydrolysis. Triplicate samples were taken at each time point and the experiment was repeated 3 times. A student’s t-test was conducted to determine significant differences between mean glucose levels in the treatment and the control. At 0 min the control contained 0.03 ± 0.01 g/L glucose and increased to 0.63 ± 0.01 g/L glucose after 180 min. The treatment started at 0.14 ± 0.02 g/L glucose and increased to 4.65 ± 0.17 g/L glucose after 180 min. The level of glucose in the treatment after 180 min was significantly different (P < 0.05) from the control. These results indicate that indigenous enzymes in a barley mash can sufficiently hydrolyze lactose in acid whey. This gives opportunity for utilizing the yogurt byproduct as a raw material in the brewing industry. Further research will look into process development for optimal enzyme activity.

Key Words: whey, distilled, sustainability

Production of whey protein-maltodextrin conjugates at a pilot plant scale. Y. Lu, Y. Gong, S. Khanal, M. Molitor, and J. Lucey, Center for Dairy Research, University of Wisconsin-Madison, Madison, WI. Department of Food Science, University of Wisconsin-Madison, Madison, WI.

Conjugation of whey proteins with dextran has been previously studied at a bench top level, and these conjugates had greatly improved functionality. We wanted to develop a process to produce whey protein conjugates at a pilot plant scale so that potential applications of these ingredients could be explored. For scale-up process, we switched from dextran to food grade maltodextrins (MD). We evaluated the impact of the different molecular weight (dextrose equivalent, DE) of MD. We studied the ratio of carbohydrate to protein and concentration of MD for conjugation reaction. The novel “wet” conjugation process developed at University of Wisconsin was used for conjugation. A mixture containing 20% total solids with a ratio of MD to protein = 3:1 was selected, and MD with DE values of 4, 10, 15, and 18 were tested. Mixtures were held at 62°C for 24 h to promote conjugation. The average molecular weight of the conjugates was around 22 - 96 kDa. We observed bacterial growth during the conjugation reaction, and the source of bacteria was identified as the heat stable spore former, Geobacillus stearothermophilus. Bacterial growth caused a significant decrease in pH, which negatively impacted the conjugation reaction. Microfiltration of the reaction mixture eliminated this bacteria from the raw material before conjugation. No further pH drop was observed in conjugation process. Nanofiltration was used to remove small sugars from MD before conjugation. A full scale up pilot plant trial that was completed that produced a spray dried conjugate powder. This powder had a protein content of ~12% and was tested to confirm presence of conjugates. We also confirmed that partially hydrolyzed whey proteins could react with MD to form conjugates. We are exploring options to produce conjugate powders with higher protein levels and enhanced functionality.

Key Words: maltodextrin, conjugation, whey proteins
The actions and supervision of the Brazilian government to enforce the regulations to adapt to the new requirements, should raise the quality standards of the entire dairy chain. The objective of this study was to analyze the microbiota and natural incidence of aflatoxin M1 (AFM1) in milk based dietary supplements. For the analysis were used the standards described by the normative instruction n. 62 by Brazilian Ministry of Agriculture, Livestock and Supply (MAPA); the normative instruction n. 7 by National Health Surveillance Agency (ANVISA); Standard Methods of the Examination of Water and Wastewater (APHA); the Merck manual and the modified method ISO/TS 22964; Pitt; Hocking in Fungi and food; mycotoxins handbooks of FAO/WHO Expert Committee on Food Additives (JECCA). The analyzes were carried out in the laboratories of the State Center for Food Research at PESAGRO-RJ.

Ten brands were collected from 8 different lots. Classification with a bimestrial difference at different market stablemen’s, with intention to make an average per brands (total of 80 samples). It was observed the following minimum and maximum variations in the counts for the proposed incubation schemes: DRBC (2.00 to 4.86); DG18 (1.88 to 4.40);YPD (2.00 to 4.90); DCPA (2.0 to 3.90). Trials of the natural incidence of mycotoxins demonstrated detectable levels of AFM1 (0.023 - 0.050 μg kg⁻¹) in the samples evaluated (Table 1). All brands of milks supplements analyzed by AFM1 incidence agree Brazilian legislation standards, but some trials exceed international legislation. The fungi count exceeded the stipulated by APHA and FDA/FAO. Such contamination confers potential risk to consumers.

