Monday 24 October 2022		
	PCH-North	**PCH-South**
	Session Chair: Steve Cui	
8:30-8:50	Welcome, S. Cui and D. Goff	
8:50-9:30	P1 Prof. Dr. Katsuyoshi Nishinari, Japan, The History of the IHC	
9:30-10:10	P2 Prof. Dr. Stefan Kasapis, Australia, Inaugural Glyn O. Phillips Prize lecture: Protein-ligand interactions and controlled delivery for the design of fortified foods	
10:10-10:40	**Break**	
	Session Chair: Dan Ramdath	
10:40-11:15	K1 Prof. Dr. Thomas M.S. Wolever, Canada, Total Fibre vs Types and Sources of Fibre in Subjects with and without Diabetes: Role of Viscosity	
11:15-11:50	K2 Prof. Dr. Heather Armstrong, Canada, Rethinking dietary fibre in inflammatory bowel diseases: when something we thought was always good might not be good for all	
11:50-1:10	**Lunch / Poster**	
	Session Chair: Stefan Kasapis	**Session Chair: Heather Armstrong**
1:10-1:30	C1 - Arabinoxylan from wheat bran: research and applications Go to abstract	C13 - Exploring the inhibitory mechanism of p-coumaric acid from pitaya fruit on a-amylase via molecular biochemistry, enzymatic assays, spectroscopy and in-silico simulations Go to abstract
1:30-1:50	C2 - Thermal and non-thermal processing of bean flour to modify its functionality for use in bakery products Go to Abstract	C14 – The Effect of Genipin Crosslinking On Caffeine Release From Gels of Natural Polymers Go to abstract
1:50-2:10	C3 - Investigating the potential of blending cereal and pulse flours for the manufacture of protein- and dietary fiber-rich puffed snacks Go to abstract	C15 - Delivery of liposomal-encapsulated bioactives from New Zealand damson plums and their incorporation into a functional milk beverage Go to abstract
2:10-2:30	C4 - Use of a novel gluten substitute in the formulation of gluten-free bread doughs: rheological, microstructural, and thermal properties characterizations Go to abstract	C16 - Standardization and Evaluation of Prebiotic Behavior Using In-vitro Validation - Study of Sudanese Gums: A Biotechnological Leads Go to abstract
2:30-2:50	C5 - Use of pulses purées as a novel ingredient to modulate the physical characteristics of pound cake Go to abstract	C17 - Co-precipitates of soy proteins and hydrophobic flavonoids as water-soluble delivery systems for incorporation into functional foods Go to abstract
2:50-3:10	C6 - Impact of different hydrocolloids on the quality of gluten-free naan bread Go to abstract	C18(r) - Using a Biplot Validation Study, Acacia Gums and Adansonia Digitata Supplementation: Prospective for Boosting Immunity to Combat the COVID-19 Go to abstract
3:10-3:30	**Break**	
	Session Chair: Huihuang Ding	**Session Chair: Aiqian Ye**
3:30-3:50	C7 - Inhibition of ice crystal growth by tamarind (Tamarindus indica L.) seed polysaccharide and molecular weight effects Go to abstract	C19 - Nanoemulsion-based gels: Effect of gelling agent type and concentration on their physical properties Go to abstract
3:50-4:10	C8 - Structural characteristics of pine cellulose nanocrystals obtained using two drying techniques: freeze and spray-drying Go to abstract	C20 - Molecular interactions between soybean glycinin (11S) and soybean phenolic compounds Go to abstract
4:10-4:30	C9 - Physicochemical and functional characterization of water-soluble hempseed (Cannabis Sativa L.) polysaccharides and its potential applications Go to abstract	C21 - Interactions Between Dilute Suspensions of Pea Protein Isolate and Rapid Swelling Starch Go to abstract
4:30-4:50	C10 - Assessment of the impact of Acacia senegal provenances at different dates of tapping on gum arabic yield in North Kordofan Go to abstract	C22 - Unexpected morphological modifications of assortment proteins of pea and flaxseed in presence of sodium bicarbonate upon high moisture extrusion: Part I, topological and conformational characteristics, sensory attributes, and viscoelastic phenomena Go to abstract
4:50-5:10	C11 - Effect of Stand Type and Tree Size on Gum Arabic Yield and Seed Characteristics of (Acacia senegal) in North Kordofan State, Sudan. Go to abstract	C23 - Unexpected morphological modifications of assortment proteins of pea and flaxseed in presence of sodium bicarbonate upon high moisture extrusion: Part II, microstructural behavior, mechanical perspectives and colloidal deformation pattern Go to abstract
5:10-5:30	C12(r) - Acidic heteroglycan from corn silk: structural & conformational properties and hepatoprotective activity Go to abstract	C24(r) - Modelling the diffusion kinetics of bioactive compounds from composite gels of protein and polysaccharide Go to abstract

C1 - 107 # Arabinoxylan from wheat bran: research and applications

Qingbin Guo & Tianjin University of Science and Technology Qingbin Guo[1]* Yan Liu[1] Xingyue Xiao[1] Xuerui Zhu

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Abstract Wheat bran has a great value-added potential due to its rich source, low cost and abundance of bioactive ingredients. Arabinoxylan (AX) is the primary soluble dietary fibre from wheat bran. In the present study, wheat bran was alkali soaked and extrusion processed to improve the extraction yield of AX. The obtained AX as the primary research focus was involved in three aspects as follows. First, the structure and functional relationships of AX were studied. AX samples with various Mws and degrees of branching were prepared using different modification methods. Their physicochemical and functional properties and proper fluorescence labeling methods were also compared. The inhibition effects of AX on starch digestibility and its bread application were studied as well. The results provided a deep understanding of the structure & function relationship of AX, which showed that the higher the molecular weight and viscosity of AX, the lower the GI value of bread. Second, the covalent interactions between AX and different polyphenols were studied. Two AX-phenolic acid conjugates were prepared, and their functional and physiological properties were investigated. The results showed that AX-polyphenol conjugates showed overall decreased Mw, increased antioxidant effects and inhibition effects against starch digestibility compared to the original AX. The conjugating strategy of AX with polyphenols could enhance the biological activity of AX and widen its application in food and medicine areas. Third, Interactions between AX and protein were studied. AX-WPI (whey protein concentrate) conjugates were prepared through both dry heating and enzymatical methods. The structural features and emulsifying properties of conjugates were investigated. The results showed that the emulsifying properties of AX-WPI conjugates were 30 times higher than that of commercial gum arabic, which can be applied as a new novel polysaccharide emulsifier in dairy products, meat products, etc. Successful delivery of these studies not only provides the theoretical basis for the industrial application of AX in food, cosmetics and pharmaceuticals but also explores novel value-added applications of wheat bran and other cereal brans as well.

