

Effect of thawing-assisted ultrasound on pork meat.

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Abstract

Although iodine is not considered essential in terrestrial plants, its exogenous application has been related to potentiation of redox metabolism and increased tolerance to stress. Salinity is recurrent stress, affecting the production of a great variety of horticultural species such as tomato plants; the present experiment was carried out under the hypothesis that application of 100 μM KIO_3 , can function as an inducer of tolerance to salinity stress. The results from the univariate perspective were not clear. However, from the multivariate perspective, it was found an increase in the accumulation of iodine in foliar tissue with the KIO_3 and $\text{KIO}_3 + \text{NaCl}$, and positive correlation with the antioxidant potential. A negative correlation with P, N, and height was also evidenced.

In the seedlings that were subjected to salinity stress (NaCl and $\text{KIO}_3 + \text{NaCl}$), a positive correlation was found with dry weight, fresh weight, number of leaves, stem width, as well as with Ca, Na and Cu, and a negative correlation with the content of Mg, K, Fe and Mn. Therefore, the foliar iodine application exerts beneficial effects enhancing salinity stress tolerance.

Keywords: Freezing, Meat, Thawing, Ultrasound.

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Inactivation of *E. coli* by supercritical CO₂, pulsed electric field and high-power ultrasound

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Abstract

Nowadays, most people's lifestyles are fast-paced, and they seek to meet their nutritional needs in a quick and convenient way that doesn't take up too much time [1]. Due to this, processed products have grown exponentially despite their low nutritional value. In Mexico, huitlacoche or cuitlacoche has traditionally been appreciated as a culinary delight since the time of the Aztecs, and its potential as a functional food and as a producer of natural bioactive substances, which can be used in the production of fortified foods, is currently being studied [2]. For this reason, the purpose of this research was to develop a cookie with oatmeal (*Avena sativa* L), amaranth (*Amaranthus* spp.) and freeze-dried huitlacoche (*Ustilago maydi*-*Zea mays*) as functional ingredient. Total phenol content was evaluated showing an increase from 118,848 to 404,303 mgEAG/100g and antioxidant capacity was determined by the ability to inhibit free radicals 1, 1-diphenyl-2-picrilhydrazyl (DPPH). Finally, a bromatological and microbiological characterization was carried out, showing the following results: 6.45% moisture, 2.23% ash, 14.68% fat, 8.28% protein and 3.06% total fiber. A sensory evaluation of the cookie was performed using a hedonic test for aspects such as color, taste, hardness, chewability and general acceptability, in a group of 60 untrained people, which was accepted by its flavor and texture.

Keywords: Non-thermal technologies, inactivation, *E. coli*.

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Abstract

Although iodine is not considered essential in terrestrial plants, its exogenous application has been related to potentiation of redox metabolism and increased tolerance to stress. Salinity is recurrent stress, affecting the production of a great variety of horticultural species such as tomato plants; the present experiment was carried out under the hypothesis that application of 100 μM KIO_3 , can function as an inducer of tolerance to salinity stress. The results from the univariate perspective were not clear. However, from the multivariate perspective, it was found an increase in the accumulation of iodine in foliar tissue with the KIO_3 and $\text{KIO}_3 + \text{NaCl}$, and positive correlation with the antioxidant potential. A negative correlation with P, N, and height was also evidenced.

In the seedlings that were subjected to salinity stress (NaCl and $\text{KIO}_3 + \text{NaCl}$), a positive correlation was found with dry weight, fresh weight, number of leaves, stem width, as well as with Ca, Na and Cu, and a negative correlation with the content of Mg, K, Fe and Mn. Therefore, the foliar iodine application exerts beneficial effects enhancing salinity stress tolerance.

Keywords: Freezing, Meat, Thawing, Ultrasound.

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[2] Aykin- Dinçer, 2021. Meat Science, 176, 108469

Effect of thermal treatment in protein content and innocuity of the grasshopper (*Sphenarium purpurascens*)

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Abstract

Insects' consumption by humans, known as entomophagy, is a common practice in Asia, Africa, and Latin America. Nowadays, insects are a cheap and healthy protein source alternative [1, 2]. In Mexico, since prehispanic times entomophagy was practiced. Some examples of edible insects are grasshoppers, axayácatl, jumiles and beetles [3]. In this work, we studied the effect of different thermal treatments on the concentration of protein (CP), and microbiological content. Samples of *Sphenarium purpurascens* were submitted into different thermal treatments of forced convection drying in an open system (A: 180 °C and 6 m/s, B: 180 °C and 3 m/s, C: 90 °C and 6 m/s, D: 90 °C and 3 m/s) and closed system (E: 80 °C and 10 m/s). First, it was carried out a characterization of the raw matter (RM), where we obtained the parameters of comparison for the treatments. For protein quantification, was determined by Bradford test. For innocuity, it was done microbial counts for total coliforms (CT), aerobic mesophylls (AM), fungus, and yeast (FY) by the spread plate method. The RM showed a protein concentration of 208.33 mg/g of sample. The grasshopper with thermal treatment showed a decrement on protein of 64.48% in A treatment, followed by B with 59.58%. The treatments with lowest decrement were C (17.06%), D (15.61%) and E (6.66%). In fresh sample of grasshopper showed growth in the three microbial counts. In the case of the treated the growth of microorganisms tend to less than 1.0×10^2 UFC/mL. As a result of the low moisture and water activity in the sample, due to the drying process. Therefore, the used of an air fryer could be an alternative for the process of edible insects without affecting their protein concentration and innocuity.