Table 1 (abstract T87). Fungi count (log₁₀ cfu g⁻¹) in the Dichloran Rose Bengal Chloramphenicol agar (DRBC) and aflatoxin M₁ concentration (μg kg⁻¹), in milk food supplement samples

<table>
<thead>
<tr>
<th>Brand</th>
<th>DRBC</th>
<th>AFM₁</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>4.06a</td>
<td>0.0415A</td>
</tr>
<tr>
<td>Y</td>
<td>3.41b</td>
<td>0.0365A</td>
</tr>
<tr>
<td>Z</td>
<td>3.30b</td>
<td>0.0345A</td>
</tr>
<tr>
<td>W</td>
<td>3.29b</td>
<td>0.0353A</td>
</tr>
<tr>
<td>A</td>
<td>3.06b</td>
<td>0.0425A</td>
</tr>
<tr>
<td>B</td>
<td>4.41a</td>
<td>0.0505A</td>
</tr>
<tr>
<td>C</td>
<td>4.30a</td>
<td>0.0245A</td>
</tr>
<tr>
<td>D</td>
<td>3.69b</td>
<td>0.0233A</td>
</tr>
<tr>
<td>E</td>
<td>3.16b</td>
<td>0.0345A</td>
</tr>
<tr>
<td>F</td>
<td>3.41b</td>
<td>0.0365A</td>
</tr>
<tr>
<td>Mean</td>
<td>3.60</td>
<td>0.3596</td>
</tr>
</tbody>
</table>

a,b, Means with the same letter in column are equivalent in accordance with Duncan test (P ≤ 0.005).

Key Words: Aspergillus flavus, mycotoxin production, aflatoxin M₁


Significant volumes of skim milk are concentrated in the Dairy Industry, primarily as an intermediate step in the production of milk powder. When concentration is conducted by thermal evaporation, detrimental changes to product quality occur. Additionally, mesophilic and thermophilic spores can develop and form biofilms within milk evaporators. These spores are extremely difficult to remove and ultimately affect the quality and shelf life of products made from the concentrated milk. In this work, the process of concentrating milk using forward osmosis (FO) was evaluated for its ability to concentrate skim milk at refrigerated to sub ambient temperatures and maintain product quality unchanged. Pasteurized skim milk (Cornell Dairy, Ithaca, NY) was concentrated at 4°C and 15°C using a pilot-scale FO unit (Ederna, France), equipped with a polymeric membrane. Batches of 8L of skim milk were concentrated in triplicate, and the physico-chemical properties of the concentrates were evaluated. The water flux for the FO process decreased exponentially with time, while sample concentration increased exponentially. At 4°C, flux decreased from 3.02 ± 1.32 L/(m²h) at 5min (initial sample °Brix: 9.83 ± 0.15°) to 0.96 ± 0.21 L/(m²h) after 7h (sample °Brix: 28.50 ± 0.78°). The flux was higher for the 15°C runs, ranging from 3.13 ± 0.57 L/(m²h) at 5min (initial sample °Brix: 9.83 ± 0.15°) to 0.87 ± 0.18 L/(m²h) at 7h (sample °Brix: 33.17 ± 2.39°). Because of the lower viscosity at 15°C, a higher concentration factor was achieved at this temperature (4.17 ± 0.65) as compared with 4°C (3.37 ± 0.43). FO concentrates were diluted to their original total solids (TS) content with deionized (DI) water and subjected to color measurements, in triplicate, using a CR-400 chromameter (Konica Minolta, Japan). Luminosity (L*) values of concentrated and re-diluted FO concentrates were not significantly different (P > 0.05) compared with the original skim milk. These results demonstrate that FO can achieve a high concentration factor for skim milk, with no impact on the product color or its chemical components. The process requires further optimization to maximize concentration rate, but the data obtained so far suggests that FO can be a very attractive alternative to thermal concentration of milk.

Key Words: forward osmosis, skim milk concentrate

T89 Withdrawn

T90 Edible electrospun nanofibers from caseinate and pullulan blends. S. Akkurt*1,2, K. L. Yam1, L. Liu2, R. Kwoczak2, and P. M. Tomasula2, 1Food Science Department, Rutgers University, New Brunswick, NJ, 2Dairy & Functional Foods Research Unit Department of Agriculture, Agricultural Research Unit Service, Eastern Regional Research Center, Wyndmoor, PA.