Keywords wheat bran; arabinoxylan; molecular structure; molecular modification; functions; molecular interactions

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C2 - Thermal and non-thermal processing of bean flour to modify its functionality for use in bakery products

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Wheat flour is the primary ingredient of staple food products in many diets around the globe. However, with the increasing consumer demand for high-protein and gluten-free products, alternatives to wheat flour have gained more traction. Bean flour is rich in both macro- and micronutrients with starch and protein being the major components. However, the specific makeup of the starch/protein matrix in beans hampers their interaction with water, causing decreased functionality of bean flour in bakery products. Hence, the purpose of this study was to modify the functional properties of starch and protein (inherent hydrocolloidal components of bean flour) and the starch/protein matrix to alter bean flour's functionality for use as bakery ingredient. Bean flour was processed using thermal and non-thermal treatments. For the thermal treatment, the flour was exposed to dry heat (DH) at temperatures varying between 120 ℃ and 190 ℃ for 15 min. For the non-thermal treatment, aqueous flour slurries (flour: water – 1:4) were subjected to high pressure processing (HPP) at pressures ranging from 250 to 500 MPa for 3 min; followed by freeze drying. The change in the structural and molecular makeup of starch and protein as a result of processing was studied using light microscopy and ATR-FTIR. The consequent overall change in the functionality of the flour was studied using rapid visco analyzer (pasting properties), rheometer (dynamic rheological parameters; G' and G") and by determining the water holding capacity of the flour. The soft wheat flour was used as a reference for the study. FTIR results showed that processing (both DH and HPP) affected the secondary structure of the protein and the crystallinity of the starch present in the flour. Along with this, microscopic studies showed a change in the structural makeup of the starch granules for both treatments. The peak viscosities as determined by pasting profile analysis, of the processed bean flours were higher than those of unprocessed flour. The storage modulus (G') of all flours was higher than the loss modulus (G"). However, the dynamic rheological parameters (G' and G") of HPP flours were higher than those of the unprocessed flours. Conversely, the G' and G" for DH flours were lower than those of the unprocessed flour. The water holding capacity of processed flours was slightly higher than the unprocessed flour. These results imply that the temperature and pressure treatments led to changes in the protein matrix surrounding the starch granules thus, increasing the water accessibility of starch that further causes change in functionality (pasting profile, rheology, and water holding capacity) of the flour. The importance of this study lies in the fact that the properties that were achieved by each of the different types of processing on the bean flours were very different, which may open different opportunities for bean flours as highly functional, novel ingredients for bakery food manufacturing and product development.

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C3 - Investigating the potential of blending cereal and pulse flours for the manufacture of protein- and dietary fiber-rich puffed snacks

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Puffed snacks are predominantly made from refined cereal flours, which are high in highly digestible carbohydrates but low in nutritious proteins and dietary fibers. More recently, consumers are demanding healthier snacks. With the recognition of the importance and benefits of plant proteins in our diets, application of high protein ingredients in puffed snacks warrants investigation. For example, to make up for the limitation of lysine in cereal flours and also to boost the protein content of the end product, pulse flours can be added to the formula, giving the blend a complete amino acid profile. Whole cereal and pulse fours are also good sources of dietary fibers. However, due to the tendency of forming large aggregates during extrusion and the nature of their rigid structure and large particle size, protein and dietary fiber respectively, can result in unappealing products (e.g., harder texture). The development of protein- and dietary fiber-rich puffed snacks requires careful manipulations of ingredient formulation and extrusion conditions. In this study, high protein (26.4%, db) green lentil and high dietary fiber (22.9%, db) barley flours were employed as an example to investigate the possibility of using cereal and pulse flour blends to produce nutritious puffed snacks without compromising physical quality. The effects of blending ratio, extrusion temperature and moisture on physical and nutritional properties of extrudates were studied.

The blends were extruded at five blending ratios (barley: green lentil, 100: 0, 75: 25, 60: 40, 45: 55, 0: 100, db), two barrel temperature profiles (60-130℃ and 70-140℃ from feeder to die) and three feed moisture contents (15, 18 and 21%). Higher protein and dietary fiber resulted in denser and harder extrudates, due to increased competition with starch for water which impacts overall expansion. High temperature significantly improved extrudate overall expansion and textural properties. The effects of feed moisture depended on the blending ratio, parallel with the total protein and dietary fiber content of extrudates. The blend 45: 55 showed the optimum extrudate expansion and texture. X-ray microtomography results showed that this blending ratio also produced lower mean wall thickness, overall larger mean cell size, and larger connectivity between cells. Extrusion significantly improved in vitro protein digestibility (IVPD) of all blends by up to 10%. Blending increased the limiting amino acid score and hence improved the in vitro protein digestibility corrected amino acid score (IVPDCAAS) of extrudates. The blend 45: 55 showed the highest average IVPDCAAS (68.62%). With slight tune-up, the blend 45:55 have great potential to carry “good source of protein” claim in both the US and Canada. All extrudates from blend 60: 40 met the requirements to be labelled as “good source of dietary fiber” in the US. Overall, this study using barley and green lentil flours as a demonstration showed that blends of cereal and pulse flours have great potential to replace refined cereal flours to produce protein- and dietary fiber-rich puffed snacks. These innovative ingredients will not only contribute to healthier diets, but also broaden the market for cereal and pulse flours. To top

C4 - Use of a novel gluten substitute in the formulation of gluten-free bread doughs: rheological, microstructural, and thermal properties characterizations

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Nowadays, the only treatment for celiac disease is a lifelong gluten-free diet. Therefore, it would be necessary to present to celiac patients appetizing products, with characteristics similar to those formulated with wheat flour. Technologically, the main difficulty lies in replacing the gluten, the astonishing wheat flour dough network, especially when making bread that is devoid of it. Compared to other cereals, wheat gluten proteins are distinguished by their ability, after hydration and kneading, to form a three-dimensional, viscoelastic, extensible and gas-impermeable network. Indeed, gliadins and glutenins, the protein fraction of gluten, are responsible for the viscosity (extensibility), and the elasticity (rigidity, cohesiveness) of bread dough, respectively. To make gluten-free bread doughs having rheological properties comparable to those of wheat flour dough, and giving, after baking, a bread with a spongy structure and textural properties analogous to those of ordinary breads, requires the substitution of the gluten network by another having the same techno-functional properties. This was the subject of a patent application N° TN 2015/0462, entitled 'Composition and process for preparing a gluten substitute'. This invention, based on the use of two synergetic hydrocolloids, a protein, and a polysaccharide, and a specific preparation process contributing to the network formation, was used in this study to formulate four new gluten-free bread dough samples, having the same water content, and based on different ratios of waxy corn starch and potato starch.