Keywords: Thermal treatment, protein, innocuity, grasshopper

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Ultrasound or pulsed electric field applied to fresh orange juice

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Abstract

Non-thermal technologies for food processing, such as ultrasound (US) or pulsed electric fields (PEF) keep gaining importance, due to their capacity to inactivate pathogenic and spoilage microorganisms, besides to preserve bioactive compounds and fresh-like characteristics in fruit juices. Orange juice (OJ) is considered a natural source of phytochemicals with health-benefits by reducing degenerative diseases [1]. Most phytochemicals are heat sensitive. In this regard, this study was focused to evaluate the effect of US or PEF treatments on the phytochemical properties and sensorial characteristics of OJ. Fresh just squeezed OJ were exposed to US (20 kHz and 700 W) for 5 min and 100% amplitude or PEF (monopolar-square pulses of 3 kV/cm, 100 Hz and 400 μ s). Color, antioxidant capacity, and total phenolic content (TPC) were evaluated in control and treated juices. PEF increased the b* value (20.31 ± 0.37) with respect to the control (19.10 ± 0.26), while US decreased this parameter (17.33 ± 0.40). The lightness parameter (L) increased from 54.77 ± 0.69 (control-OJ) to 57.90 ± 0.49 (US-OJ) and 56.83 ± 0.64 (PEF-OJ). The PEFOJ showed lower antioxidant capacity (0.484 ± 0.004 mg eq. Trolox) than the control (0.501 ± 0.004 mg eq. Trolox), but the US-OJ had the highest value (0.51 ± 0.003 mg eq. Trolox). US and PEF enhanced the TPC (51.83 ± 0.46 and 41.70 ± 1.85 mg GAE/100mL, respectively) compared to that in control juice (21.09 ± 0.89 mg GAE/100mL). Regarding flavor characteristics, control and treated juices were evaluated qualitatively after cold storage (1 week), and the bitter taste was lower in the US-OJ and PEF-OJ. These results demonstrated that US and PEF are potential alternatives to increase or retain the antioxidant capacity and TPC of OJ and improve sensorial properties during storage.

Keywords: Phytochemical properties, Non-thermal technologies, Orange juice.

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Effect of organic and conventional production methods on physical-chemical quality parameters of Persian lime fruits (*Citrus × Latifolia* Tanaka Ex Q. Jiménez)

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Abstract

The consumption of organic foods has increased in recent years, which has achieved beneficial effects on health and it has contributed to reducing the environment impact [1]. The demand for organic lemon consumption in Europe and Eastern countries and in the United States has increased [2]. Mexico is one of the largest lemon producers worldwide, which is why it has been shown to be interesting in organic production schemes and in obtaining good quality fruit for national and international markets [3,4]. Therefore, the objective of this work was to evaluate the effect of organic and conventional production methods on the chemical-physical quality of Persian lime fruits (*Citrus × Latifolia* Tanaka Ex Q. Jiménez). The evaluation parameters were weight, equatorial diameter, longitudinal size, juice volume, pH, total soluble solids and citric acid percentage. The fruits were collected in two orchards located in the citrus region of Tierra Blanca, Ver., Mexico, is one by organic and conventional production system. There was no statistical difference in the content of total soluble solids and the percentage of citric acid in the fruits of the two types of orchards evaluated, however, it was shown that the values of pH, weight, equatorial diameter, longitudinal size and volume of juice were statistically different, being higher in fruits from orchards with organic production methods. Therefore, organic production methods represent an alternative to obtaining Persian lime fruits with the quality demanded by domestic and export trade. In addition, it is also an alternative to reduce the use of chemical fertilizers and to obtain healthy fruits for the consumer.

Keywords: Organic lemon, physical-chemical quality, healthy food, organic production. Phytochemical properties, Non-thermal technologies, Orange juice.

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Inking development in Peach fruit (*Prunus persica* L.) and its possible chemical and biochemical mechanism

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Abstract

In the last decade, the production of peaches in Mexico has decreased. One of the causes is related to visual defects such as inking, which is manifested as dark spots on the skin [1]. The mechanism that induces this problem is not well known [2]. The aim of this project is to provide knowledge that allows to elucidate the mechanisms involved in fruit inking. Peach fruit of three varieties: MG8, Colegio and 229 were collected from orchards. Skin samples from affected and unaffected fruit were analyzed for Fe content, total phenolic content, phenolic profile and polyphenol oxidase activity (PPO). Fe content was higher in inked fruits of MG8 and Colegio varieties. As well, MG8 variety exhibited the highest phenolic content (104.5 mg eq gallic acid/100g FW), whereas Colegio and 229 varieties showed lower values (86.8 and 87 mg eq of ga/100g respectively). Comparing the total phenolic content of inked and non-inked fruits of the same variety, it was observed that inked fruits showed higher phenolic content (44% in MG8 and 25.2% in Colegio), whereas 229 variety didn't manifest the phenomenon. In addition, PPO activity was enhanced in inked fruits of MG8 and Colegio varieties. An induction model to reproduce the phenomenon was developed by brushing and spraying different solutions of Fe. Fruits subjected to brushing and Fe salts, developed inking immediately after damage, and the phenolic content increased as the brushing time intensified and the concentration of Fe salts was higher. All these data seem indicate that peach inking is highly linked to variety, phenolic content and an excess of Fe ions.

Keywords: peach, inking, phenolic compounds, heavy metals.

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Deep Learning and Computer Vision for Mayonnaise Acceptability Prediction

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Abstract

Image analysis has been gaining interest in food science for the automation of processing, evaluation, and quality control [1,2]. The present work aims to develop different deep learning classifiers, in combination with computer vision, for assessing the visual quality of mayonnaises into acceptable and non-acceptable products using a simple photograph of the product. The database of 300 pictures was classified by a semi-trained panel, then, the database was split into training and testing sets at 70 and 30 %, respectively. The image processing (feature extraction) was done in Julia Programming Language (1.6.4). The color features included the mean, standard deviation, skewness, and kurtosis of each color channel in RGB, HSV, and CIELab color spaces; additionally, the Haralick features (texture features) were obtained using a Gray-Level Co-occurrence Matrix. An Artificial Neural Network (ANN) and a Convolutional Neural Networks (CNN) using the Adam optimizer were developed in Keras (2.4.3) using Python (3.10) and evaluated in terms of accuracy, precision, and recall. The ANN showed the best results in all classification metrics, it demonstrated to be able to classify accurately (accuracy = 0.988) and precisely (precision = 0.977) the mayonnaise samples; moreover, the recall (0.999) indicates a high reliability to avoid false negative classifications. In contrast, the CNN showed lower values for all metrics: accuracy = 0.934 precision = 0.965, recall = 0.933. Even though the ANN demonstrated to be superior, the CNN results indicate that this latter can be considered as a good classifier. In summary, it is possible to construct deep learning models based on computer vision for assessing the quality of mayonnaise products, with high accuracy and reliability.

