treated with PATP delivered higher CLA retention and a lower hydroperoxide concentration compared with the UHT equivalent process. The kinetic information obtained was used to build pressure-temperature diagrams for CLA retention and lactulose formation. The outcomes of this study are considered a step further for the development of shelf-stable milk processed by PATP.

Key Words: conjugated linoleic acid, kinetics, modeling,

0568 Impact of shear, heat and pH on the conformation, digestibility and antigenicity of lactoglobulin.
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Processing-induced conformational changes can modulate the digestibility of food allergens and their antigenicity. Effects of pH (3, 5, 7), temperature (80, 100, 120°C), and shear (100, 500, and 1000 s^{-1}) on conformational changes (monitored by surface hydrophobicity, total thiol content, FTIR, and gel electrophoresis) and their relation to antigenicity (determined by indirect enzyme-linked immunosorbent assay) of β-lactoglobulin (β-lg) were investigated. Overall, heating at low pH (3) caused the unfolding of proteins and fragmentation by partial acid hydrolysis and thereby exposed β strands that contributed to the appearance of some hidden epitopes resulting in higher antigenicity. Heating at pH 5 and 7 decreased allergenic response due to covalently bonded molecular polymerization and aggregation, which destroyed and/or masked some epitopes. Shear alone had no effect on the antigenic response of β-lg but could have an influence in combination with pH and/or temperature. Overall, heating β-lg solutions to 120°C at pH 5 with shearing (100–1000 s^{-1}) resulted in minimal antigenicity. Structural modifications of β-lg via denaturation or SS/SH-mediated interactions can either enhance or decrease its antigenicity. Based on these results, effects of different pH (3, 5, or 7), temperature (room temperature or 120°C), and shear (0 s^{-1} or 1000 s^{-1}) on the gastrointestinal digestibility of β-lg and post digestion antigenic characteristics were further studied. Regardless of pH, unheated β-lg showed resistance to peptic digestion with high antigenic value while it was fairly susceptible to pancreatin with moderate reduction in antigenicity. Heating at 120°C significantly improved both peptic and pancreatic digestion attributed to structural alterations and resulted in much lower antigenicity; the level of reduction was pH dependent and the lowest antigenicity was recorded at pH 5. High shear (1000 s^{-1}) slightly reduced digestibility and, thereby, enhanced antigenicity of unheated β-lg at pH 5 and 7 but reduced at 120°C irrespective of the pH. Thus, treatment at pH 5, 120°C, and 1000 s^{-1} could potentially reduce post digestion antigenicity of β-lg.

Key Words: processing, shear, heat, pH, β-lactoglobulin, digestibility, antigenicity

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DAIRY FOODS DIVISION SYMPOSIUM: ADVANCES IN SUSTAINABILITY WITHIN THE DAIRY PROCESSING INDUSTRY

0569 New packaging and strategies to enhance your sustainability plan. E. Comere*, *Tetra Pak Inc., Denton, TX.*

Tetra Pak is the world's leading food processing and packaging solutions company. Working closely with our customers and suppliers, we provide safe, innovative, and environmentally sound products that each day meet the needs of hundreds of millions of people in more than 170 countries around the world. With more than 23,000 employees based in over 80 countries, we believe in responsible industry leadership and a sustainable approach to business. Technical development in the packaging industry is intense today, and everyone is trying to crack the code of sustainable packaging introducing new base materials (e.g., renewable, plant based, biodegradable, etc.), processes, and strategies. Driving innovations that address environmental impacts and designing products with the environment in mind will deliver a new competitive edge that can't be ignored. We have already seen multiple innovations in packaging over the last few years. After light weighting and recycling, the next stage of evolution and innovation is around raw material selection, with companies acknowledging our natural resource challenges and rethinking what their packaging is made of. At the same time, new packages have to meet stakeholder demands and offer good convenience while winning environmental arguments in an increasingly competitive business environment and circular economy context. It also highlights how predominant the role of packaging is in the food and drink supply chains (beyond ensuring food contents are delivered safely to consumers, it helps reduce food waste). This session will focus on packaging trends and new sustainable material options, sustainable sourcing, i.e., expanding focus from the end of life of the package (reuse/recycling) to the beginning of a package's life cycle and increasing use of renewable materials responsibly sourced, and understanding the nature of consumer knowledge (including gaps) surrounding sustainable packaging practices

