2018 NATIONAL CONFERENCE

POSTER ABSTRACTS
Monday, May 28, 2018
DAY 1

Ingredient Innovations

[1] MODELING OF HIGH PRESSURE IMPREGNATION OF APPLE CUBES

Hamed Vatankhah and Hosahalli S. Ramaswamy
Department of Food Science and Agricultural Chemistry, McGill University, Ste Anne de Bellevue, QC

High pressure impregnation (HPI) is a novel technique to infuse desired fluids into porous biomaterials. In this study, the pressure-driven fluid migration into porous media such as fruits and vegetable tissues were fully characterized, and a mathematical approach was used to describe the mechanism of pressure-driven flow during the holding period of high pressure processing (HPP). A lumped method was used for the estimation of mass transfer parameters using an analogy to Fick's second law. In addition, a least squares optimization algorithm was introduced as inverse parameter estimators to obtain the associated mass diffusivity coefficients. The approach was verified using a model system involving liquid diffusion (1% w/w ascorbic acid solution) into a porous solid matrix (apple cubes) under HPP conditions (100-600MPa) with different holding times (0 - 30 min). The associated fluid diffusivity values ranged 4.38×10^-9 to 2.19×10^-8 m^2s^-1. In addition, the first-order kinetics model was used to characterize the effect of pressurization rate on fluid uptake with respect to the effective porosity and a mass transfer rate (s^-1). Within 100 to 300 (MPa/min) pressurization rates, the obtained porosity and transfer coefficients ranged,0.23 to 0.25, and 3.6 ×10^-2 to 10.5 × 10^-9, respectively. Finally, a model for the entire process was developed based on the combination of a first-order kinetics during the come-up time and a linear diffusion process during pressure holding time.

[2] EFFECT OF SUBCRITICAL WATER ON BARLEY STARCH-RUTIN COMPLEXATION

Idaresit Ekaettea and Marleny D.A. Saldañaa
Department of Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, AB

Barley is an important grain crop in Canada, however its utilization for food purposes is <1%. Barley grain contains 62-81% starch. Starch is composed of D-glucose polymers namely amylose, and amylopectin which represents the amorphous, and crystalline regions, respectively. Starch has been recently reacted with phenolic compounds at high temperatures >100oC but there is no report for starch-rutin complexation. Rutin, a yellow colour phenolic glycoside is known for its anticancer properties. Therefore, the overall objective of this research was to utilize barley starch with varying amylose content to form starch-rutin complexes using a novel technology known as subcritical water (sCW) processing. Barley starch (BS) was mixed with rutin trihydrate in a ratio of 304:1w/w using a 250mL sCW reactor under the conditions of 100,120,140, & 160 oC at 70 bar for 30 min. BS-rutin complexes were obtained by precipitating sCW treated starch-rutin gels with ethanol, and further lyophilized. Results of analyses on lyophilized sample (LS) showed that the highest rutin content was 0.87 mg/g LS with the 0% amylose starch (>99% amylopectin) at 100oC. The rutin content decreased to 0.25 mg/g LS with increased temperature at 160oC due to depolymerization of starch at high temperatures. A similar trend was observed for the 22% amylose starch (78% amylopectin), with a decrease of rutin content from 0.53 mg/g LS at 100oC to 0.19 mg/g LS at 160oC. In conclusion, starch amylose content is important for BS-rutin complexation under sCW conditions. BS-rutin can be used as nutraceuticals in the Canadian food industry.

[3] CHARACTERIZATION OF SEQUENTIAL PEARLING FRACTIONS OF FAVA BEANS

Brasathe Jeganathan, Jun Gao, Feral Temelli, and Thava Vasanthan
Department of Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, AB

Fava bean (Vicia faba L.) is a protein-rich legume crop with great potential; however, there is limited research on its value-added processing. This will be the first systematic study to explore the distribution of chemical components of fava beans by sequential pearling and optimizing it for the efficient separation of grain components for subsequent processing targeting protein isolation. High-tannin (Athena (HT)) and low-tannin (Snow Bird (LT)) varieties of fava beans were dehulled in a tangential abrasive dehuller and were then sequentially pearled by time control for 9 cycles in triplicate. Based on the results of the compositional analysis of macro components and scanning electron microscopic imaging, proteins were concentrated more in the outer layers which were gradually reduced towards the inner layers, ranging from 42.55±1.02 to 35.03±0.45% (w/w, dry weight basis (db)) for LT and 38.89±0.66 to 33.21±0.59% for HT. The starch content showed an inverse trend, ranging from 29.80±0.68 to 40.10±0.73% for LT and 28.62±0.45 to 45.33±0.95% for HT. The 60% pearling flour had a significantly ($p<0.05$) higher protein content (39.86±0.08 and 38.12±0.13%) compared to dehulled whole beans (34.42±0.30 and 33.67±0.07%) for both LT and HT, respectively. Taking advantage of this distribution, 60% pearling flour shows potential as a raw material for subsequent processing for protein isolation. The findings can contribute to developing functional food ingredients from fava beans.

[4] TEWARI ZERO-OXTECHTM SYSTEMS EXTENDS SHELF-LIFE OF CASE-READY STEAKS

Gaurav Tewari
Sargent Farms LTD, ON

Appearance is a primary factor in determining consumer preference and willingness to purchase meat products. Consumers have shown a preference for meat packaged in Polyvinyl Chloride (PVC) overwrap as compared to vacuum packaging or modified atmosphere packaging (Carpenter et al., 2001); however, PVC overwrapping has a shorter display shelf-life than the other packaging methods. With a shift in the beef industry toward using case-ready packaging at the packing plant rather than butchers cutting and wrapping meat in the grocery store, an oxygen scavenger system has been developed by “Tewari Zero-OxTechTM”to extend the shelf-life of case-ready beef in PVC overwrap. Overwrapped packages are placed in a mother bag which is evacuated of oxygen and filled with a mixture of CO_2 , N_2 , and CO. This novel technology of using oxygen scavengers helps provide consumers with the color and package they prefer. The oxygen scavenger is placed in the mother bag and then absorbs the residual oxygen to help prevent metmyoglobin formation and discoloration, as well as help prevent microbial growth. Overwrapped packages may be held in mother bags for several weeks prior to opening and being put on retail display for several days. The objective of this study was to examine the color stability of case-ready overwrapped beef stored in mother bags with “Tewari oxygen scavengers” for 1, 2, 3, or 4 weeks, as evaluated by a subjective panel and by an objective colorimeter.