Keywords: artificial intelligence, visual quality, Artificial Neural Networks, Convolutional Neural Networks.

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Valorization strategy of red and yellow coffee pulp (*Coffea arabica*)

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Abstract

Most benefits of coffee have been found in its beverage, however, processing by-products have been reported as source of compounds of high value [1]. Some of those compounds are phenolic compounds, alkaloids as caffeine, and carotenoids as β -carotene and lutein [2]. Coffee pulp are the main solid residues representing about 29% (dry base) of the cherry [3]. In this study, the proximal analyses of red and yellow coffee pulp, as well as the determination of the total carotenoids content, comparing two drying methods (dehydration vs. freeze-drying) were carried out. For carotenoid extraction, a 23 factorial design using ultrasound assisted extraction was assessed. The influence of color of coffee pulp (red or yellow), the composition of solvent mixture (ethanol: ethyl acetate, 80:20, 20:80 v/v) and the biomass – solvent ratio (1:20, and 1:40 w/v), on the extraction yield and carotenoid concentration in the extract was studied. From proximal composition can be highlighted high contents of dietary fiber (65.12 and 68.15% w/w) and protein (9.44 and 9.67% p/p) for red and yellow variety, respectively. The yellow pulp (194.16 ± 3.77 mg β -carotene equivalent/100 g sample) had a higher concentration of carotenoids compared to the red pulp (146.15 ± 1.49 mg β -carotene eq./100 g sample) and the freeze-drying method allowed to protect those compounds to be degraded. On the other hand, using a biomass-solvent ratio of 1:40 w/v for yellow pulp, the higher carotenoids concentration in the extract was achieved (253.90 mg β -carotene equivalent/100 g sample). However, no significative differences were found at the proposed levels of ethyl acetate: ethanol mixtures. The maximal carotenoids concentration extract was encapsulated by spray drying. The encapsulated extract was included as functional ingredient for the formulation on a dairy product. Some physicochemical characteristics were evaluated on the product such as texture, color, and taste profile by electronic tongue.

Keywords: Carotenoids, proximal analyses, ultrasound extraction, functional foods, dairy products.

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Polyphenolic content and antioxidant activity of agro-industrial residues from oregano essential oil extraction process

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Abstract

The essential oil process from Mexican oregano (*L. graveolens*) englobes a current environmental problem with the production of liquid (aromatic waters, AW) and solid residues (residual plant material) that could be a potential source of bioactive molecules [1] with interesting properties for food and health industries. In this context, the objective of the project was to extract and evaluate the antioxidant and antimicrobial properties of the liquid and solid residues from essential oil extraction. The recovery of polyphenols from solid residues was carried out by ultrasound extraction (UAE); the polyphenols present in the extracts and aromatic water were purified with amberlite XAD-16. After that, polyphenolic content was evaluated as total polyphenols and flavonoids; the antioxidant capacity was also determined by DPPH and FRAP assay. The obtained data demonstrated that AW could be a source of antioxidant molecules, the polyphenols recovered from AW showed a IC₅₀ value lower (534.16 ± 39.28 mg/L) than solid residues (IC₅₀ = 670.18 ± 26.14 mg/L); the findings suggest that that residual materials from EOs extraction has potential as a source of bioactive molecules. Still, more studies are needed to elucidate the molecules present in the extracts and evaluate possible risks.

Keywords: Agro-industrial residues, antioxidant activity, polyphenolic compounds.

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Analysis of mass transfer during beet baking

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Abstract

Baking kinetics of beet slices were generated at different temperatures (110, 120, and 130 °C) to analyze the effect of temperature on effective moisture diffusivity using Fick's law of diffusion [1]. The initial C_0 , critical C_c , and equilibrium C_∞ water concentration (thermogravimetric method) were evaluated and half-thickness L was determined (digital vernier) [2]. The mass transfer coefficient k_Y and mass flux density N_c for the Constant Rate Period (CRP) and effective diffusivity D_e for the Falling Rate Period (FRP) were estimated. Initially, D_e is assumed as constant (Method of Slopes by Subperiods, MSS and Method of Successive Approximations, MSA), and later, that D_e is variable (Quadratic Model, QM) [3]. When analyzing the mass transfer kinetics at 110, 120, and 130 °C, C_0 , C_c , and C_∞ ranged from 11.0 to 12.5, 7.1 to 7.9, and 0.03 to 0.04 kg of water/kg d.s., respectively, and L was 8.29×10^{-4} m. In the CRP, k_Y varied from 0.28 to 0.35 kg water/m²s, N_c was found between 0.010 to 0.013 kg water/m²s. The D_e coefficient at 100 °C ranged from 3.25×10^{-10} to 6.28×10^{-9} m²/s (MSS), 1.42×10^{-11} to 8.88×10^{-10} m²/s (MSA), and 5.82×10^{-11} to 2.03×10^{-9} m²/s (QM), at 120 °C changed from 3.65×10^{-10} to 4.14×10^{-9} m²/s (MSS), 9.48×10^{-12} to 1.20×10^{-9} m²/s (MSA), and 7.01×10^{-11} to 2.30×10^{-9} m²/s (QM); finally, at 130 °C varied from 4.34×10^{-10} to 4.13×10^{-9} m²/s (MSS), 1.87×10^{-11} to 1.40×10^{-9} m²/s (MSA), and 8.47×10^{-11} to 2.90×10^{-9} m²/s (QM). The estimations of beet baking kinetics in the CRP and FRP were considered adequate $R^2 > 0.990$ and $R^2 > 0.998$, respectively. For the FRP, the best fit was obtained with QM. Evaluating the variable D_e with QM, leads to an adequate fit for FRP baking kinetics in products with infinite plate geometry.