Key Words: sustainable, environment, renewable

0570 Life cycle environmental assessment of yogurt production and consumption in the USA.
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The innovation Center for U.S. Dairy commissioned and jointly conducted a life cycle assessment (LCA) of the yogurt supply chain focused on defining potential environmental impacts with the University of Arkansas. The system boundaries for this study include milk production, yogurt processing, filling and packaging, retail, and finally consumption of the yogurt including disposal of the packaging material. Estimated impacts in various unit processes (milk production, processing, packaging, transport, retail, and consumption) including product losses at each stage are reported and discussed. The functional unit is 1 kg of yogurt products consumed by U.S. consumer as sold at retail, for the year 2013. LCA data were analyzed using stochastic methods (Monte Carlo simulation) to quantify and characterize uncertainty. The impact categories used in the evaluation include climate change, photochemical oxidant formation, cumulative energy demand, freshwater eutrophication, freshwater depletion, water eutrophication, human toxicity, and marine eutrophication, ecosystems, and ecotoxicity. Here, the environmental profile is defined as the comprehensive set of inventory and impact assessment results. The report also provides interpretation and evaluation of the results to help identify the potential risks and opportunities in the yogurt production value chain. The overall cradle-to-grave GHG emissions for set, stirred, and nontraditional Greek yogurt as sold at retail were found to be 6.03, 4.98, and 7.65 kg CO_2e per kg of yogurt consumed, respectively. Using a simulated traditional Greek yogurt plant for production LCI, the cradle-to-grave greenhouse gas emissions were estimated to be 8.92 kg CO_2e per kilogram consumed. In the cradle-to-grave assessment, production of milk is the dominant contributor to most environmental impacts, and thus ongoing industry efforts to improve milk production will lead to improvements in the yogurt manufacturing sector as well. In the farm-gate-to-retail-gate analysis, yogurt transport was the single largest GHG emission contributor followed by ingredients, electricity, and packaging materials. The results suggest that careful optimization of the transport distances and the selection of transport refrigeration system using low-GWP refrigerants could reduce environmental impacts.

Key Words: yogurt, LCA, environmental impact

0571 Using big data to drive sustainable CIP. J. Curran*, *Ecolab, St. Paul, MN.*

The promise of big data as a means to drive process consistency and conformity is alluring to many industries; however, the execution often falls short of the desired outcome due to a lack of analytical resources or an inability to capture the key metrics that help drive decisions. In food and beverage processing, much of this data is already captured using existing plant instrumentation. Further, the trend has been toward recording this information electronically to allow for more data points and faster analysis; however, this data is rarely used to its fullest potential. It is stored as required, and reviewed as necessary. In the development of a new platform, Ecolab has created a method of transforming this data into actionable information, allowing customers to utilize their own data around Clean in Place, coupled with new devices to more accurately measure chemical concentration. This data is captured and utilized in process-specific algorithms to drive sustainability, profitability, and product quality. The result has been a dramatic reduction in water, energy, chemistry, and time consumed for CIP, while at the same time achieving a quantifiable increase in product quality. This is often achieved simply due to the increased process visibility, enhanced analysis, and the increased consistency and conformity that results from the analytical process and does not require large capital investment. Using big data in food and beverage processing facilities to drive sustainability has proven itself as a concept. It does, however, require process understanding and a focus on the drivers within each facility to ensure that change is made in a way that positively impacts both sustainability and product quality, food safety, and brand protection.

Key Words: CIP, analytics, sustainability

0572 Processing sustainability: ideas to create a comprehensive effort. D. Skidmore*, *Hilmar Cheese Company, Inc., Hilmar, CA.*

Hilmar Cheese Company, Inc. was recognized with the 2015 Outstanding Dairy Processing & Manufacturing Sustainability award by the U.S. Dairy Sustainability Awards. The company's Headquarters & Innovation Center was designated LEED Platinum® (Leadership in Energy and Environmental Design) in 2014. The company has produced an annual commitment to sustainability report since 2010 documenting progress and improvements and sharing this information with customers and consumers. The publicized report follows the Stewardship and Sustainability Guide for U.S. dairy, a voluntary framework for tracking and communicating progress. It also incorporates some of the methodologies outlined in the Global Reporting Initiative. The company tracks and improves in four key areas: environment, employees, economic value, and community engagement. The conference presentation will highlight activities in each key area, including water recycling and reuse, solid waste reduction, employee engagement, and community education.

Key Words: corporate responsibility, environmental stewardship, economic value, social responsibility, water reclamation