The objective of this work was to investigate the rheological, microstructural, and thermal properties of the novel gluten-free bread doughs, and to compare them to a bread-making wheat flour dough used as a control. The physicochemical (water, protein, fat, and ash contents, particle size, etc.), techno-functional (viscosity, starching properties and gelatinization), and thermal properties of the different ingredients were studied. The rheological properties of these gluten-free doughs were determined by empirical (Farinograph, SMS-Kieffer extension cell) and fundamental methods (dynamic tests). In the last case, the power-law model was used to fit the experimental data. Results demonstrated that, at the same water content, the various Farinograph parameters were different in all formulations. The frequency spectra showed that the four doughs presented a viscoelastic behavior. All dough samples presented G′ values higher than G″ all over the frequency range, concluding that the four gluten-free bread doughs were structured systems with a predominant elastic behavior. Also, doughs microstructures were conducted by scanning electron microscopy (SEM) and results showed a tridimensional network coating the starch granules. The differential scanning calorimetry (DSC) thermograms showed two starch gelatinization peaks, and an amylose-lipid complex dissociation peak, except for the formula containing only waxy corn starch.

Key words: Gluten-free bread dough, gluten substitute, rheology, SEM, DSC. To top

C5 - Use of pulses purées as a novel ingredient to modulate the physical characteristics of pound cake

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To meet the growing interest in plant-based and local food, this study uses black Beluga lentils and whole yellow peas - two different pulses cultivated in Quebec province - in an innovative way to modulate pound cakes characteristics. The pulses were separately cooked and mashed in their cooking water to produce a purée ingredients containing each 27% of dry matters. A formulation of pound cake was used as a model to study the impact of 20, 40, 60 and 80% substitution of the wheat flour by pulses purée on the physical characteristics of the cakes. To isolate the effect coming from the dry matters' composition of the purées, formulation without purées were produced to match the amount of humidity of the ones containing pulses purée. Flow behaviour measurements were conducted on the cake batters to determine their viscosity, the central height of the cakes was measured with a digital caliper and texture characterization was performed using a profile analysis (TPA). As the substitution level of the flour by pulses purée increases, the viscosity of the batter and the cake height decrease. This could be explained by an increasing amount of humidity in the batter and a decreased content of starch, an important component of cake structure. However, if the batters containing the same amount of humidity are compared, the ones made with pulses purée present a higher viscosity. At 80% substitution of wheat flour, the height of the cakes and their elasticity decrease if the formulation contains pulses purée. These results could be explained by a higher content of protein and by hydrated fibres present in the pulses purée increasing the viscosity and modifying the protein network in the cake structure. This study highlights the interest to use pulses purée as an innovative ingredient to expand the sensorial diversity of pastry products.

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C6 - Impact of different hydrocolloids on the quality of gluten-free naan bread

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Hydrocolloids are essential elements in gluten-free food product formulations used to improve texture and sensory acceptance by consumers. Some hydrocolloids and hydrocolloid combinations have properties that mimic gluten functionality, such as psyllium husks, methylcellulose, xanthan gum, and sometimes combinations of multiple gums. These can be used to preventstarch granule settling and stable gas bubbles. In this study, we intend to prepare gluten-free flatbread, which has been widely accepted in the Middle East and North America. Satisfactory gluten-free naan bread was developed by using a blend of 70% rice flour and 30% chickpea flour with either 5% psyllium husk powder or a mixture of xanthan, guar, and flaxseed gums. To mimic the quality and sensory characteristics of naan bread with psyllium husk fiber, different levels (0.5-0.75-1.00%) of the hydrocolloids flax seed gum and guar-xanthan gum mixtures were evaluated in gluten-free naan bread with the addition of chickpea flour being used to help improve the protein profile by further balancing the amino acids composition. The synergistic interactions of xanthan gum and guar gum helped the starches trap air while flaxseed gum aided with the film formation, helping retain the carbon dioxide produced by yeast in the naan bread. Their combination results in a synergetic effect, improving the quality of gluten-free naan bread. This study provides new opportunities for developing gluten-free staple foods by incorporating pulses.

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C7 - Inhibition of ice crystal growth by tamarind (Tamarindus indica L.) seed polysaccharide and molecular weight effects

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Introduction: Considering the development of high-quality frozen foods, for a long time the scientific community has focused on synthetic small molecules as antifreeze agents, but bio-based polysaccharides provide a fine-tunable and biocompatible alternative. Herein, we report the discovery of inhibition of ice crystal growth by a galactoxyloglucan from the tamarind seed kernel and its molecular weight effects. Methods: Tamarind seed polysaccharide (TSP) fractions with different molecular weights were prepared by endocellulase hydrolysis. An in-depth physicochemical characterization was carried out, including size distribution, molecular conformation morphology, and aggregation behavior. TSP fractions were assessed for performances in ice recrystallization inhibition (IRI), ice-shaping, freezing, and melting behavior. A comprehensive evaluation of the interaction of TSP with ice crystals and water was conducted by XRD, solid-state NMR, and in situ Raman spectroscopy.

Results and Discussion: Four TSP fractions with mean weight-average molecular weight from 2412.38 to 20.75 kDa were prepared while preserving the natural structure. Enzymolysis reduced the molecular weight of TSP but promoted the molecular chain swelling and solvation and an associated reduction in the tendency to form self- and intermolecular aggregation. Ice recrystallization was effectively inhibited by TSP, and its activity displayed significant dependence on molecular weight. Such as, decreasing the molecular weight to a certain range, such as 224.04 kDa and 90.41 kDa, could enhance IRI activity. Native TSP did not show significant changes in freezing point, even slightly promoted freezing at high concentration, while intermediate-molecular weight TSP showed reductions in both freezing point and melting point. TSPs showed an interaction with ice but did not show a macroscopic ice-shaping effect. A perturbation on the water H-bond network by TSPs was also reflected by normalized Raman spectra. This combined effect depends on the balance between adequate molecular weight and inevitably molecular aggregation of the polysaccharide and may explain the action mechanism of inhibition of ice crystal growth.

Conclusion: These findings suggest the great potential of TSP for use as a novel cryoprotectant in frozen food. A combined effect involving a short-range interaction with ice and a long-range perturbation on the water H-bond network may provide a new direction to understanding the exact action mechanisms, which is expected to prove and clarify the molecular and atomistic details in further work. Enough concern must also be paid to the problem of molecular weight and its dependent molecular aggregation of the polysaccharide in practical application.