[5] X-RAY TECHNOLOGY FOR BONE-DETECTION FOR THE POULTRY INDUSTRY

Gaurav Tewari
Sargent Farms LTD, ON

Vision systems had been in research for several decades for commercial application for the food industry. Ever-changing inherent characteristics of food affected by intrinsic and extrinsic factors, has provided a challenge to vision systems to make it way from lab/pilot test to full scale commercialization. This is especially true for commercialization of X-ray technology for bone-detection for the poultry industry. X-ray detection is dependent on "density" and modern market demands chicken which are relatively younger in age, with less calcified bone structure, making it hard for x-ray technology to be fully implemented for bone-detection. X-ray System need to be engineered to meet the stringent inspection demands of the poultry industry. The unique design of the X-ray system should allow for enhanced poultry bone inspection of both young and mature birds (wishbone, rib bone, fan bone, etc.) and to provide bone detection down to 2.0 - 3.0mm. The system should also detect many other types of foreign bodies and quality defects such as: metals (down to 0.6mm - 0.8mm), glass, stones, high density plastic/rubber, incorrect weight, sizing, etc. with purposed build modules such as: De-boning in-feed section, reject mechanism, re-work light stations, etc. while allowing higher throughput, better line efficiency and lower labor cost. This presentation shall present recent breakthroughs in X-ray technology for poultry industry leading to full-scale commercialization.

[6] SUBCRITICAL WATER TECHNOLOGY: BIOACTIVE STARCH FILMS

Yujia Zhao and Marleny D.A. Saldaña
Department of Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, AB

Bioactive food packaging is an innovative approach to meet the increasing demand for environmentally friendly products as well as the need to extend food shelf life. The objective of this study was to produce bioactive films from potato by-products or cassava starch by subcritical water (SCW) technology with gallic acid, chitosan or carvacrol essential oil added. The patented process used a subcritical fluid reaction system. The effect of temperature, pressure, glycerol/starch ratio, gallic acid/starch ratio, chitosan/starch ratio, and carvacrol/starch ratio were investigated. All films produced were characterized by mechanical, chemical and functional properties. Films produced with potato peel/cull at the ratio of 1.3:1 w/w had the highest tensile strength (7.8 MPa). However, maximum elongation value of 100% was obtained using chitosan and cassava starch. The addition of chitosan decreased the water vapor permeability of films from 6.7 to 3.6*10-4 g/h.m.Pa, due to the formation of ester bonds between -COOH groups of gallic acid and -CH2OH groups of starch and chitosan, as well as hydrogen bonds between NH3+ of the chitosan backbone and OH− of the starch, and electrostatic interactions between COO− and NH3+ as confirmed by FTIR. The chitosan and carvacrol films extended product shelf-life to 25 days compared with the control. Therefore, SCW is a suitable technology to produce bioactive starch films.

[7] HYDROLYSIS OF BIOPOLYMERS IN SUBCRITICAL WATER

Yujia Zhao and Marleny D.A. Saldaña*
Department of Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, AB

Starch and chitosan are biopolymers widely available in agricultural and food by-products. Starch and chitosan can be converted by hydrolytic depolymerisation into dextrins and low molecular weight chitosan. The objective of this study was to understand the effect of subcritical water (SCW) conditions on reaction mechanisms of cassava starch and chitosan. Temperature, pressure and different chitosan/starch ratios were evaluated using a subcritical fluid reaction system. Hydrolysates produced were characterized for amylose content, reducing ends, particle size, molecular weight and zeta potential. A maximum amylose production of 27.1% from cassava starch was obtained at 75 ºC and 155 bar, almost two-fold of native cassava starch (16.9%). At all pressures investigated, significant decrease was observed at 150 ºC. No sugar (DP ≤ 6) was detected in the starch hydrolysate, indicating only the depolymerisation to dextrins. Overall, an increase of reducing ends from 1.6 to 17.3 mg glucose equivalent/g starch was observed. The depolymerisation was also confirmed by the decrease of starch molecular weight from 1243.5 (native starch) to 79.9 kDa after SCW treatment. A lower degree of depolymerisation of chitosan was obtained compared to starch, where the molecular weight decreased from 205 (untreated chitosan) to 24.6 kDa, and the particle size decreased from 2.23 µm to 308.3 nm. In addition, the increase of zeta potential (-4 mV) to 2.11 mV after mixing with chitosan demonstrated the interaction between starch and chitosan. Therefore, SCW is a potential technology for dextrin production, and promotes complexation between starch and chitosan.

[8] NUTRITIONAL PROFILES OF ENZYMATICALLY MODIFIED PEA PROTEIN CONCENTRATES

Dellaney Konieczny[1], Matthew G. Nosworthy[2], James D. House[2,3,4,5], Darren Korber[1], Michael Nickerson[1] and Takuji Tanaka[1]
[1]*Department of Food and Bioproduct Sciences, University of Saskatchewan, Saskatoon, SK*
[2]*Department of Food and Human Nutritional Sciences, University of Manitoba, Winnipeg, MB*
[3]*Richardson Centre for Functional Foods and Nutraceuticals, Winnipeg, MB*
[4]*Canadian Centre for Agri-Food Research in Health and Medicine, Winnipeg, MB*
[5]*Department of Animal Science, University of Manitoba, Winnipeg, MB*

Pea protein concentrates are a nutritious food ingredient being rich in protein, carbohydrates, vitamins/minerals, but low in fat. To improve the nutritional value, partial enzymatic hydrolysis was employed as a means of reducing the bioactive compounds present (e.g., total phenolics and condensed tannins, and trypsin and chymotrypsin inhibitors) and improving the *in vitro* protein digestibility of the ingredient. During this research, partial enzymatic hydrolysis of air classified pea protein concentrates (PPC) was performed using four different enzymes (i.e., trypsin, pepsin, papain and Savinase) to achieve degrees of hydrolysis of 2-4% and 10-12%. In all cases, the enzymatic process was able to significantly reduce all measured bioactive compounds. The total phenolic content of the PPCs were reduced from ~3.0 to ~1.3-1.9 mg Gallic acid equivalents (GAE)/100 g following enzymatic modification, with Savinase being most effective. In all cases, condensed tannins were reduced from ~0.7 mg GAE/100 g to values that were undetectable by the assay for all enzymes. Trypsin inhibitory activity was reduced from 38 to 10-15 trypsin inhibitor units/mg following enzymatic modification, where Savinase being most effective; whereas, chymotrypsin inhibitory activity was reduced from 64 to 3-6 chymotrypsin inhibitor units/mg following enzymatic modification, where papain was most effective. Enzymatic modification also improved the digestibility of all samples as evidenced by improved *in vitro* protein-corrected amino acid scores. In all cases, the limiting amino acids were found to be cysteine/methionine. Overall, enzymatic hydrolysis was found improve the nutritional properties of PPC.