Electrospinning is a technique that applies an external voltage to a polymer solution to produce micro- or nano-scale fibers. This technique has been used to electrospun synthetic polymers from organic solvents and more recently to create edible fibers from aqueous calcium (CaCAS) or sodium caseinate (NaCAS) solutions. Previous studies showed that electrospinning of pure CaCAS or NaCAS from aqueous solutions was not possible. To overcome this challenge, pullulan (PUL), which creates homogeneous nanofibers, was used as a spinning aid. The objective of this study was to examine the effect of PUL addition on the entanglement of PUL and CAS molecular chains, compared with the pure CAS and PUL solutions, and on the morphology and size of the resultant electrospun nanofibers. Stock solutions of 15 wt% CaCAS, NaCAS, and PUL (controls) were prepared separately, and stirred for 2h at 20°C. Blends of the CAS and PUL solutions were prepared in a 1:1 weight ratio at various concentrations. 3mL of each solution was then loaded into a syringe to feed a nanofiber electrospinning unit at flow rate of 1mL/h, and at 11 or 20kV, respectively. Each run was observed for fiber deposition on the rotating drum. Electrospaying was observed for pure PUL, CaCAS or NaCAS solutions at concentrations below 6.0, 9.0, or 7.0 wt% because the low solution viscosities did not promote molecular entanglement. Fibers were observed for CaCAS: and NaCAS:PUL above 9.0 and 9.5wt% showing entanglement with the added PUL. Fiber sizes were determined using ImageJ software to sample the fibers and calculate mean diameters from scanning electron microscopy images. More
Delactosed milk powders (DMP) are produced from enzymatic lactose hydrolysis and, due to presence of galactose and glucose in their formulation, these powders have higher tendency of stickiness, caking and browning during the drying process. For this reason, the production of delactosed powders is yet a challenge for the dairy industry. This work aimed to evaluate the effect of operational drying parameters ($\theta_{\text{air, in}}$ = inlet air temperature and $M_{\text{CM}}$ = concentrated milk flow rate) on the physicochemical and technofunctional properties of DMP. Furthermore, the expenditure of energy during the drying process was evaluated from mass and energy balances. DMP was produced by both variations of $\theta_{\text{air, in}}$ (from 115 to 160°C) and $M_{\text{CM}}$ (from 0.3 to 1.5 kg·h$^{-1}$) in a pilot single stage spray dryer. Powder produced at lower temperatures ($\theta_{\text{air, in}} < 145^\circ$C) and higher milk flow rates ($M_{\text{CM}} > 1.3$ kg·h$^{-1}$) presented elevated mass loss (~30%). Under these conditions, water was not efficiently removed from the product resulting in powders with high humidity (~11% w·w$^{-1}$), $a_w > 0.2$ and strong agglomeration to equipment. The combination of higher temperatures ($\theta_{\text{air, in}} > 130^\circ$C) and lower milk flow rates ($M_{\text{CM}} = 0.3$ kg·h$^{-1}$) resulted in powder with high temperature favoring the Maillard reaction in which were confirmed by presence of products as 5-hydroxymethylfurfural and brown color. In general, by working with $M_{\text{CM}}$ values between 0.5 and 1.0 kg·h$^{-1}$ for any tested temperature, it was possible produce DMP with color, rehydration, humidity, aw and particle morphology closer to milk powder containing lactose (control). Within this group, best results were observed in the powders produced at $\theta_{\text{air, in}} = 145^\circ$C and $M_{\text{CM}} = 1.0$ kg·h$^{-1}$: humidity = 4.2%, aw = 0.2, light yellow color, complete rehydration, mass losses = 15% and energy losses = 22%. Even under optimal drying conditions, this DMP showed energy expenditure of 28,000 kJ·kg$^{-1}$. This approach is a potential tool that can be used by dairy industries to evaluate the properties and cost of delactosed dairy powders.

Key Words: delactosed milk powder, mass and energetic balances, caking

T93 Preliminary studies on heat stability of high protein dairy beverages containing modified milk protein concentrate.

K. Pandalaneni*, J. Amamcharla1, C. Marella2, and L. Metzger2, 1Kansas State University, Manhattan, Kansas, 2Midwest Dairy Foods Research Center, Brookings, South Dakota.