Keywords: Beet slices, Baking, Kinetics, Effective diffusivity.

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Rheological study of dough and pasta made with durum wheat semolina and chickpea flour

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Abstract

Knowing the rheological behavior of the dough is important to understand the structuring of the pasta during lamination and cooked [1]. There are few studies on the rheological behavior of the dough for the preparation of pasta that relate their quality and texture characteristics. There is interest in developing pasta with raw materials that provide greater nutritional value, such as chickpea flour. The objective of this study was to evaluate the structural changes through rheological measurements of dough and cooked pasta made with durum wheat semolina (DWS) and chickpea flour (CP). Two formulations were made 100:0 (only DWS) and 40:60 (ST: CP). The pasta was made in lasagna-line form using a rolling machine. Frequency sweep tests were performed at 25 °C from 0.1 to 10 Hz within the linear viscoelastic region. The pasting profile of raw pasta was performed according to AACC method 76.21. The doughs presented similar viscoelastic behavior; in cooked pasta, DWS pasta showed a higher G' moduli (8736.3 Pa to 1 Hz) than pasta with CP (3398.1 Pa to 1 Hz), which is associated with a strong network produced by gluten, which acts as a physical barrier and limits the swelling of starch granules. The values of G'' for the DWS pasta was 1608.8 Pa to 1 Hz and for pasta with CP was 899.3 Pa at 1 Hz. This decrease in the modules indicate the formation of a less cohesive structure, due to a lower content of gluten [2]. In the pasting profile, the pasta with CP showed a lower maximum viscosity peak than the DWS pasta, which can be attributed to the presence of dietary fiber, which could form a cross-linked network around the starch granules that limits its swelling [3]. In conclusion, the structuring of the pasta occurs due to the interactions of the components during its processing.

Keywords: Rheology, pasta, chickpea, semolina.

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Rheological study of dough and pasta made with durum wheat semolina and chickpea flour

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Abstract

Knowing the rheological behavior of the dough is important to understand the structuring of the pasta during lamination and cooked [1]. There are few studies on the rheological behavior of the dough for the preparation of pasta that relate their quality and texture characteristics. There is interest in developing pasta with raw materials that provide greater nutritional value, such as chickpea flour. The objective of this study was to evaluate the structural changes through rheological measurements of dough and cooked pasta made with durum wheat semolina (DWS) and chickpea flour (CP). Two formulations were made 100:0 (only DWS) and 40:60 (ST: CP). The pasta was made in lasagna-line form using a rolling machine. Frequency sweep tests were performed at 25 °C from 0.1 to 10 Hz within the linear viscoelastic region. The pasting profile of raw pasta was performed according to AACC method 76.21. The doughs presented similar viscoelastic behavior; in cooked pasta, DWS pasta showed a higher G' moduli (8736.3 Pa to 1 Hz) than pasta with CP (3398.1 Pa to 1 Hz), which is associated with a strong network produced by gluten, which acts as a physical barrier and limits the swelling of starch granules. The values of G'' for the DWS pasta was 1608.8 Pa to 1 Hz and for pasta with CP was 899.3 Pa at 1 Hz. This decrease in the modules indicate the formation of a less cohesive structure, due to a lower content of gluten [2]. In the pasting profile, the pasta with CP showed a lower maximum viscosity peak than the DWS pasta, which can be attributed to the presence of dietary fiber, which could form a cross-linked network around the starch granules that limits its swelling [3]. In conclusion, the structuring of the pasta occurs due to the interactions of the components during its processing.

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Rheological study of dough and pasta made with durum wheat semolina and chickpea flour

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Abstract

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Keywords: Rheology, pasta, chickpea, semolina.

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Comparison of Non-isothermal Nucleation Kinetics by Spectrophotometric Analysis and DSC in Oleogels

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Abstract

Oleogels are an important alternative for the replacement of hydrogenated fat in foods, as well as vehicles for release of nutraceuticals [1]. The initial oleogelation process as well as the formulation are determinants to obtain the desired characteristics in oleogels. The microstructuring process in oleogels has been studied by techniques highly sensitive to thermal variations, such as differential scanning calorimetry (DSC) [2]. However, there are other available techniques and equipment that can be employed to perform similar evaluations. Non-isothermal nucleation kinetics by spectrophotometric methods can be used as alternatives to basic crystallization studies. The birefringence of the oleogel crystals can influence the results obtained by spectrophotometry in comparison with those obtained by DSC [3]. Therefore, the objective of this research was to present a comparison of both techniques. Oleogels were obtained with a minimum concentration of gelator and another saturated one, using different vegetable oils. The crystallization profiles of the oleogels were obtained by DSC, a non-isothermal nucleation kinetics was evaluated by optical microscopy. The Fisher-Turnbull model was used to evaluate the behavior during microstructuring. The results obtained by spectrophotometry indicate that it can be a good alternative, easily accessible in oleogel crystallization studies, when high sensitivity or very specific thermal parameters are not required.

Keywords: Crystallization, Microstructure, Nucleation, Oleogels.

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Effective diffusivity as a function of time in baked potato slices