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C8 - Structural characteristics of pine cellulose nanocrystals obtained using two drying techniques: freeze and spray-drying

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Currently there is a growing interest in finding compounds of natural origin that replace chemical surfactants to stabilize emulsions. An interesting alternative are polymeric particles of nanometric dimensions, such as cellulose nanocrystals (CNC). During CNC synthesis, the drying stage is critical due to its effect on the crystal structure that could affect the stability of emulsions. Therefore, the objective of this work was to evaluate the physical-structural properties of CNC obtained by two types of drying.

Pine cellulose pulp was processed by acid hydrolysis (H2SO4: 59% w/w - 30 min - 64°C) to produce CNC. After centrifugation, two types of drying were applied: a) Spray-Drying (SD, 180°C, flow rate-180 mL/h) and b) Freeze-Drying (FD, -80°C, 0.05 mBar). Physical-properties of CNC such as: particle size and zeta potential (DLS), topography analysis-AFM, thermogravimetric analysis-TGA, crystallinity-XRD, spectra by FTIR, conductometric titration, composition of CHNS (elemental analyzer) and Sorption isotherms (DVS) were measured.

SD-samples presented particle size 300±53 nm and zeta potential -41±9 mV, whereas FD-samples showed 183±24 nm and -42±1 mV. The degradation temperature regardless of the type of drying was ~284°C. Interestingly, the isotherms showed significant differences ($p<0.05$) in terms of equilibrium humidity at relative humidity (RH) contents greater than 80% (SD-~25% Hbs; FD-~48% Hbs at 90% RH). Also, SD-samples showed a type-II isotherm whilst FD-samples a type-IV isotherm, suggesting structural differences in CNC attributable to the drying method. XRD analysis helped to elucidate whether the structural differences are attributed to crystallinity or to the composition of chemical elements such as C,H,S; where the SD-samples presented 40.6%-C; 5.9%-H; 0.6%-S being different to FD-samples that contained 32.6%-C; 4.9%-H; 1.8%-S. The sulfur content of the samples was correlated with the amount of NaOH that was used when performing the conductometric titration, where the FD-samples used a greater amount of NaOH (11.3 mL) to reduce conductivity compared to the SD-samples (10.8 mL). In addition, it was observed that the FTIR spectra indicated that, regardless of the type of drying, they presented similar bonds, observing differences in their intensity.

Therefore, the results obtained suggest that the type of drying influences the structure of CNC. This information is relevant since it can be used as an input for the design of scaled up

processes for CNC, and the evaluation of CNC performance in high-value applications such as stabilization of o/w emulsions by pickering effect conducted by CNC.

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C9 - Physicochemical and functional characterization of water-soluble hempseed (Cannabis Sativa L.) polysaccharides and its potential applications

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The whole hempseed contains about 27.6 % of fiber, of which approximately 5.4% and 22.2% are constituted by soluble and insoluble fiber respectively. The defatted hempseed meal contains about 42.6 % of total fiber. There has been a plethora of studies carried out to study the physicochemical and bioactive properties of hemp protein, oil and other phytochemical constituents. Yet, there is little data available on extraction, yield, physicochemical characterization and functional applications of polysaccharides from hempseeds with or without hull. To develop significant applications of soluble hempseed polysaccharides (HSP), it is critical to understand its physicochemical properties. Hence, the objective of the current study is to investigate the physicochemical properties of soluble hempseed polysaccharide in comparison with pectin and flaxseed gum. Properties such as molecular weight distribution, conformation, total sugar content, uronic acid content, rheological and emulsification properties were evaluated. The results indicated that the HSP was constituted of 33% uronic acids and 53% total sugars, and the conformation was in oblate ellipsoidal shape (Rg=23.07 nm, Rh=22.61 nm). In contrast with flaxseed gum and pectin, HSP showed the highest surface activity above 0.5% (w/v) which increased with increasing concentration. The dynamic flow curves of HSP showed shear thinning behavior at low shear rates ranging from 0.01 to 10 1/s, followed by Newtonian behavior at high shear rates. Emulsion stability of HSP (87.7±1.23 %) and flaxseed gum (91.4±1.23 %) did not show a significant difference ($p < 0.05$). The effects of pH and heat treatment on HSP stabilized emulsions were insignificant ($p > 0.05$) as opposed to flaxseed gum. This study has provided insightful data in using hempseed polysaccharides as a novel ingredient in food industries.

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C10 - # Assessment of the impact of Acacia senegal provenances at different dates of tapping on gum arabic yield in North Kordofan

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Gum arabic, is natural non wood forest product is a very important crop in Africa and in Sudan, it play significant role for poor farmer, it consider as an effective peasant industry. The importance of gum not depend in the fact that it has a wide range of uses in food industry up to atomic reaction but it has great support to livelihood of the farmer. Due to the considerable reduction on supply of the product, this study is targeted to cover unstudied factor which could have impact on gum yield. To evaluate the impact of provenance on gum yield, a two factors randomized complete block design experiment was conduct at Demokeya site; Six provenance at three dates of tapping was tested and repeated for two seasons (2019/2020) - (2020/2021). Gum was collected for (7) picking, a computer software program (MSTAT-C) was used for statistical analysis of variance. The result of two seasons combined analysis was presented in seven tables for each picking and the mean gum yield. The result of analysis revealed a highly significant ($p \leq 0.001$) effect for interaction of the experimental factors on gum arabic yield. The study found that Demokeya provenance origin groups was significantly the best yield in all pickings except the 7th at the mid-October tapping; (33.3, 42.91, 70.87, 79.67, 41.61 and 43.99 (Kg/ha) for the 1st, 2nd, 3rd, 4th, 5th and 6th pickings respectively). The study concluded that it is not recommended to move Acacia seed for specific ecological zone to another when propagation by seeds is require. If happened, it is recommended to consider the period of tapping for origins of reproductive material. A clear record of Acacia seed provenance origin is recommended.

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C11 - Effect of Stand Type and Tree Size on Gum Arabic Yield and Seed Characteristics of (Acacia senegal) in North Kordofan State, Sudan.

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To study the effect of stand type and tree sizes on gum arabic yield of Acacia senegal tree species, two locations of local villages in Sudan, called Demokeya a reserved research testing site east Elobeid town and Al-Rahad natural open forest had been selected inside the gum arabic belt. Two sizes (base on stem diameter at breath height of the trees) were determined within these two forests. A combination of four variables was considered as source of variation to be tested for gum yield and seeds production. Every experimental level was represented with (5 trees). Seeds and gum arabic yield were collected from these combination groups separately, seeds were measured and gum was weighed. The data obtained was subjected to statistical analysis using (SAS) computer software program. The result showed a highly significant differences on fruits (pod) width and length (p = 0.001) and significant different on seed/fruits (p = 0.05). Variation within the number of seeds per pod and the variation within the number of seeds per pod of Acacia senegal revealed that the trees of Demokeya size-2 (6-10 cm) showed the highest significant difference in the number of seeds per pod (5.2 seed/fruit). The result also showed significant differences at significant level (P = 0.01) on gum yield for size class, in the both sites, size class (2) was higher gum yield all around the fifth pickings for Demokeya and Al-Rahad areas.