Milk protein concentrates (MPC) are becoming a preferred source of protein in ready-to-drink dairy beverages. Calcium-mediated aggregation of proteins during storage is one of the main reasons for the failure of these beverages. In the current study, 2 batches of each MPC85 (control), 20%-calcium reduced (MPC-20%), and 30%-calcium reduced (MPC-30%) were evaluated in 2 phases and in duplicate. In both the phases, 6 MPC powders were reconstituted to 8% protein solutions, added with 0, 0.15, and 0.25% concentrations of sodium hexametaphosphate (SHMP), and analyzed for heat stability by measuring heat coagulation time (HCT) at 140°C. In phase I, MPCs were reconstituted in distilled water and pH was adjusted to 7 before 3 concentrations of SHMP were added. MPC-30% and MPC-20% exhibited the highest HCT of ~32 min at all levels of SHMP addition while MPC85-Control has the least HCT time of ~21–25 min at 0 and 0.15% SHMP. HCT of control (28.06 min) at 0.25% SHMP and HCT of MPC-30% (32.79 min) and MPC-20% (30.96 min) at 0% SHMP were not significantly different ($P > 0.05$). In phase II, MPCs were reconstituted in a model dairy beverage formulation consisting, 10.26% of a mixture of gums (gellan gum, carrageenan, cellulose gel, and microcrystalline cellulose), maltodextrin, and sugar along with, 0.12% potassium citrate. Formulations were homogenized and treated with 3 concentrations of SHMP after adjusting pH to 7. It was found that the presence gums and sugar adversely affected the HCT of formulated model beverage. Control at 0% SHMP and MPC-20% at 0% SHMP exhibited the highest HCT of 8.86 and 8.37 min, respectively and the HCT is not statistically different ($P > 0.05$). This study shows the possibility of reduced levels of phosphate addition by using calcium reduced MPCs.

Key Words: calcium-reduced MPC, sodium hexametaphosphate, high protein beverage
T94  Development of the method for the determination of the undenatured whey proteins in milk powder products. Z. Zhao*1, Z. Gaygadzhiev2, and M. Corredig1,2, 1University of Guelph, Guelph, ON, Canada, 2Gay Lea Foods, Guelph, ON, Canada.

The whey protein nitrogen index (WPNI) is an established method for grading skim milk powder (SMP) products depending on their heating history. This method is based on the principle of salting out of denatured soluble protein (whey proteins) and then an acid-induced aggregation of the remaining native protein, which causes an increase in turbidity. The WPNI index is derived from a standard curve. The objective of this research was to evaluate if WPNI number is also applicable to milk protein concentrates (MPC), as in these systems, the type of soluble proteins and their aggregation state may be different than in skim milk powders, after reconstitution. WPNI numbers were derived, and the composition of the serum phase as well as the level of denaturation for various milk concentrates and isolates were measured using nitrogen analysis, as well as electrophoresis and cation exchange chromatography. To test the method, milk powder products were reconstituted to a final protein content of 3.2% and skim milk was used as standard. The results show that WPNI numbers obtained from the standard method were higher than the cation exchange chromatography. The denaturation of whey proteins, especially the β-lactoglobulin, was inhibited in MPC compared with SMP. In MPC, the WPNI number obtained from cation exchange chromatography was 5.24 ± 0.12 mg/g, while the WPNI number for low heat SMP was only 3.98 ± 0.11 mg/g. Therefore, the WPNI method is not an appropriate method to determine the undenatured whey proteins for MPC as their turbidity values are out of the range of the standard curve. Alternatively, the method of cation exchange chromatography exhibits great accuracy and reproducibility and can be used for determining the undenatured whey proteins in both liquid and powder milk products.

Key Words: whey protein, skim milk powder, cation-exchange chromatography

T95  Effect of sonication on viscosity of reconstituted SMP and MPC as influenced by solids content. V. Deshpande* and M. Walsh, Utah State University, Logan, UT.