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Abstract

Baking can be considered a healthy alternative to frying as no fat is added. Due to food composition and processing conditions, it is important to know the parameters involved during baking [3]. The objective was to analyze the diffusion parameters during mass transfer in baking of potato slices (*Solanum tuberosum* L.) at 120, 130, and 140 °C. Fick's law of diffusion was used. The mass transfer coefficient (k_Y) and mass flux density (NC) for the constant rate period were evaluated. For the falling rate period, effective moisture diffusivity (De) was estimated; first considering it as constant [(Method of Slopes by Subperiods (MSS) and Successive Approximation Method (SAM))] and then as variable [Quadratic Function of Time (QFT)] [1,2]. The k_Y coefficient was found from 0.121 to 0.152 kg water/m²·s·ΔY and mass flux NC was between 5.7×10⁻³ and 7.3×10⁻³ kg water/m²·s. Critical moisture content, X_c varied from 2.62 to 2.52 kg water/kg d.s. The De estimated for 120, 130, and 140 °C by the MSS varied from 4.35×10⁻¹⁰ to 3.91×10⁻⁹ m²/s, 4.16×10⁻¹⁰ to 5.48×10⁻⁹ m²/s, and 6.8×10⁻¹⁰ to 1.66×10⁻⁹ m²/s, respectively. While De obtained by the SAM ranged from 1.88×10⁻¹¹ to 1.33×10⁻⁹ m²/s, 5.04×10⁻¹¹ to 1.37×10⁻⁹ m²/s, and 5.11×10⁻¹¹ to 1.31×10⁻⁹ m²/s for the same temperatures. The variable De (QFT) ranged from 4.30×10⁻¹³ to 1.56×10⁻⁹ m²/s, 2.18×10⁻¹¹ to 2.15×10⁻⁹ m²/s, and 8.51×10⁻¹² to 7.10×10⁻¹⁰ m²/s, for 120, 130, and 140 °C. For the constant rate period, the estimated baking kinetics was adequately fit to the experimental one (R² ≥ 0.999). On the other hand, the best estimations during the falling rate period were obtained using the SAM and the QFT methods (R² ≥ 0.999). This study will allow an adequate estimation of mass transfer with variable diffusivity in baked products.

Keywords: baking, effective diffusivity, potato slices, model.

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Effect of PGPR in Monoglyceride and Vegetable Oil Oleogels

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Abstract

Surfactants are amphiphilic molecules with ability to interact at an oil-water interface. The intermolecular interactions present in each matrix will depend on the functional groups that make up these molecules [1]. Polyglycerol polyricinoleate (PGPR) is a molecule with good solubility in a wide variety of oils. Monoglycerides are among the most used molecules in obtaining oleogels, however, it presents a crystal- β polymorphism [2]. However, an α -crystal structure is desirable for food applications and has better properties in oleogels, so it is necessary to delay β -formation. The development of oleogel matrices using monoglycerides and PGPR in mixture allows obtaining metastable systems [3]. However, the effect of this surfactant on the gelator to reach such metastability is still unknown. Therefore, the objective of the present work was to evaluate the effect of PGPR on oleogels with monoglyceride. Oleogels with monoglyceride (10% w/w) and low concentration of PGPR (0, 1, 1.43 and 2% w/w) were obtained. They were stored at 10 and 25°C for 24 h. Hansen solubility parameters were calculated [4]. Thermal evaluation was performed by differential scanning calorimetry. Polarized light micrographs were obtained. Solid fat content was determined by nuclear magnetic resonance. A lower temperature shift of the exotherm corresponding to $L\alpha \Leftrightarrow Sub\alpha$ was found, due to the effect of the surfactant concentration, indicating a delay in the crystallization of the monoglyceride. With increasing PGPR concentration ($\geq 1.43\%$), the endotherm corresponding to the formation of β , disappears in the melt at time 0 at 25°C, and reappears after 24h. Surfactant molecules can retard polymorphism in oleogels.

Keywords: Monoglyceride, Oleogels, Solubility, Surfactant

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Heat transfer simulation during guava cooking

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Abstract

Guava (*Psidium guajava* L.) is distinguished by the presence of nutriment with healthpromoting properties, like vitamin C, and due to its high respiration rate, it is required to process it to lengthen its shelf-life [1]. Nevertheless, heat treatments diminish the product quality by inducing the demotion of several nutriment [2]. The objective of this study was to simulate the heat transfer during cooking of guava. Thermal conductivity (k) and thermal diffusivity (α) (linear heat source method), bulk density (ρ) (volume displacement), and specific heat capacity (C_p) (definition of α) were measured at 25, 55, and 85 °C. The convective coefficient (h) (lumped parameter analysis) was also evaluated. The solution to Fourier's second law for a spherical geometry was employed. For thermophysical properties, a completely randomized design was used, factor was temperature (25, 55, and 85 °C) and Fisher's test was used to compare means. The k parameter ranged from 0.523 to 0.793 $W \cdot m^{-1} \cdot K^{-1}$, as temperature increased, α changed linearly from 1.40×10^{-7} to $2.06 \times 10^{-7} m^2 \cdot s^{-1}$, mean ρ was 987 $kg \cdot m^{-3}$ with no significant differences ($p > 0.05$), and C_p varied from 3548 to 4105 $J \cdot kg^{-1} \cdot K^{-1}$. The h coefficient was 820 $W \cdot m^{-2} \cdot K^{-1}$. Considering constant thermophysical properties at 25, 55, and 85 °C, the simulated temperature histories were compared to experimental results and R^2 were 0.991, 0.996, and 0.999, respectively. This indicates that the simulated data fit properly to the experimental ones. The achievement of an adequate simulation of the heat transfer during the cooking process can lead to estimate vitamin retention and the residual enzyme activity from a heat penetration analysis, using the corresponding decimal reduction times and z values.

Keywords: Simulation, Heat transfer, Fourier's second law, Guava.

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Prediction of perceived color changes (ΔE) of a natural colorant from *Justicia spicigera* by using probabilistic and Time-to-Fail models

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Abstract

Justicia spicigera (JS) leaves have been used for coloring; leaves decoction generates a violet color [1]; anthocyanins' presence change color due to pH [2]. Recently, JS pigments were applied to corn tortillas, yogurt, and jellies [3,4]. Survival analysis establish the time when a product is rejected. Probabilistic models (PM) estimate the probability of acceptance/rejection based on the time to reach a certain value. This study aimed to model the Time-to-Fail (TTF) and probability of JS pigments color change (ΔE) during heating at different temperatures at pH levels. Pigment was extracted by leaves maceration. Extract maltodextrin (5% w/v) was lyophilized. Then, 0.01 or 0.002g/mL was added to McIlvaine buffer, and its pH value was adjusted between 2 to 12 (citric acid 0.1M, NaOH 1M). Solutions were subjected to 40-80°C. Color solutions were determined spectrophotometrically. L^* , a^* , b^* and $\Delta E = ((L^* - L_0^*)^2 + (a^* - a_0^*)^2 + (b^* - b_0^*)^2)^{1/2}$ was calculated. To fit the TTF and PM, values were classified as 1 or F when $\Delta E > 4$ and 0 or C when no changes were observed. Both TTF ($R^2 = 0.800$) and PM accurately predicted the color changes. TTF decreases with increasing pH, especially at 80°C; neutral pH region was the most stable regardless of temperature. pH 4 to 8 requires at least 600 min at 50°C to exhibit a $\Delta E > 4$. Decreasing colorant concentration, makes less noticeable changes. Less time to color change is observed at high temperatures. Same trend was observed in the PM; high pH values and temperatures increase the probability of presenting $\Delta E > 4$. Neutral region was stable. In conclusion, TTF and PM allowed to predict colorants behavior during thermal processing.