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C12 - # Acidic heteroglycan from corn silk: structural & conformational properties and hepatoprotective activity

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This study aimed to investigate the structural characterization, conformational properties, and hepatoprotective activity of corn silk polysaccharide (CSP-50E). CSP-50E was an acidic heteroglycan, and the Mw of CSP-50E was detected to be 1.93 × 105 g/mol. Furthermore, CSP-50E presented random coils conformation in an aqueous solution based on the analysis of HPSEC. Besides, structural analysis with methylation and NMR (1D/2D) indicated that CSP-50E contained →4)-α-Galp-(1→, →4)-α-GalpA-(1→, →4)-β-Glcp-(1→ and →4)-α-GalpA-(1→(-OMe), The branches substituted at the →3,4)-Galp-(1→, →4,6)-Galp-(1→, →3,6)-Manp-(1→, and terminated by α-Araf-(1→ and α-Manp-(1→. In addition, various monosaccharides and high uronic acid of CSP-50E could effectively promote HL-7702 cell proliferation via the caspase cascade pathway. Therefore, the results demonstrated that CSP-50E could be a promising traditional supplement to prevent ethanolic hepatitis.

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C13 - Exploring the inhibitory mechanism of p-coumaric acid from pitaya fruit on α-amylase via molecular biochemistry, enzymatic assays, spectroscopy and in-silico simulations

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α-Amylase is a digestive enzyme that catalyses the breakdown of starch into reducing sugars in the digestive tract. Existing literature has reported that phenolic compounds derived from plants are effective therapeutic agents with a strong inhibitory effect on digestive enzymes. This is due to binding interactions impeding enzymatic activity, thus decreasing caloric uptake in the digestive system. The binding interactions generally occur via hydrogen bonding and/or hydrophobic forces between the enzyme and the phenolic compound. However, the molecular mechanism of ligand stabilisation and the binding affinities between α-amylase and p-coumaric acid (a phenolic acid widely found in pitaya fruit) are yet to be studied [1,2].

Receptor-ligand interactions in food systems have been studied by Lineweaver-Burk kinetic analysis, UV-vis spectroscopy, circular dichroism (CD), Fourier-transform infrared spectroscopy (FTIR), fluorescence spectroscopy, differential scanning calorimetry (DSC) and molecular modelling [3,4]. This combined analysis reveals structural changes and interaction forces resulting from complexation between protein and ligand, with binding sites and residues responsible for ligand stabilisation being proposed by molecular modelling. Understanding of the α-amylase-p-coumaric acid interacting mechanism along these lines would provide a theoretical basis for the design of novel plant-based functional foods for the prevention and treatment of diabetic patients.

The present work has found a significant increase in the UV-vis absorption of α-amylase upon complexation with p-coumaric acid, with addition of p-coumaric acid also appearing to quench the intrinsic fluorescence of α-amylase with a 1:1 stoichiometry, leading to the decrease in fluorescence intensity. This outcome is likely a result of the formation of hydrogen bonds between hydrogen acceptor sites of protein and hydroxyl groups of the phenolic acid, which expands the π electron cloud density in the vicinity of aromatic amino acid residues and the phenolic ring of the ligand. CD and FTIR analysis showed an increase in α-helical components of α-amylase upon complexation with p-coumaric acid, likely hampering the channelling of the substrate into the catalytic sites. Kinetic analysis, DSC and molecular modelling have also been conducted to support and further identify the binding pocket between p-coumaric acid and α-amylase.

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C14 - The Effect of Genipin Crosslinking On Caffeine Release From Gels of Natural Polymers

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There is an ever increasing focus on adding value to foods by creating functional systems to meet consumer needs and desires. Although adding bioactive compounds and nutraceuticals is an excellent way to address this, product developers are hampered by the susceptibility of these natural materials to degradation in typical conditions of processing, storage and digestion in the human GI tract [1]. One such way to protect these compounds from harsh temperatures, pH and other external stimuli is through entrapping them in hydrogel systems [2]. Controlled release by diffusion of bioactives from these hydrogels greatly influences the functionality of the delivery vehicle.

This work expands upon the principles of diffusion by examining the relationship between microstructural properties of low-solid gels and molecular transport from these matrices. Chitosan was crosslinked with trisodium phosphate and alginate with calcium chloride. Analysis by FTIR confirmed successful crosslinking and bioactive entrapment for each system while WAXD and rheology highlighted the structural changes brought about through crosslinking. Excellent thermomechanical stability was seen across all hydrogel systems.

Use of the Flory-Rehner equation and swelling theory unveiled the type of crosslinking that impacted the water infusion ability of the various networks. This was then correlated to the diffusion of the bioactive caffeine, showing that structural properties determined by crosslinking levels govern release behaviour [3]. Further correlation between pore size and caffeine release was examined for each network type with increasing mesh size through either decreasing crosslinker concentration or swelling leading to faster rates of caffeine release. Thus the work provides a good case study on crosslinking for the control of the release of bioactive compounds and nutraceuticals from natural hydrogels.

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C16 - # Standardization and Evaluation of Prebiotic Behavior Using *In-vitro* Validation Study of Sudanese Gums: A Biotechnological Leads