Skim milk powder (SMP) and milk protein concentrate (MPC) are evaporated before spray drying. It would be an economical advantage to obtain a solution of higher % total solids (TS) before spray drying. This is problematic because it leads to an increase in the viscosity. Ultrasound or sonication has been shown to decrease the viscosity of milk protein solutions, therefore, this research studied the effects of sonication on the viscosity of reconstituted MPC (rMPC) and SMP (rSMP) as influenced by %TS at 60°C in a continuous operation. MPC and SMP were reconstituted to 30–34% TS and 46–54% TS, respectively and circulated in a continuous operation at a flow rate of 1.8 L/min for a total of 60 min and 15 min respectively before being sonicated (Hielscher UIP500 sonicator with flow cell). Samples were sonicated (70% amplitude) for a total of 6 min (samples collected after every 2 min). The viscosity was measured at 60°C using a viscometer. Statistical analysis was performed on triplicates using t-tests (α = 0.05). Overall, there was an increase in viscosity with an increase in solids content and a decrease in viscosity upon sonication for both rSMP and rMPC. For rSMP, as compared with presonication, the decrease in viscosity after 2, 4, and 6 min of sonication was 25.3, 29.8, and 33.0% (for 46% TS); 16.0, 37.9, and 42.0% (for 50% TS); 5.7, 9.6, and 13.3% (for 52% TS); 12.0, 16.2, and 22.6% (for 54% TS), respectively. For rMPC, as compared with presonication, the decrease in viscosity after 2, 4, and 6 min of sonication was 30.6, 36.6, and 46.8% (for 30% TS), 19.5, 30.3, and 36.0% (for 32% TS), 24.4, 19.2, and 25.0% (for 34% TS), respectively. Sonication significantly decreased the viscosity of rMPC and rSMP at 2, 4, and 6 min as compared with presonication. For rMPC, the mean viscosity of the 34% TS sample after 6 min of sonication was lower than the mean viscosity of 30% TS sample before sonication. Thus, allowing for an increase in TS by 4% to be spray dried without increasing the viscosity of the solution. For rSMP, sonication did not allow for an increase in %TS without increasing the viscosity of the sample, which can be attributed to the age thickening of the samples.

Key Words: milk protein concentrate, spray drying, skim milk powder

T96  Determination of the appropriate emulsion formulation for microencapsulated milk fat powder production. A. B. Himmetaoglu1, Z. Erbay*2, and M. Cam3, 1Department of Gastronomy and Culinary Arts, Faculty of Tourism, Alanya Handullah Emin Pasa University, Antalya, Turkey, 2Department of Food Engineering, Faculty of Engineering and Natural Sciences, Adana Science and Technology University, Adana, Turkey, 3Department of Food Engineering, Faculty of Engineering, Erciyes University, Kayseri, Turkey.

Microencapsulation technology provides a great protection for perishable food materials, which degrade in the presence of heat, moisture and light, and it’s highly preferable to minimize handling, transportation, and storage costs. Emulsion properties (stability and viscosity) directly affect the microencapsulation process and thus stability of microencapsulated product. In the spray-dried encapsulation process, it’s important to obtain a low-viscosity feed emulsion to achieve a successful microencapsulation. Combinations of carbohydrates and proteins are primary choice as wall materials since they provide low viscosity and improved solubility. In this study, 5 different carbohydrates: 6-DE maltodextrin (LM), 18-DE maltodextrin (HM), lactose (L), sucrose (S), oxidized starch (OS), and 2 different proteins: sodium caseinate, fat-free whey protein concentrate powder (W) used in 5 different proportion (ratio of protein/wall material in between 10 and 50%) and 50 types of emulsions were prepared. Oil-in-water emulsions with 25% solid and 30% wall material content were prepared from cream with 72.5% milk fat content. To evaluate emulsion stability, creaming index and viscosity analyses were conducted. The viscosity of the emulsion at 35°C and 45°C was measured by Brookfield DV-II+ Pro Viscometer (Brookfield Engineering). To calculate creaming index, emulsions were placed in test tubes and stored at room temperature for 24 h. Separation of cream and serum phases was observed after 24 h storage. The results of creaming index analyses showed that the most stable emulsion wall materials were HM+C (10%, 20%), LM+C (10%), HM+W (30%, 40%, 50%), L+W (30%, 40%, 50%), LM+W (10%, 20%, 30%, 40%, 50%). As for the viscosity analyses, viscosity of the emulsions was lower when W was used as the protein source in the wall material. Lower viscosity values were obtained when carbohydrate wall materials based on L, S and HM were used. The best formulation was determined to be L+W (30%). This work was supported by The Scientific and Technological Research Council of Turkey (TUBITAK) [project no: 2150948].

Key Words: microencapsulation, emulsion stability, milk fat