Keywords: Prediction models, time-to-fail model, probabilistic model, natural colorants.

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Production of lactic acid by fermenting reducing sugars obtained by enzymatic saccharification of fruit peels

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Abstract

Since 2016, Mexico has produced 37.96 million tons of pineapple (P), banana (B), lemon peel (LP) and sugar cane (SC) [1]. Wastes of these products represent around 40% of total production, and they relate almost completely to environmental pollution [2]. However, they contain polysaccharides that induce the production of hydrolytic enzymes in different *Aspergillus* species [3] and can be a good source of reducing sugars (RS) for bacteria to produce organic acids [4]. We developed a solid-state culture with *A. niger* growing on equal quantities of LP and SC bagasse. After 100 h, we obtained a multienzymatic extract (ME) that contained xylanases (1400 U/g), exopectinases (60 U/g), invertases (900 U/g), glucoamylases (1180 U/g), CMCase (1100 U/g) and FPAses (300 U/g). Alternatively, we washed B or P peels (PP) to eliminate the soluble RS, prepared suspensions containing dried peels (66 g/L each in independent experiments) and sterilized them. Finally, we discarded the soluble RS released after sterilization, added 50 mM acetate buffer pH 5.0 and the ME, and incubated at 50 °C for 24 h. After 12 h, we obtained the highest concentrations of RS (14 g/L from BP and 38 g/L from P peel); enzymes seemed to suffer inhibition by the RS released. *Lactobacillus delbrueckii* produced 0.8 g of lactic acid (LA) for each gram of RS of the liquor obtained after saccharifying PP. In this bioprocess, we produced LA using agricultural residues as the main raw materials.

Keywords: Polysaccharides, polysaccharases, solid-state culture, value added products

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Effective moisture diffusivity in baked sweet potato snacks

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Abstract

The objective of this study was to analyze the effect of baking temperature on diffusion parameters based on Fick's law [2] when producing slices of snack-type sweet potato. For the Constant Rate Period (CRP), local mass transfer coefficient (k_Y) and mass flux density (N_c) were evaluated [2]; subsequently, the critical moisture content (X_C), and the parameters for the Falling Rate Period (FRP), equilibrium moisture content (X_∞), half-thickness (L), and effective moisture diffusivity (D_e) were determined. It is first assumed that D_e is constant (Method of Slopes by Subperiods, MSS and Method of Successive Approximations, MSA) [3] and then, that D_e is variable (as a Quadratic Function of Time, QFT) [3]. When studying mass transfer kinetics (100, 120, and 140 °C), the initial moisture content ranged from 4.95 to 5.78 kg water/kg d.s., k_Y varied from 1.5×10^{-3} to 2.7×10^{-3} kg water/m² · s · ΔY, N_c was found between 7.2×10^{-5} to 1.3×10^{-4} kg water/m² · s, X_C oscillated from 2.54 to 3.53 kg water/kg d.s., X_∞ ranged from 0.03 to 0.04 kg water/kg d.s., and L was 6.8×10^{-4} m. D_e at 100 °C ranged from 4.24×10^{-12} to 4.00×10^{-11} m² /s (MSS), 5.23×10^{-14} to 5.23×10^{-12} m² /s (MSA), and 4.44×10^{-11} to 1.28×10^{-9} m² /s (QFT), at 120 °C was between 4.61×10^{-12} and 4.63×10^{-11} m² /s (MSS), 2.80×10^{-11} and 7.93×10^{-10} m² /s (MSA), and 2.77×10^{-11} and 1.46×10^{-9} m² /s (QFT), while at 140 °C ranged from 8.12×10^{-12} to 8.54×10^{-11} m² /s (MSS), 7.95×10^{-11} to 1.20×10^{-9} m² /s (MSA), and 7.25×10^{-11} to 2.32×10^{-9} m² /s (QFT). The baking kinetics for CRP were adequately estimated ($R^2 > 0.998$) and for FRP, the best estimation was obtained with variable D_e ($R^2 > 0.999$). This study will allow a proper estimation of mass transfer variables in baked goods that can be represented as an infinite plate

Keywords: Baking, Sweet potato snack, Moisture content, Effective moisture diffusivity.

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Production, purification and characterization of L-asparaginase from *Bacillus velezensis* isolated from lignocellulosic materials

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Abstract

Since the discovery of acrylamide in food in 2002 [1], governments have created new regulations and established limits on the acrylamide content in edibles owing to its classification (B2: possible carcinogenic) [2]. This situation boosted the search for alternatives to decrease the acrylamide content in foods, without affecting the organoleptic characteristics. One alternative which has been shown to be efficient is the use of Lasparaginase. Nowadays commercial asparaginase for food is sold, but only three companies sell it (NOVOZYMES, DSM and Kerry), the enzymatic characteristics of these enzymes are different due to the microbial sources where they come from: a yeast, *Aspergillus oryzae* and *Aspergillus niger*. The aim of this work is to produce, purify and characterize the L-asparaginase obtained from *Bacillus velezensis* isolated from lignocellulosic materials. The behavior of the enzyme obtained from *Bacillus velezensis* has shown a good enzymatic activity from 30°C to 80°C with an optimum at the temperature of 50°C, the pH was from 4 to 9 showing the optimum at 7, for the enzyme of Novozymes the temperature and pH where 37°C to 60°C and 4 to 8. The purification was carried out using ammonium sulphate for the precipitation of the enzyme, followed by a dialysis and gel filtration chromatography using Sephadex G-100x

Keywords: Acrylamide, L-asparaginase, *Bacillus*, enzyme, production, purification.