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Background: The European Union, the Codex Alimentarius, and the **Food** and **Drug Administration** have agreed that Acacia gums have a dietary fibers behavior among novel **hydrocolloid ingredients**. **Aims:** This pioneering study aimed to screen the potential **prebiotic** activity of pure and an optimum blended formula, mainly composed of *Acacia senegal* gum (ASNG) and *Acacia seyal* gum (ASYG). **Methods:** We evaluated its biomarker properties using short-term batch ***in-vivo*** experiments to support the innate immune system. To achieve this goal, we used both **artificial stomach** (SHIME system) and quantitative polymerase chain reaction (**qPCR**) analysis to evaluate the **potential prebiotic activities** of **ASNG** and **blended formula**. Also, we investigated the biomarker substances, including **short-chain fatty acids (**SCFAs**)**, **ammonium**, **pH**, and **prebiotic bacteria**, using an artificial stomach condition (pH2, pepsin); **small intestine** (**porcine pancreatic enzymes and bile salts**); and **large intestine** (representative bacterial inoculum). **Results**: After **24**h and **48**h, we initially quantified samples for **DNA** extraction. The **SCFAs** produced by **ASNG** led to an increase of all three main SCFAs (**proportionally more propionate**). In contrast, blended formulas (**ASNG** and **ASYG***)* correlated to a **butyrogenic** effect. We quantified high **lactic acid** production in **blended formula** compared to **ASNG**. The **ammonium** concentration of blended formula (ASNG and ASYG) was **34%** lower, significantly ($P \leq 0.05$), than production compared to **ASNG**. Intestinal incubation with blended formula (ASNG and ASYG) revealed a higher concentration of **pH decrease**. Interestingly, **ASNG** led to higher **gas production** than the blended formula (**ASNG** *and* **ASYG)**. Both samples (pure ASNG and blended formula) increased the total **bacteria** concentration and correlated with a **bifidogenic** and **lactobacillogenic** effect. However, samples (pure **ASNG** and blended formula) demonstrated potential **prebiotic activity**, leading to different fermentation profiles. Thus, **ASNG** released higher **SCFAs** production and **bifidogenic/lactobacillogenic** effects. Overall, the blended formula is **butyrogenic**, with **less ammonium** and **gas** production. This may be because of the effect of bifidogenic or lactobacillogenic. **Conclusion:** This data suggests that both (ASNG and blended formula) might have prebiotic ingredients for future biological and hydrocolloid applications.**Keywords:** Artificial stomach, Dietary fibres, Immune system, Novel hydrocolloids and Sudanese gums

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C18 - Using a Biplot Validation Study, Acacia Gums and Adansonia Digitata Supplementation: Prospective for Boosting Immunity to Combat the COVID-19 Pandemic

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Background: The innate immune system (IIS) prevents the host from being infected by pathogenic organisms, including viruses, bacteria, parasites, and fungi. An increased metabolism level, which needs energy sources and substrates for strengthening and controlling molecules, supplemented this keen action, eventually obtained from the superfood. Aims: This is the first study that investigates the micronutrient values (MNVs) and microbial contents of an optimum blend formula at a ratio of 5:3:2 (grams) prepared for Acacia gums (Acacia seyal, Acacia sengal, and Adansonia digitata L pulp (ADLPs)), respectively. Objective: The study's main objective is to develop an optimal formula using a specific combination of AGs and ADLPs to support the infected COVID-19 patient's IIS based on MNVs. Methods: We investigated the MNVs, including microbial content and vitamins, using High-Performance Liquid Chromatography (HPLC) and short-chain fatty acids (SCFA) from AGs, using an artificial stomach. We conducted a randomized trial and a pilot study to identify the effects of the daily optimum blended formula (OPF) (3 in 1) on Covid-19 patients. They gave one hundred five participants the blended (5:3:2 grams/3 times per day) until symptom relief. Results: Incubated at 35°C for 48 hours, the monocyte counts (MCs) of blended (3in1) revealed a safety level of less than 2.4x105 Cfu/g. Vitamins C, A, B1, and B3, which represented approximately 281±3.01, 201±1.53, 3.02±0.023, and 2±0.006 mg/100g DW, respectively, dominated the vitamin concentration of blended (3in1) significantly ($p \leq 0.05$) higher than all samples of vitamin content in this study. In terms of prebiotic activity, SCFA, such as acetate, butyrate, and propionate, AGs (PMC) produced (7% SCFA after 48 hours of incubation) significantly ($p \leq$

0.05) less than AGs (PTC) (50% SCFA after 24 hours of incubation). Finally, based on biplot results, twenty-six (86%) out of the 30 patients improved dramatically over the three days in their clinical conditions on the symptoms, which involved cough, fatigue, and fever; therefore, they regained their abilities to smell and taste and the disappearance of the skin rashes. Conclusion: Finally, the blended (3 in 1) MNVs showed potent evidence of their use in traditional medicine and in preventing and combating COVID-19 symptoms among patients and contact persons. This suggests the potential use of AGs blended with ADLPs as natural antiviral agents to support the system.

Keywords: Gum Arabic; Short-chain fatty acids; Vitamins; Prebiotic; Artificial stomach, High-Performance Liquid Chromatography (HPLC)

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C19 - Nanoemulsion-based gels: Effect of gelling agent type and concentration on their physical properties

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Globally, the population over 65 years old is growing more rapidly than the other population segments. This situation represents a challenge for the Food Industry since the elderly have a higher risk of suffering nutritional deficiencies due to the physiological changes that they experience due to aging. Therefore, the design of soft gels based on bioactive nanoemulsions can be a valuable alternative for the nutrition of elderly people with swallowing disorders. In this context, this work aimed to develop gels based on bioactive nanoemulsions to evaluate the effect of gelling agent type and concentration on their physical properties. For that, oil-in-water bioactive nanoemulsions (droplet size=188±1 nm) with 5% w/w of ω 3-rich oil were prepared by ultrasound homogenization. Then, two gelling hydrocolloids (carrageenan-CA and agar-AG) were added to the nanoemulsion at different concentrations (CA: 0.5 - 1.5% w/w, AG: 1.0 - 1.5% w/w). Nanoemulsion-based gels were characterized by color properties (CIELab space using a colorimeter), physical stability (measured as %water holding capacity-WHC), flow properties (rotational rheometer), texture-profile analysis (TPA) (texture analyzer), and infrared spectra (ATR-FTIR device). Results showed that gels with CA were more yellowness than AG ones, particularly at the highest concentrations. As expected, the %WHC was higher when increasing the concentration of both hydrocolloids. CA-based gels were more stable than AG-based ones (>%WHC). All gels showed non-Newtonian and Ostwald-de-Waele flow behavior; when the hydrocolloids' concentration was increased, the gels' consistency and shear-thinning behavior also increased. In addition, AG-based gels showed a thixotropic behavior, while CA-based ones presented a mixed behavior (rheopectic and thixotropic behavior at low and high shear rates, respectively). The texture properties of all gels exhibited low hardness, adhesiveness, chewiness, and cohesiveness, indicating a soft gel texture; however, CA-based gels presented the highest textural parameter values. The FTIR spectra of the gels showed the absorption peaks associated with the functional groups of the raw materials, and no differences were observed between hydrocolloids type. Finally, it is possible to obtain soft gels based on nanoemulsions with different physical properties, which could be useful to elaborate foods with varied textures for older people with swallowing problems.