[9] FUNCTIONALITY OF ENZYMATICALLY MODIFIED PEA PROTEIN CONCENTRATES

Dellaney Konieczny, Darren Korber, Michael Nickerson and Takuji Tanaka
Department of Food and Bioproduct Sciences, University of Saskatchewan, Saskatoon, SK

Pea protein is gaining tremendous market interest as a plant-based, non-soy alternative to animal-derived protein in the food industry. To improve its performance as an ingredient, partial enzymatic hydrolysis of air classified pea protein concentrates (PPC) was performed using four different proteinases (i.e., trypsin, pepsin, papain and Savinase) to achieve degrees of hydrolysis of 2-4% and 10-12%. Each of the chosen enzymes has different substrate preferences and preferred conditions, which could lead to differences in protein unfolding to give different surface characteristics and functional properties. Overall, water hydration capacity was improved from 0.60 g/g for the untreated PPC to 1.4-1.9 g/g following enzymatic modification, with the greatest improvement occurring using pepsin. Oil-holding capacity, on the other hand, only increased slightly from 0.7 g/g to 0.9-1.1 g/g following enzymatic modification, with the greatest improvement occurring using Savinase. Foaming capacity was reduced for all enzymatically-modified PPC, with much lower foaming abilities occurring at pH 4 versus pH 7 and 10, which were similar. Foams prepared from pepsin modified PPC showed the least reduction in foaming capacity. Furthermore, foam stability was only slightly improved following enzymatic modification; whereas, all enzymes showed similar foam stabilities. Partial enzymatic hydrolysis was proven to improve the properties of PPC for food applications.

[10] INVESTIGATING ALTERNATE SOURCE AND EXTRACTION METHODS TO OBTAIN CHITIN

Adedayo Leke-Aladekoba[1] and Beth Mason[2]
[1]Dalhousie University, Halifax, NS
[2]Cape Breton University, Sydney, NS

Chitin is a naturally abundant biopolymer consisting of β (1,4) linked 2-acetamido- 2-deoxy-β-d-glucose (n-acetylglucosamine), that has widespread applications in agriculture, medicine, biotechnology, cosmetics, etc. Although, it is synthesized by many different organisms, crustacean shells dominate the commercial production. The present study focuses on the extraction of chitin from insects using conventional and alternative extraction methods including enzyme-, microwave- and ultrasound-assisted extraction and compares the physicochemical characteristics of the end products. The conventional extraction from black soldier fly larval meal resulted in 9.72% yield, while the enzyme-, microwave-, and ultrasound assisted extractions yielded 42.33%, 11.41% and 13.71% on dry weight basis respectively. Although the yield from enzyme assisted extraction was the highest, it is plausible that excipients such as proteins and other fibres could have been extracted along with chitin. The FTIR patterns displayed bands corresponding to the stretching and vibration of OH, NH and CO bonds thus confirming the presence of α-chitin. Furthermore, elemental analysis showed nitrogen content of chitin extracts ranging between 5.76% - 7.68% with enzyme assisted chitin extract having the highest at 7.68%. Detailed information about the nanofibers and pore compositions were obtained via SEM. This study is the first to investigate the potential of alternative extraction techniques to isolate chitin from an insect source with the aim of identifying benign, more cost-effective and low energy.

[11] HIGH PRESSURE EFFECT ON CHICKPEAS QUALITY

Fatemah Alsalman and Hosahalli Ramaswamy
Department of Science and Agricultural Chemistry, McGill University, Ste Anne de Bellevue, QC

High pressure (HP) processing was applied as soaking treatment of Kabouli chickpeas to enhance their nutritional and textural quality. A comparison was made between HP soak-treatment of chickpeas (100–600MPa; one to six consecutive 10min cycles) with and without a traditional pre-soak treatment (2h at 40°C) followed by two different cooking procedures: one in a pressure cooker and other using conventional cooking. Phytic acid and tannin content were measured for samples with the softest texture and for raw and overnight soaked chickpeas. Hydration percentage, texture profile analysis and color parameters evaluated for all samples. The extent of hydration after HP-soak treatment was 38.0% which increased to 48.4% when HP treated after the conventional soaking (2h, 40°C) pretreatment. Hydration after 12h overnight soaking at room temperature was 42.5%. Hardness of HP soaked chickpeas was significantly lower than the overnight soaked ones. During soaking, chickpeas had brighter color as the pressure increased up to 600MPa, while during cooking chickpeas turned darker. HP soak treatment reduced tannin content to 25 mg CE/ 100g and phytic acid to one fifth of the content in raw chickpeas and these were significantly lower than overnight soaking. HP soak treatment therefore could reduce the anti-nutritional factors eliminating the need for overnight soaking. Pressure cooking reached a desired texture ≤ 20N in10min which could not be accomplished in an hour of conventional cooking.

[12] FORMATION OF SODIUM CASINATE-CHITOSAN AND CALCIUM CASINATE-CHITOSAN COMPOSITE BASED EDIBLE FILMS: STUDY THE PHYSICOCHCEMICAL AND STRUCTURAL PROPERTIES

Amal M. A. Mohamed and Hosahalli S. Ramaswamy
Department of Science and Agricultural Chemistry, McGill University, Ste Anne de Bellevue, QC

Blending of the biopolymer such as polysaccharides and proteins is an alternative promising way to enhancement the properties of edible films and coatings. The aims of this work was to evaluate the physiochemical and structural properties of calcium caseinate-chitosan (CaCa-CH) and sodium caseinate-chitosan (NaCa-CH) composite edible films. Films were prepared in appropriate ratio to obtain the following proportions: 100:0, 0:100, 90:10 and 10:90 (CH: NaCa) and same with calcium caseinate –chitosan mixer. Optical, barrier, surface, mechanical and microstructural properties of all film were determined. The swelling index, water vapour permeability, and transparency of the blending films were reduced comparing with control films. The film solubility in water base on the dry value results showed that with increasing the chitosan amount the solubility of the films decreased; 19.7%, 36.49% and 53.12% for CH 100:0, CH: NaCa 90:10 and CH: NaCa 10:90 respectively. FTIR analyse showed good compatibility for all films while the SEM showed homogeneous and smooth surface. The future work will focus on the improvement the barrier and mechanical properties of sodium caseinate –chitosan and calcium caseinate –chitosan edible based film.

[13] EFFECT OF OSMOTIC SOLUTE MIXTURE (SUCROSE: MALTODEXTRIN) ON MICROWAVE OSMOTIC DEHYDRATION UNDER CONTINUOUS FLOW MEDIUM SPRAY- MICROWAVE VACCUM PROCESS USING CCRD.