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Effect of organocatalytic modification on high amylose starch

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Abstract

The acetylated starch with high degree of substitution (DS) is used in diverse applications due to its physicochemical and functional characteristics [1] . However, the use of reagents for acetylated starch has pollution problems and low DS. Organocatalytic esterification is a strategy to increase the DS of acetylated starch ($DS \geq 0.2$) [3] , replacing the traditional starch esterification with anhydride acetic [1]. Furthermore, the DS of the linear molecules was higher than amylopectin of acetylated starches [2] . The objective of this work was to evaluate the effect of the organocatalytic modification on the DS of high amylose maize starch. High amylose maize starch (HM: 70% of amylose) was modified with tartaric acid as an organocatalyst and acetic anhydride as a modifier; normal maize starch (NM: 30% amylose) was used as a control. HM presented lower DS (1.9) than NM (2.4); however, the molecular structure of both modified starches showed the presence of ester carbonyls (bands 1740 and 1210 cm^{-1}) and a reduction of hydroxyl groups (band 3300 cm^{-1}) in the FTIR spectra, that is related to the chemical modification of the starch. It was observed higher deformation and fissuring of the modified starch granules of HM than NM, as well as a decrease in birefringence, and the presence of granular aggregation. The low DS of HM indicated that amylose content restricted the organocatalytic starch modification.

Keywords: Starch, Maize, High amylose, Organocatalytic modification.

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Broccoli waste extracts on cherry tomatoes postharvest

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Abstract

Agroindustrial wastes, such as cruciferous waste, are important and of great interest. These are natural sources of bioactive compounds and generate value-added by-products [1]. Therefore, reusing agro-industrial wastes could bring great benefits both in food preservation and the circular economy. The general objective of this research was to evaluate the effects of broccoli (*Brassica oleracea*) waste extracts on the preservation of cherry tomatoes (*Solanum lycopersicum* var. *cerasiforme*). The extracts were obtained from dehydrated broccoli leaves [2], with two different solvents (ethanol and methanol) at 70% and ultrasound for 20 min. Three different concentrations of the extract (5, 10, and 20 ppm) were used as treatments and applied by immersion in a water solution. The fruits were stored for 36 days at 21 °C. The effect on postharvest physical and chemical parameters of the fruits was evaluated. The methanol extract (20 ppm) resulted in less dehydration, greater firmness, and red color, indicating slow ripening. pH and total soluble solids are quality attributes of cherry tomatoes, with a positive effect of methanol-based treatments. Therefore, treatment with broccoli waste is effective in prolonging the shelf life of fruits such as cherry tomatoes, to the benefit of consumers who demand quality postharvest products.

Keywords: Bioactive compounds, cruciferous vegetables, agroindustrial wastes

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Effect of thermal process on physical and microstructural quality of creole Toluqueño popcorn

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Abstract

Creole Toluqueño popcorn from the México State is not widely consumed because of the consumer preference to the commercial type [1], therefore local producers search for alternatives to its use, hence the effect of thermal process on the quality [2] of this creole popcorn is necessary in order to observe the differences between these type of grains. The aim of this work was to evaluate physical and microstructural quality of creole Toluqueño and commercial popcorn through different thermal processes (microwave, oil, and air heating). Image analysis of grains showed a higher area ($0.49 \pm 0.06 \text{ cm}^2$) of the creole than the commercial corn ($0.27 \pm 0.03 \text{ cm}^2$) being the commercial more spherical than creole corn. Texture analysis showed that the creole grain is softer than commercial. The heating rate of the air treatment was the highest ($2.136 \text{ }^\circ\text{C/s}$, commercial and $2.02 \text{ }^\circ\text{C/s}$, creole) than microwave and oil heating. The air heating produced the highest popcorn popping performance in commercial corn (71.88%), while microwave heating promoted the highest value (12.93%) in creole Toluqueño maize. In general, the air heating produced a better quality of popcorn because they are softer and with less rubbery texture. Microstructural analysis showed a better shape of starch granules in a microwave treatment deducing a minor gelatinization grade. In conclusion, creole grain had less popcorn popping performance because of its higher size and softer texture and the air heating was the best treatment because of the higher quality of popcorn. This study provides important information about the knowledge of the creole performance by different heating treatments.

Keywords: creole popcorn, heating treatment, popcorn quality, texture, microstructure.

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Study of the breaking of food matrices through digital analysis of images and audio signals

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Abstract

Phenomena related to food breakage are studied due to their importance in characterising the sensory attributes of products, as well as being a factor in operations related to the supply chain [1,2,3]. The texture, as a concept, has two main components: kinesthetics and auditory [2], which results in the breakage and acoustic pattern [3], coupled the mechanical profile, offer a broader view of the development the breakage. Digital image analysis has been used as a tool for quantitative characterization of patterns, both rupture [4] and acoustic [5], generating a novel approach to fracture mechanics. Therefore, the objective of this work was to characterize the phenomenon of rupture in food matrices with respect to time, using acoustic techniques in conjunction with digital image analysis and fractal behavior in foods with fragile behavior. The fracture phenomenon was analysed by the acoustic approach of five foods of a crisp nature (Mexican biscuits, Saladitas biscuits, Crackets, Sabritas Chips and Chicharrón). This analysis, was obtained by capturing audio during the food breaking process, and subsequently, applying the digital analysis of audio signals, determining parameters in the amplitude-time domain through the Wavelet transform and, in the amplitude-frequency domain through the Fourier transform and Hilbert Huang transform [4,6,7]. These parameters helped to describe the acoustic behaviour of the analysed samples. Also, the characterization of the acoustic pattern of the audio signals was carried out through digital image analysis, provided multifractal spectra, which helped a morphometric characterization of the acoustic patterns, which, coupled with lacunarity parameter, generated a complementary and descriptive approach to acoustic characteristics of the crispy foods

Keywords: Breakage, Multifractal analysis, Lacunarity, Crispy food.