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C20 - Molecular interactions between soybean glycinin (11S) and soybean phenolic compounds

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Consumption of plant based proteins has grown significantly in recent years due to an increased awareness of their health benefits and a consumer shift towards a more plant based diet. Soybean (Glycine max) dominates the current market for plant based protein choice and is a source of all 9 essential amino acids. Soy protein can be further divided into its main constituents, glycinin (11S) and beta conglycinin (7S) which contribute approximately 40% and 30% of their total protein content respectively, and are easily digested by the human body [1]. Soybeans also contain a rich source of phenolic compounds including biochanin A, the glycosides genistin and daidzin and the aglycone genistein, which have each been associated with antioxidant, anticancer and ant-iinflammatory properties amongst others [2].

There is presently very little research published on the interactions between soy protein fractions and soy derived phenolic compounds. Knowledge of the interactions between these compounds will assist in the development of functional foods and other applications in the food industry. This work utilises molecular docking studies to assist in demonstrating and predicting the different binding sites between phenolic compound and protein. With more in-depth molecular dynamics simulations offering an insight into changes to solvent accessible surface area, intramolecular hydrogen bonding and alterations to secondary structure, induced by binding interactions [3]. Fluorescence quenching analysis and circular dichroism yield binding constants and secondary structure changes respectively, which are in broad agreement with in-silico analysis.

The binding affinity and location of phenolic compounds on the glycinin molecule is dependent on the structure of the phenolic compounds, and the presence or absence of a glycosidically linked sugar moiety. Further investigation is needed regarding the changes to the techno- and bio-functionality of the phenolic and glycinin molecules that may be induced by their interaction at ambient and high temperature treatments.

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C21 - Interactions Between Dilute Suspensions of Pea Protein Isolate and Rapid Swelling Starch

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Proteins and polysaccharides are essential macromolecules that are responsible for a variety of properties in foods. Their role in plant-based food systems has become of great interest as the products created are highly dependent on the ability of the ingredients to form structures and interact. Three rapid swelling waxy maize starches, including chemically modified, thermally inhibited, and, granular cold water swelling, were combined with pea protein isolate (PP1) to create a fundamental plant-based meat analogue composite. The rheological and textural properties of the composite demonstrated that the type of starch highly influenced the structure and interaction ability with PP1. Thermally inhibited starch and PP1 were able to act synergistically where 30%w/w protein addition actively filled the starch matrix and enhanced the composites, resilience, chewiness, and ductility. The viscosity of 5%w/v protein-starch suspensions were then investigated to further understand the interactions occurring. For thermally inhibited starch, the addition of PP1 significantly ($P \leq 0.05$) increased the viscosity, reaching a maximum between 20-25%w/w protein, suggesting a synergistic interaction. The modified and cold-water swelling starches could not interact to the same extent, and the addition of PP1 decreased the viscosity. In the synergistic complex, interactions were predominantly electrostatic, with more minor contributions from hydrogen bonding. The investigation was extended to additional commercial pea protein isolates; however, enhanced viscosity interactions were limited to PP1. It was determined through assessing protein functional properties that PP1 had greater water holding capacity, smaller particle size, a greater number of lower molecular weight fragments, increased solubility upon interacting with thermally inhibited starch, and the greatest α-helix: β-sheet ratio relative to the other two isolates. Overall, we identified specific protein-starch interactions that could aid in designing plant-based food systems.

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C24 - Modelling the diffusion kinetics of bioactive compounds from composite gels of protein and polysaccharide.

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In order to keep up with the increasing competition, the food industry is continuously being challenged to improve products in terms of cost efficiency and contribution to maintaining a healthy lifestyle (Kasapis, 2008). The use of proteins and polysaccharides in the food industry is widespread but when used in combination, these polymers exhibit thermodynamic incompatibility leading to phase separation. The interplay of gel formation and phase separation has been successfully studied using techniques like light scattering, rheology, calorimetry and microscopy. Rheology-based blending laws are being used extensively to ascertain the mechanical properties of the composites from the shear modulus and the phase volume of the individual phases in the mixture (Mhaske et al., 2020).

The diffusion kinetics of single-phase systems have been studied by various researchers using diffusion theory (Rubilar et al., 2017, Whitehead et al., 2019), To date, work has not been carried out to rationalize the diffusion kinetics of a two-phase system. This study was conducted to understand the diffusion kinetics of vitamin B6 from composite gels of protein (gelatin) and polysaccharide (agarose) via blending law and diffusion modelling. Fourier-transform infrared spectroscopy (FTIR), X-ray Diffraction (XRD), confocal laser scanning microscopy and small-deformation oscillation in shear were used to analyse the structural properties of composite gels. UV-vis spectroscopy was employed to study the diffusion kinetics of vitamin B6 from the gelatin-agarose gels. FTIR confirmed that no chemical interactions occurred between gelatin and agarose in the mixture. XRD was used to study the morphology of the gelatin-agarose-vitamin B6 system, showing that it remained largely amorphous. Confocal laser scanning microscopy provided tangible evidence of the phase-separated nature of the two polymeric constituents in the mixture. Blending law predictions were used to calculate the phase volume and effective concentrations of the individual components in the gel. Using UV-vis spectroscopy, the diffusion of vitamin B6 was measured experimentally from the composite gels prepared from the estimated phase volumes and effective concentrations of the individual components according to blending law modelling. These blending laws were modified to provide corresponding relationships for the diffusion coefficients of each phase and the composite. Thus, theoretical diffusion coefficients were calculated, which were compared favourably with those from the experimental studies. Results argue for the presence of a blending law-based diffusion theory that can predict the diffusion kinetics of bioactive compounds in aqueous composite gels of biopolymers.

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C22 - # Unexpected morphological modifications of assortment proteins of pea and flaxseed in presence of sodium bicarbonate upon high moisture extrusion: Part I, topological and conformational characteristics, sensory attributes, and viscoelastic phenomena

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The present study aims at gaining a better understanding on the structuring mechanisms, sensory and textural attributes of pea extrudates with 0 and 3% (w/w) flaxseed protein influenced by the addition of sodium bicarbonate ($NaHCO_3$, NB) (0.4 and 0.8%, w/w) during high moisture extrusion. Sensory results mainly indicated favor of juicier texture and less compacted texture at 0.8% of NB content resulting in a significantly ($P < 0.05$) improved overall acceptance. At controlled heating and shearing conditions, anisotropy occurred with an increased level of FPC following remarkable modification in protein-protein interactions for extruded samples. The functional properties were affected by the increase in NB content within the domain structure of filaments. Following this, the expressible moisture and cooking yield were increased and textural properties, such as cutting force and elasticity, were decreased upon the addition of NB. The mechanical and thermal results were positively plotted in the KBKZ model and hypothetically represented that the protein aggregates in the added-NB samples. Scanning electron microscopic observations then proved the formation of structured macromolecules with small and large air holes entrapped in the domain orients. Part I of this study tried to show precise aspects in structuring of the plant-based meat alternatives and their physicochemical properties. It emphasized the importance of domain structure of extruded plant proteins in the development of satisfactory meat analogs using NB.