Bhakti Shinde and Hosahalli S. Ramaswamy
Department of Science and Agricultural Chemistry, McGill University, Ste Anne de Bellevue, QC

A novel drying method was developed by combining microwave osmotic dehydration under continuous flow medium spray (MWODS) and microwave vacuum drying (MWV) method. The study was focused on implementing the microwave energy in optimal way to produce better quality dried product in shorter time. In this study frozen thawed mangoes were subjected to MWODS pretreatment using sucrose and maltodextrin solute mixture as an osmotic solute. The MWODS parameters- temperature (50 C), contact time (30 min) and flow rate (2 L/min) kept constant. About half of the initial moisture content was removed during MWODS pretreatment. Finished drying was performed using MWV method to result in a final moisture content of 20%. The MWODS-MWV process was employed using a central composite rotatable design (CCRD) at five coded levels each (−1.68, −1, 0, 1, and 1.68) by varying the processing conditions; concentration of osmotic solute during MWODS pretreatment, initial and final power level of MWV. The responses were collected based on the physical properties and quality attributes (color and texture) of the dried product and analyzed using ANOVA. Overall, results indicated that MWODS-MWV process was adapted to obtain higher quality product when treated at 60% osmotic concentration in MWODS process, 20% initial and 10% final power level in MWV process. The increased concentration of sucrose-maltodextrin solute mixture was showing improved quality characteristics of the product. The study concluded that the novel drying method can be used as time and energy saving process to optimize the product quality in reduced time.

[14] EFFECT OF MULTILAYER INTERFACE ON THE GELATION OF NANOEMULSIONS

Kunal Kadiya[1], and Supratim Ghosh[1] and Sacha Desparez[2]
[1]*Department of Food and Bioproduct Sciences, University of Saskatchewan, Saskatchewan, Canada*
[2]*Agrosup Dijon, Dijon, France*

Emulsion gels are widely used in different food products, including salad dressings, table spreads, etc. In these semi-solid products, flow behaviour is restricted due to the formation of network of oil droplets and continuous phase biopolymers. In this work, negatively charged pectin of different degree of esterification (DE) were used to form electrostatic interaction with positively charged whey protein isolate (WPI) stabilized oil droplets at pH 3. The aim was to determine the influence of DE (30-90%) and concentration (0-1wt%) of pectin on the gelation behavior of WPI stabilized nanoemulsions. The emulsions were prepared by high-pressure homogenization with average droplet size ranging from 150 – 500 nm and evaluated by charge, rheology and confocal microscopy. Emulsions containing 0.17 wt% pectin were unstable due to bridging flocculation. Above 0.34 wt% pectin or higher a strong gelation behaviour was observed due to the higher thickness of the multilayer interface and the formation of large aggregates between excess pectin and WPI in the continuous phase. Strain-sweep rheology of the emulsion gels showed a two-step yielding behaviour due to the breakdown of large aggregates into individual clusters and then into smaller fragments. The gelation in emulsion achieved at a much lower oil concentration, using the multilayered approach, can serve as an attractive option to produce low-fat products for Canadian food industry.

[15] STUDY LEGUME PROTEIN MICROSTRUCTURE BY MICROSCOPY AND XPS

Mohamed S. A. Hassan, Salwa Kaboune and Inteaz Alli
Department of Science and Agricultural Chemistry, McGill University, QC

The objective of this work is to (i) isolate proteins from 50:50 ratio of white kidney bean and chickpea flours using NaOH extraction/ isoelectric precipitation (NaOH-WK:CPI) and citric acid extraction/ cryoprecipitation (Cryo-WK:CPI) (ii) study microstructural characteristics of protein isolates stored at 40C for 27h by light microscope, scanning electron microscope (SEM) and X-ray Photoelectron Spectroscopy (XPS). Light microscope pictures showed that NaOH extraction/ isoelectric precipitation produced amorphous protein aggregates while citric acid extraction/ cryoprecipitation produced crystalline proteins. SEM of NaOH-WK:CPI showed small pores distributed on rough surfaces while cryo-WK:CPI showed smooth surfaces without pores. Chemical composition of protein isolate surfaces was examined by XPS. Carbon, Oxygen and Nitrogen contents of NaOH-WK:CPI were 82.5, 13.7 and 3.7%, respectively while those of cryo-WK:CPI were 77.3, 16.3 and 6.4%, respectively. XPS analysis of high resolution Carbon showed four main chemical components namely hydrocarbon, ether and alcohol, ketone and aldehyde and carboxylic acid and ester; Nitrogen components of protein powder surfaces were NH2 and Amide Nitrogen, while functional groups of Oxygen determined on protein powder surfaces were O=C-N, C-O and O-C=O. Studying surface structure properties of protein isolate powders helps to understand their functionality such as wetting, dispersibility, oxidative stability, flowability and cacking

[16] REDUCING OFF-FLAVOURS AND THE IMPACT ON LENTIL PROTEIN FUNCTIONALITY

Chang Chang[1], Andrea Stone[1]*, Rick Green[2], and Michael Nickerson[1]
[1]Department of Food and Bioproduct Sciences, University of Saskatchewan, Saskatoon, SK
[2]POS Bio-Sciences, Saskatoon, SK

Lentil protein isolates (LPI) have shown great interest to the food industry because of their nutritional and functional value; however, their use is hindered by the presence of off-flavours. Alcohol extraction is one means of reducing these compounds to give milder tastes. The objective of this research was to examine changes to the flavour profiles in LPI in response to alcohol washing (e.g., acetone, ethanol, and isopropanol at 35-95%), and the resulting impact on their functional (e.g., solubility and emulsion stability) attributes. Flavour profiles (i.e., aldehydes, alkanes, alkenes, alcohols, aromatic hydrocarbons, acryloyls, furans, ketones, and terpenes) were identified using headspace solid-phase microextraction (HS-SPME) combined with gas chromatography-mass spectrometry (GC-MS). Overall, ethanol and isopropanol washings substantially reduced the flavour compounds, especially aldehydes and acryloyls, at ethanol and isopropanol concentrations between 35-75%, with less extraction occurring when 95% alcohol was used. Due to the protogenic nature of acetone, a large number of ketones (e.g., isopropylidene acetone) were produced leading to an increase in the number of volatile compounds in LPI. Therefore, LPIs treated by ethanol and isopropanol (at concentrations of 35%, 55%, and 75%) were carried forward to investigate the functional properties at pH 7.0. Findings indicated that although all ethanol and isopropanol washed LPIs had similar emulsion stability as the original LPI, the solubility was significantly decreased by 35%-55% ethanol and isopropanol. Of the alcohols studied, 55% ethanol and 35% isopropanol were most promising concentrations to remove off-flavours, however both adversely affected their solubility.

[17] EMULSIFYING PROPERTIES OF LENTIL PROTEIN AND FENUGREEK GUM COMPLEX

Pravin Vasant Gadkari[1], Natalie Longmore[1], Supratim Ghosh[1], and Martin Reaney[2]
[1]*Department of Food and Bioproduct Sciences, University of Saskatchewan, Saskatoon, SK*
[2]*Department of Plant Sciences, University of Saskatchewan, Saskatoon, SK*

The study was focused to develop an emulsifier through complexation between lentil protein isolate (LPI) and fenugreek gum (FG). The LPI-FG complex formation was studied as a function of pH (7 to 2), and mixing ratios (1:3 to 3:1). The interfacial and emulsification behaviour of soluble complexes obtained at pH 2 and 7 were further investigated. Significant decrease in oil/water interfacial tension was observed when 0.1 wt% total biopolymer concentration was used, however, compared to pure LPI, the LPI-FG complex showed no significant difference. The presence of FG significantly decreased interfacial storage modulus of LPI. The interface at pH 2 was more stronger and elastic compared to pH 7 due to the higher interfacial electrostatic interaction between FG and LPI at pH 2. The complex, and the individual biopolymers (0.1 wt%) was used to prepare 1 wt% oil-in-water beverage emulsions using multiple passes through a high-pressure homogenizer. In all cases, stable emulsions with average droplet diameters < 500 nm were produced at pH 2 and 7. Complexation with FG significantly improved emulsification behaviour of LPI by increasing the rate adsorption at the oil/water interface due to improved solubility and lower interfacial modulus of the complex. The LPI-FG complexation could be a novel way to utilize Canadian agriculture products for the production of natural emulsifier for food and beverage applications.

[18] GERMINATION OF FABA BEANS CHANGES FLOUR FUNCTIONAL PROPERTIES

Whisley Wei[1], Janitha Wanasundara[1,2], Mehmet Tulbek[3], and Phyllis Shand[1*]
[1]*Department of Food and Bioproduct Sciences, University of Saskatchewan, Saskatoon, SK*
[2]*Agriculture and Agri-Food Canada, Saskatoon, SK*
[3]*AGT Food and Ingredients Inc., Saskatoon, SK*

Germination is one critical step in transforming a seed to a plant and causes biochemical changes in seed constituents. Two cultivars of faba bean (*Vicia faba L.*) seeds (Malik, high vicine/convicine and Fabelle, low vicine/convicine) were soaked in water and germinated at ambient temperature while maintaining >70% relative humidity. Seeds were sampled at 24 h, 48 h, and 72 h of germination and both cultivars reached > 90% germination at 72 h. Samples were freeze dried and milled for analyses. Studies were repeated on three separate lots of seeds. Seeds of both cultivars were similar in protein, total starch, and total dietary fiber (30%, 32%, and 23%, respectively) before germination. Soaking and germination significantly increased ($p<0.05$) water holding capacity (WHC) and oil absorption capacity (OAC) of flour from both cultivars. Among the Rapid Visco Analyser (RVA) pasting properties, a reduction in peak viscosity (by 44% and 43% for Malik and Fabelle, respectively) and final viscosity (by 69% and 64% for Malik and Fabelle, respectively) was observed at 72 h germination. Germination did not significantly change vicine/convine levels, but there were reductions ($p<0.05$) in seed oligosaccharides. Germination resulted in faba bean flours with low viscosity and enhanced WHC/OAC. Germinated faba bean flour is an alternative to chemically modified ingredients in the food industry.

[19] FUNCTIONALITY OF PEA & WRINKLED PEA FLOURS OF DIFFERENT PARTICLE SIZES

Rashim Setia[1], Yikai Ren[1], Zihong Lei[1], Yongfeng Ai[1], and Thomas D. Warkentin[2]
[1]Department of Food and Bioproduct Sciences, University of Saskatchewan, Saskatoon, SK
[2]Deptartment of Plant Sciences, Crop Development Centre, University of Saskatchewan, Saskatoon, SK

Pea is Canada's most widely grown pulse crop, and pea flour (PF) is a popular food ingredient. Different from the common varieties of field pea widely grown in Canada, wrinkled pea is known for its high amylose content of the starch (66-72% amylose), which could impart unique functional properties and enhance the carbohydrate nutritional value of wrinkled pea flour (WPF). In this study, wrinkled pea seeds (B99/108 and 4140-4 varieties) and field pea seeds (CDC Meadow and CDC Golden varieties) cultivated in two locations in Saskatchewan were all ground to pass through a 0.4-mm or 1.0-mm screen to prepare WPF and PF samples. Results showed that WPF had significantly lower total starch contents (28.4-30.0%) but higher total dietary fiber contents (21.8-32.2%) than PF (46.8-51.5% and 11.4-18.7%, respectively). For both WPF and PF, the total dietary fiber contents of coarse samples (≤1.0 mm) were 3-4% greater than those of the fine counterparts (≤0.4 mm). WPF had greater resistant starch contents than PF. WPF exhibited substantially lower viscosity than PF of the same particle size in the Rapid Visco Analyzer profiles. The water-holding and oil-binding capacities of WPF and PF, however, were not significantly different for both particle sizes. The growing locations did not show noticeable effects on the functionality and carbohydrate nutritional value of WPF and PF. The obtained data will be correlated with the amylose contents and thermal properties of WPF and PF.

[20] ISOLATION AND CHARACTERIZATION OF PEA, LENTIL AND FABA BEAN STARCHES

Liying Li[1], Tommy Z. Yuan[1], Rashim Setia[1], Yongfeng Ai[1], and Bin Zhang[2]
[1]Department of Food and Bioproduct Sciences, University of Saskatchewan, Saskatoon, SK
[2]South China University of Technology, Guangzhou, China

There is growing interest in exploring new approaches to increasing the industrial applications of pulse starch, a co-product from pulse processing. In the current study, a simple and effective method was developed to isolate pea, lentil and faba bean starches from air-classified starch-rich flours, and their molecular structure, functional properties and in vitro digestibility were examined in comparison with commercial pea, normal maize, waxy maize and tapioca starches. The isolated pulse starches showed a purity comparable to the commercial starches. Amylose contents of the isolated pea (41.1%), lentil (38.0%) and faba bean starch (39.9%) were similar to that of the commercial pea starch (40.7%) but significantly greater than those of normal maize (31.2%), waxy maize (1.9%) and tapioca starch (30.6%). Amylose contents of the studied starches were inversely correlated with the breakdown viscosities ($r = -0.78$, $p = 0.037$) but positively correlated with the setback and final viscosities ($r = 0.77$, $p = 0.041$ and $r = 0.77$, $p = 0.043$, respectively). Resistant starch (RS) contents of the raw pulse starches (35.5−46.7%) were considerably higher than those of raw maize starches (10.9−18.3%); however, RS contents of the cooked starches were not significantly different. The knowledge and technology acquired from the research will be valuable for the pulse industry to find new opportunities to utilize pulse starch.