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C23 - # Unexpected morphological modifications of assortment proteins of pea and flaxseed in presence of sodium bicarbonate upon high moisture extrusion: Part II, microstructural behavior, mechanical perspectives and colloidal deformation pattern

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Following the Part I, the micro alterations in structural, colloidal and morphological attributes of various composition of high moisture extruded (HME) pea and flaxseed proteins in presence of sodium bicarbonate ($NaHCO_3$, NB) were thoroughly investigated. The optimum formulation of pea protein isolate (PPI) with the addition of 0 and 3% (w/w) flaxseed protein concentrate (FPC) was used in presence of 0.4 and 0.8%, w/w of NB. Fourier transform infrared spectroscopy (FTIR) revealed that 3% (w/w) extruded flaxseed protein partially maintains its native conformation, whereas its structure has been irreversibly changed in the presence of 0.8% of NB. That was rationalized on the basis of specific rearrangements between sulfhydryl and disulphide bonds following application of NB and reduction in the hydrophobicity of the flaxseed globulin molecule. The influences of FPC on the interfacial protein matrix of extruded and non-extruded systems were then examined and modeled using Cox-Merz rule and van-Gurp Palmen plot. The outcomes of FTIR and STEREO showed the formation of a new matrix with NB and flaxseed proteins in HMEs. These patterns were then confirmed by the higher values of GN° (van Gurp Palmen) associated with the change in the elasticity and the molecular entanglement. The results indicated that the NB significantly ($P < 0.05$) tailored the texture of pea-flaxseed protein HMEs.

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C15 - Delivery of liposomal-encapsulated bioactives from New Zealand damson plums and their incorporation into a functional milk beverage

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Damson plums are rich in bioactive compounds such as flavonoids and anthocyanins, which are potent antioxidants with proven health-promoting properties. However, to date, there is no systematic publication/report about the type and concentration of various bioactive compounds in damson plums or using this type of plum as a food ingredient in the food industry. This study aimed to: 1) extract, identify, and encapsulate polyphenols from the damson plum to investigate the effect of encapsulation on their bioefficacy; 2) compare the physical and chemical stabilities of the encapsulated ingredient in freeze-dried or liquid forms during processing and storage; and 3) assess the behaviour of the encapsulated plum extract after its incorporation into a functional milk product.

Fresh New Zealand damson plums were freeze-dried and ground into a powder and extracted with different methods explained above. The freeze-dried damson plum powder (FDDPP) was then encapsulated in liposomes made of soy lecithin granules using high-shear homogenisation and/or microfluidisation. The encapsulation efficiency (EE) was assessed by the determination of various phenolic compounds using high-performance liquid chromatography (HPLC) before and after the application of Sephadex filtration to separate free phenolics and encapsulated phenolics. Finally, the encapsulants containing FDDPP were incorporated into milk (whole/full-fat) as a functional beverage, and the effect on the physiochemical properties of the milk product was assessed. Milk was chosen as a suitable delivery vehicle (functional food) for the incorporation of the manufactured liposomes containing FDDPP, due to its availability, convenience, and potential nutritional benefits. The physical and chemical stabilities of the phenolic compounds in the functional milk containing free and encapsulated FDDPP were assessed using a pH meter, rheometer, and HPLC analysis.

Neochlorogenic acid achieved the highest EE (98.86%) with the additional microfluidisation step in liquid liposomal encapsulants. In comparison, EE was around 81.40% in the liquid liposomes produced by microfluidisation; whereas, high-shear homogenisation alone produced liposomes with a much lower recovery rate (about 75.52%) for this phenolic component of FDDPP. Thus, the additional microfluidisation step resulted in the manufacture of liposomes with higher physical stability and with a smaller particle size (73.2±1.5 nm), and the highest zeta potential (-35.39±0.97 mV) for the empty liposomes in liquid form. This confirms the stability of the liposomal system manufactured for the current experiment. No significant differences ($p>0.05$) were seen in the viscosity of different milk samples containing free extract, encapsulated extract, and freeze-dried encapsulants. The encapsulants achieved by various homogenisation techniques showed different recovery rates for rutin, catechin, epicatechin, neochlorogenic acid, and rosmarinic acid from the milk containing the extract of New Zealand damson plum.

Further investigation is required to determine the effect of the extraction techniques and the liposomal encapsulation on the extraction and encapsulation efficiencies of New Zealand damson plums, respectively. Further study is also required to investigate the behaviour of encapsulated damson plum extract in different functional foods, the effect on their sensorial

properties, and the bioaccessibility and bioavailability of its phenolic compounds after food consumption.

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C17 - Co-precipitates of soy proteins and hydrophobic flavonoids as water-soluble delivery systems for incorporation into functional foods

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Plant proteins can be used for the delivery of various bioactive compounds including hydrophobic flavonoids, which possess several health-promoting properties. Due to the poor water solubility of hydrophobic flavonoids, a high concentration of the protein and a high level of incorporation into functional foods are required to achieve the corresponding health benefits. In this study, we assessed the efficiency of soy protein isolate (SPI) for the delivery of high concentrations of rutin, naringenin, hesperidin, and catechin. For each flavonoid, the SPI solution was brought to alkaline pH, and then the flavonoid and trehalose (as a cryo-protectant) were added. The mixtures were then acidified, and the co-precipitated products were lyophilised or spray-dried (after redispersion in water). Regardless of the type of flavonoids used, the co-precipitation with SPI exhibited relatively high entrapment efficiency (97-98%) and loading capacity (46-49%) for all five flavonoids. Several structural changes were seen in the scanning electron micrographs of all flavonoid-SPI co-precipitates. This included a significant decrease in the crystallinity of the flavonoids, which was confirmed by X-ray diffraction analysis, where amorphous structures of the flavonoids were observed after the treatment. Both dispersibility and solubility of the lyophilised powders in water were improved dramatically (in some cases, >10 folds) after the treatment, with further improvements observed in these properties for the powders containing trehalose. Depending on the chemical structure and hydrophobicity of the tested flavonoids, there were differences observed in the degree and extent of the effect of the protein on different properties of the flavonoids. Taken together, the results of this study demonstrated that SPI, as a biocompatible and food-grade hydrocolloid, can be used for the development of an efficient delivery system for hydrophobic flavonoids. These delivery systems can be incorporated into various functional foods or used as flavonoid supplements in the nutraceutical industry.

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