[21] SOUS-VIDE NON-ENZYMATIC CARAMELIZATION OF GLUCOSAMINE

Prinjiya Dhungel, Yuliya Hrynets and Mirko Betti
University of Alberta

Sous-vide is increasingly popular method of cooking under controlled conditions of temperature and time inside vacuumed pouches to preserve the nutritional and sensory qualities of food. This study was designed to understand whether sous-vide technology can be used to increase the generation of flavor compounds during glucosamine caramelization at relatively moderate temperatures. A 3 × 2 factorial design was conducted to study the influence of the temperature (50, 60, 70°C) and vacuum or non-vacuum conditions for 12 h on the formation of diacetyl (butterscotch flavourant), fructosazine and deoxyfructosazine (precursors of flavorful pyrazines), while minimizing the formation of toxic heterocyclic compounds as 4-methylimidazole (4-MEI), 2-acetyl-4(5)-tetrahydroxybutylimidazole (THI) and 5-hydroxymethylfurfural (5-HMF). All compounds were analyzed using high-performance liquid chromatography-tandem mass spectrometry. The entire experiment was replicated 3 times. Data were analyzed using analyses of variance (ANOVA) and the means were separated using Tukey's adjustment at $p<0.005$. The results revealed that caramelization under vacuum generated significantly lower diacetyl concentrations as compared to non-vacuum conditions at all incubation temperatures. Significantly greater concentrations of fructosazine were found in vacuum treatments; while no differences were observed between treatments on deoxyfructosazine. No detectable levels of 4-MEI were found in any of glucosamine caramels, while THI levels were significantly higher in vacuum treatments. 5-HMF was found in significantly greater amount in non-vacuum conditions. THI and 5-HMF concentrations in all studied caramels were well below the toxicity levels. This study concludes that sous-vide conditions did not improve the formation of butterscotch flavor but improved the amount of flavorful pyrazines.

[22] UNDERSTANDING PULSE CARBOHYDRATES FOR VALUE-ADDED UTILIZATION

Yongfeng Ai, Liying Li, Rashim Setia, Tommy Yuan, Anthony Zhang, and Yikai Ren
Department of Food and Bioproduct Sciences, University of Saskatchewan, Saskatoon, SK

Pulse crops are of great importance for the agri-food sector in Canada, and carbohydrates (CHO) are a major component in pulse seeds. Our research program aims to improve the functionality and nutritional value of pulse CHO for increased industrial utilization. The first focus is on pulse starch, a co-product from pulse processing. A simple, effective method was developed to isolate high-purity pea, lentil and faba bean starches from air-classified starch-rich flours. Characterization of the isolated pulse starches revealed that they had structure, functionality and digestibility distinctly different from those of commercial normal maize, waxy maize and tapioca starches. Maltodextrins produced from the pulse starches also displayed structure and functional properties different from commercial products. The second focus is on the CHO nutritional value of pulses. After cooking, isolated pea, lentil and faba bean starches showed digestibility similar to normal maize, waxy maize and tapioca starches. Starch from wrinkled pea consisted of more resistant starch (RS) than common pulse starches due to an increased amylose content (66-72% amylose). Wrinkled pea flour also had noticeably higher levels of RS and dietary fiber than field pea flour of the same particle size. The research greatly advanced our understanding of the functional and nutritional properties of pulse CHO, which is valuable for the pulse industry to identify new opportunities to utilize pulses and their fractions.

[23] STRUCTURE AND FUNCTIONALITY OF HIGH-AMYLOSE PEA AND MAIZE STARCHES

Tommy Yuan[1], Liying Li[1], Yongfeng Ai[1], and Tom Warkentin[2]
[1]Department of Food and Bioproduct Sciences, University of Saskatchewan, Saskatoon, SK
[2]Deptartment of Plant Sciences, Crop Development Centre, University of Saskatchewan, Saskatoon, SK

Amylose is known to be a critical factor to determine the functionality of starch. In this study, three methods (colorimetric, AM-C; Con A, AM-Con A; and iodine potentiometric titration, AM-T) were used to measure the amylose contents of starches from three varieties of wrinkled pea (WPS) and those from three varieties of high-amylose maize (HAM S). Amylose contents of WPS ranged from 66.3-71.9% (by AM-C), 55.8-60.7% (AM- Con A), and 66.3-72.3% (AM-T), while those of HAMS varied between 61.8-81.8% (AM- C), 51.1-79.8% (AM-Con A), and 61.8-81.8% (AM-T). Noticeable variation was found in the amylose contents of the starches as determined using the three different methods. Raw WPS showed substantially lower resistant starch (RS) content (10.4 -13.1%) than raw HAMS (49.2-66.3%), which could be attributed to the poor granular integrity and the crystallites of lower thermal stability in WPS. A similar trend was found for the cooked starches (8.3-9.1% RS of WPS versus 12.7-26.9% RS of HAMS), which could result from the lower conclusion gelatinization temperatures and the lack of amylose-lipid complex (ALC) in WPS. No significant correlations were observed between the amylose content determined using the different methods and the structure and functionality of the high-amylose starches. This study suggested that, in addition to amylose content, factors such as molecular organization and ALC formation could also markedly influence the functionality of high-amylose starches.

[24] FUNCTIONALITY OF FERMENTED PEA PROTEIN CONCENTRATE

Hayley Kumitch, Michael Nickerson, Darren Korber, and Takuji Tanaka
Department of Food and Bioproduct Sciences, University of Saskatchewan, Saskatoon, SK

In this research, an air-classified pea protein concentrate (PPC) was partially hydrolyzed using solid-state fermentation with Aspergillius niger NRRL 334 and A. oryzae NRRL 5590 over a 6-h period to obtain degrees of hydrolysis ranging between 0 and 10%. Protein, ash and lipid contents were similar regardless of the fermentation time (degree of hydrolysis) and microbe used, with values of ~41%, ~5% and ~3%, respectively. Oil holding capacities of PPC increased from 1.2 g/g at 0 h to 2.3 g/g at 6 h when fermented with A. niger, and from 1.2 g/g at 0 h to 1.4 g/g at 6 h when fermented with A. oryzae. In the case of water hydration capacities, PPC remained unchanged over the 6 h period in the case of A. niger, but increased from 1.5 g/g at 0 h to 2.0 g/g at 6 h when fermented with A. oryzae. For PPC fermented by both organisms, foaming capacity was found to be greatest at pH 3 and 7 and lowest at pH 5 (near its isoelectric point). Whereas, foams were unstable at pH 5, had minimum stability at pH 3, and were most stable at pH 7. However, foaming capacity and stability were reduced as fermentation time increased at all pH values examined (10~20% and ~76% reduction, respectively). In summary, fermentation may be used to improve the oil/water binding properties of PPC for use as a food ingredient.

[25] CRICKET AND MEALWORM PROTEIN CONCENTRATES – PROTEIN OF THE FUTURE?

Kelsey Waelchli, Andrea Stone*, Takuji Tanaka, and Michael Nickerson
Department of Food and Bioproduct Sciences, University of Saskatchewan, Saskatoon, SK

The pressing needs of protein supply growth gives rise to alternative protein sources, such as insect proteins. Cricket (CPC) and mealworm (MPC) protein concentrates were examined for their *in vitro* protein digestibility, surface charge and functional attributes. Both insect concentrates had similar proximate compositions with protein, ash and lipid contents of ~66% d.b. (dry weight basis), 5% d.b. and ~15% d.b., respectively, and had isoelectric points near pH 3.9. MPC and CPC had water hydration capacities of 1.62 g/g and 1.76 g/g, respectively, and oil holding capacities of 1.58 g/g and 1.42 g/g, respectively. Protein solubility, at pHs 3, 5, and 7, remained unchanged at ~29% for CPC, and ranged from ~22-25% for MPC. Adding chitinase increased solubility to 40.6% for CPC and 36.0 % for MPC. MPC was non-foaming whereas CPC had a foaming capacity of 82% and foam stability of 86%. MPC was limiting in lysine (limiting AA score, 0.71) whereas CPC was limiting in tryptophan (limiting AA score 0.85). *In vitro* protein digestibility (IVPD) values of 75.7% and 76.2%, and *in vitro* protein corrected amino acid scores of 0.54 and 0.65, were found for MPC and CPC, respectively. Values for a commercial pea and faba bean protein concentrate were reported for comparative purposes.

[26] IMPROVED FUNCTIONAL PROPERTIES OF PROTEIN-POLYPHENOL CONJUGATES

Saakshi Parolia[1], Supratim Ghosh[1], and Rick Green[2]
[1]*Department of Food and Bioproduct Sciences, University of Saskatchewan, Saskatoon, SK*
[2]POS Bio-Sciences, Saskatoon, SK

The purpose of the present study was to estimate how lentil protein's interaction with plant polyphenols (quercetin, rutin, ellagic acid, gallic acid) affects the physicochemical, structural, and functional characteristics of the conjugates when compared with the individual components. The interaction between polyphenols and protein was achieved by a simple grafting method. The resulting protein-polyphenol conjugates were characterized using spectroscopic and thermal techniques. The degree of conjugation was determined from the oxidation of total phenolic groups, and the presence of thiol and tyrosine residues. Finally, the antioxidant capacity of the prepared conjugates was estimated using the DPPH free radical scavenging and Ferric Reducing Antioxidant Power assays. Also, to get a better understanding of the functionality, effect of different polyphenols on the solubility, interfacial and emulsifying properties of the conjugates was also investigated. The results show a change in the secondary structure of the covalently conjugated protein in addition to giving compelling evidence of synergism - with improved functional make-up for the protein (antioxidant activities, solubility, and emulsifying properties), depending on the phenolic compound employed. Such conjugation provides a novel and an efficient way to combine the advantages of using plant protein and polyphenols in developing a healthier food ingredient for the Canadian food industry.

[27] COMPLEX COACERVATION OF DE-ESTERIFIED PECTIN WITH PEA PROTEIN ISOLATE

Prasanth K. S. Pillai*, Andrea Stone and Michael Nickerson
Department of Food and Bioproduct Sciences, University of Saskatchewan, Saskatoon, SK

Complex coacervation induced by the electrostatic attraction of food-based proteins and polysaccharide have a broad spectrum of applications such as, controlling food structure, encapsulation, multilayer structures, controlled delivery, protein purification etc. The current research examines the complex coacervation of a high methoxy citrus pectin with degree of esterification (DE)~88%, and its alkali modified derivatives [AP1 (DE ~72%), AP2 (DE ~42%), AP3 (DE: ~10%)] with pea protein isolate (PPI) as a function of pH (8.0 – 1.5) and bio-polymer mixing ratio [PPI: AP(1,2,3) 1:1 - 20:1]. Regardless of the DE value of pectin used, the pH associated with different structure-forming events shifted to higher pH as the mixing ratio increased due to less charge repulsion between neighboring pectin chains that impeded the growth of the complexes. The maximum amount of coacervates are formed at mixing ratios of 8:1, 10:1 and 15:1 for PPI: AP1, PPI: AP2 and PPI: AP3, respectively, and was accompanied by a net neutrality surface charge. The pH at which maximum interactions of biopolymers was occurred at pH ~3.8 (pH opt), and was not affected by the change in DE value of pectin. However, the de-esterification of pectin has shifted the pH related to the formation of soluble complexes (pH_c) and insoluble complexes ($pH_{\phi 1}$) of biopolymer mixtures to a higher value, which was due to the differences in their overall charge density achieved by the de-esterification. Findings from this study will lead to the improved utilization pea protein as food and /or biomaterial ingredients.

[28] EXPLORING CLEAN TASTE PULSE INGREDIENTS IN NON-DAIRY FOOD APPLICATIONS

Angie Lam, Praiya Unatrakarn, Cathy Wang, Akaysha Duchek and Mehmet Tulbek
AGT Foods and Ingredients, Saskatoon, SK

Sales of dairy-free alternatives have reached about an estimate of $2.2 billion in North America in 2017. Consumers choose dairy-free alternatives for several reasons, including health (allergens, lactose intolerance, concerns over hormone and antibiotic use), lifestyle (vegan/plant-based diets), and sensory choices. Plant-based milk substitutes are available from several sources, such as soy, almond, rice, and coconut. One of the most recent non-dairy sources is pulses, such as pea, lentil, chickpea, and faba bean ingredients. Pulses are the fifth largest crop in Canada, with approximately 7.1 million metric tons produced in 2017. They are non-GMO, low-allergen, and sustainable crops in terms of low carbon footprint and high-water use efficiency. However, one major challenge with using pulse-based ingredients is undesirable flavor attributes, which may limit their compatibility with mild-flavored food applications, such as dairy products. Using a proprietary deflavoring process, significant reductions in pulse taste and bitterness were achieved in pea and faba bean ingredients. This poster will explore the potential of clean taste pulse ingredients in several non-dairy food applications such as custard, cream cheese, ice-cream, and non-dairy milk.

[29] INVESTIGATIONS INTO WATER MOBILITY WITHIN LOW SALT BREAD DOUGH WITH NMR

Erin Hopkins[1], Ben Newling[2], Pierre Hucl[3], Martin G. Scanlon[4] and Michael T. Nickerson[1],
[1]Department of Food and Bioproduct Sciences, University of Saskatchewan, Saskatoon, SK
[2]MRI Research Centre, University of New Brunswick, Fredericton, NB
[3]Crop Development Centre, University of Saskatchewan, Saskatoon, SK
[4]Department of Food and Human Nutritional Sciences, University of Manitoba, Winnipeg, MB

Research examined water mobility within simple bread dough formulations using NMR spectroscopy. Doughs contained one of three weak organic acids (acetic, fumaric, succinic), yeast, or no acid, and either no enzyme or glucose oxidase (0.001% GO by flour weight). Two cultivars of flour, Harvest and Pembina were utilized in the study for their respective weak and strong flour characteristics. A Bruker-Minispec NMR was utilized to assess a variety of parameters to provide information about the association of water with polymers in the dough, interaction of hydrogens with the polymer lattice, and side chain motion of polymers. An open GARField magnet was utilized for diffusion measurements to assess the diffusion of hydrogen molecules in the system. Results suggested that the polymer backbones of the gluten network were not significantly affected by the inclusion of the acid or yeast; however, the inclusion of acid affected the motion in the KHz timescale, suggesting increased polymer side-chain movement. No differences were observed between types of acid. Doughs produced with Pembina flour were observed to have very slightly reduced mobile water versus Harvest. Diffusion measurements showed that the motion of water molecules is confined, indicating restricted water mobility. Overall, the inclusion of acids appears to have altered the motion on the MHz and KHz timescales, indicating effects mainly on the polymer side chains but not on the polymer backbones of the gluten network.

[30] SUBCRITICAL WATER EXTRACTION OF BIOACTIVES OF FABA HULL AND PEA POD

Alaleh Boroomand and Marleny D.A. Saldaña*
Department of Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, AB

Increasing consumption has generated high amounts of by-products such as bean hull and pod. Particularly, faba bean hull and green pea pod generated about 15% and 30% by-product, which are good sources of bioactive compounds such as tannins and phenolics. In this study, subcritical water (SCW) was used as a green solvent to valorize faba bean hull and green pea pod. Extracts were obtained using a semi continuous SCW extraction method. Extraction conditions were optimized using different combinations of temperature (100-200℃) and pressure (50-100 bar) for 40 min. Particle size (0.5 mm), flow rate (5 mL/min) and solid/liquid ratio (1:10 w/v) were maintained constant. For both systems, temperature was the most important process parameter. Also, kinetics of tannin removal showed a maximum rate of extraction in the first 15 min in both by-product systems. At 140 o C and 50 bar, the amount of tannin removed from faba bean hull (235 mg tannic acid/g hull) was higher than that for green pea pod (150.2 mg tannic acid/g pod). At the same temperature and pressure conditions, higher total phenolic content was obtained for pea pod (68.6 mg gallic acid equivalent/g pea pod) than that for faba hull (37.5 mg gallic acid equivalent/g hull). Results show that this emerging green subcritical water technology can be used successfully to remove bioactives such as tannins and phenolics from faba bean hull and green pea pod.

[31] THERMAL PROCESSING WITH SHAKA TECHNOLOGY TO EXPAND THE GLOBAL FOOTPRINT OF CONVENIENT, HEALTHIER FOODS

Salinas, F. [1], Watts, E.G.[1], King, J. [2], Wicker, L.[1], Losso, J. [1]
[1]*School of Nutrition and Food Sciences, Louisiana State University Agricultural Center, Baton Rouge, LA 70803, USA*
[2]*President, Apis Group, Colbert, GA 30628, USA*

Agitating retort systems offer quality and process advantages over static retorts. Come-up and cool-down times are about ten-fold shorter resulting in lower thermal effects at the same F_0. Shrimp, sweet potatoes, rice, cheese dips, guacamole and other products were processed at up to 180 cycles/min and 121^0C cook temperature to $F_0 = 6$ in a total process time of less than 20 min in an Allpax Products 2402 Shaka R&D batch retort. Silgan Plastics' thermoformed and Sonoco injection in-mold-label oxygen barrier containers were used; packages were sealed with Fres-co three ply peelable TDS-RD-3013 oxygen barrier film using Reycon and Control GMC sealers, respectively. Appearance of shrimp varied between intact and frayed, depending on presence of thermocouple in package and agitation speed. Sweet potato from large pieces can be processed to puree as cook-in-package, ready to eat snack. Burn-on and darkening was severe from high protein and oxidation sensitive products like cheese dips and guacamole. Flavor and texture sensory values ranged from like moderately to like very much. Collaboration between LSU, Allpax Products and other food and packaging industries facilitates industry development of innovative, portion controlled, healthier food products in a variety of packages that are attractive to consumers.

[32] EXTRACTION AND DE-ESTERIFICATION OF APPLE POMACE (*MALUS DOMESTICA* VAR. BLANCA DE ASTURIAS) SOLUBLE POLYSACCHARIDE

Morales-Contreras B.E.[1], Rosas-Flores W.[1], Morales-Castro J.[1], Wicker L.[2]
[1]*Instituto Tecnológico de Durango., Blvd. Felipe Pescador 1803, Nueva Vizcaya, 34080 Durango, Dgo., México*
[2]*School of Nutrition and Food Sciences, Louisiana State University Agricultural Center, Baton Rouge, LA 70803, USA*

Pomace from pollinator apples was used to obtain soluble polysaccharides (APSP) for possible food applications. Acid extraction was performed using 0.1N HCl. APSP was characterized for galacturonic acid (GalA), degree of esterification (DE), and rheological measurements. The extraction yield obtained was 65 mg/g apple pomace. The GalA content was 35.11% and DE was 66%. Results for 1% w/v APSP dispersion at 25 ºC showed pseudoplastic flow behavior; Herschel-Bulkley model was used for data fit. The gelling which was obtained from Valencia pulp orange; the enzymatic activity was 33.6 U/mL. Aliquots of PME were used in 30 min reactions at 30°C to obtain different pectin DE values of 42, 39, and 34% respectively. Finally, ζ-potential was measured, the results were consistent with the DE values, because the negative charge increased as DE decreased, being -33.38 mV for APSP without modification (66% DE), and -35.60, -37.54, and 39.65 mV respectively. APSP physicochemical and rheological characteristics were like other polysaccharides as pectin and with these properties can be use as thickener, stabilizer, and possibly as gelling agent in the food industry. Also, the modified APSP possibly has inhibitor agent in a lipid digestion process and emulsifying capacity.