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Biotechnological and sustainable use of giant reed (*Arundo donax*), first experimental approach.

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Abstract

The reed (*Arundo donax*) is a fast-growing plant with the ability to adapt to different climatic and soil conditions [1]; Although its origin is Asian, the species has spread throughout the world [2]; in Mexico, this species is distributed in the states of Chihuahua, Coahuila, Nuevo León, Tamaulipas, and Puebla; during its development, it consumes three times more water than typical native vegetation and is responsible for changing the landscape of riparian areas [3]; the high biomass productivity and the annual harvest period make this crop a very attractive lignocellulosic feedstock for the production of biochemicals by fermentation [4] so it is considered an invasive species to the ecosystem that has potential use as an alternative to producing industrial bioproducts [5]. The main objective of this research was to evaluate the radial growth of the fungal strains (*Aspergillus niger* GH1, *Aspergillus niger* PSH, *Trichoderma harzianum*, and *Rhizopus oryzae*) as evidence of the feasibility of use in a bioprocess. The kinetic growth of 4 fungal strains (previously mentioned) was evaluated until the invasion of the Petri dishes was completed. *A.niger* strains were the best adapted to the reed, achieving complete invasion of the dish at 36 h. of incubation, *R. oryzae* needed 42 h. and *T.harzianum* did not complete the invasion of the dish after 42 h. Therefore, *A. niger* strains are selected to continue with SSF and subsequent enzymatic production, which is projected as a sustainable alternative to take advantage of the invasive reed.

Keywords: Reed, *A.niger*, SSF, sustainable use

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Effect of low-intensity electric field on tomato's emergence and early growth (*Solanum lycopersicum* var. *Saladette*)

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Abstract

Currently, agriculture is focusing their attention on developing technologies that contribute to maintaining high-yielding and sustainable food production [1]. Among these technologies is electroculture, a technology that through the application of electrical stimuli, improve germination, plant development, and the synthesis of secondary metabolites [2]. This work aimed to study the effect of the application of low-intensity direct current electric fields (DCEF) on the emergence and early growth of tomato seeds. Seeds were exposed to different DCEF conditions (0.2, 0.4, 0.6, and 0.8 V/cm) for 3 h and the emergence parameters were evaluated: final emergence percentage (FEP), emergence index (EI), average time of emergence (MET) and emergence rate index (ERI); early growth parameters were also evaluated: seedling height, root length, dry and wet weight, and Vigor Index I and II. In the present study, it was found that DCEF conditions of 0.4, 0.6, and 0.8 V/cm improved MET, whereas conditions 0.2, 0.4, and 0.8 V/cm improved IE in comparison with untreated seeds. In addition, it was observed that the DCEF condition of 0.2 and 0.6 V/cm induced an increase in seedling height, dry weight and an improvement in values of vigor index I and II in comparison to control seeds. The results suggest that applying lowintensity DCEF improves parameters of emergence and early growth in tomato seeds. This technology is postulated as a promising and ecological method to enhance seedlings tomatoes' germination behavior and vigor

Keywords: *Solanum lycopersicum*, Electroculture, Sustainable, Emergence, Early development.

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Effect of high intensity ultrasound on the rheological properties of jackfruit *Artocarpus heterophyllus* Lam pulp

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Abstract

The objective of this research was to evaluate the effect of continuous and pulsed high intensity ultrasound (USAI) on the rheological properties of jackfruit (*Artocarpus heterophyllus* Lam) pulp diluted (1:4) (PJD) and PJD after enzymatic hydrolysis (PJDH) with pectinase 1%, as a preliminary study to PJD processing in a pilot of sono-microfiltration in tangential flow. A frequency of 20 kHz, times of 5, 10 and 15 min was applied with continuous USAI at amplitudes of 20, 60 and 100% in treatments with pulse application, 5s ON - 10s OFF and 10s ON - 10s OFF. The ultrasonic energy (kJ), temperature (°C) and intensity (W/cm²) were evaluated, in addition to the rheological properties. The results showed that the rheological properties of PJD exhibited an increase in viscosity at higher amplitude and US treatment. However, in all US treatments of PJDH, a decrease in viscosity was shown with greater time and ultrasonic amplitude, so this behavior was different from PJD, confirming that pectin is the biopolymer responsible for the changes in properties rheological [1]. The PJDH without USAI treatment presented a predominance of G'' over G' which led to a viscous behavior, while in the treatments with the application of USAI an inverse behavior was shown due to the predominance of an elastic behavior [2]. The results in this study confirm the capacity of USAI to form aggregates that increase viscosity of pulpy juices with high pectin content in fruits, without effect of temperature control on the viscosity and rheological behavior of the treated juice, indicating the need for hydrolysis of this juice before being processed in pilot sono-microfiltration in tangential flow to achieve greater stability and process performance.

Keywords: jackfruit, hydrolysis, high intensity ultrasound, aggregates, rheology

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Valorization of orange citrus by-products: impact of drying on flour technological and nutritional properties

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Abstract

Nowadays, agroindustry is generating huge amounts of waste that must be managed to reach sustainable systems. Among those residues, orange citrus by-products have attracted the interest of academia and industry, looking for alternatives that provides a circular economy [1]. The transformation of citrus by-products into orange peel flour is an attractive alternative for the valorization of the food chain supply to be integrated into different food matrices due to the nutritional and technological characteristics. Some attempts have been made of using orange bagasse in bakery [2], meat [3], and ice cream [4]. The purpose of this study was to evaluate the impact of time of convective drying on the properties of the orange bagasse. Flour characterization included moisture, water activity, color, browning index, water binding capacity, oil binding capacity, size particle and nutritional value assessed by fiber, minerals, and fat content. The yield of orange peel flour by applying hot air convection at 45°C for 18 hours was $24.7 \pm 0.7\%$. Among the characteristics, it must highlight its high-water binding capacity (4.91 ± 0.91 g/g) and appropriate browning index (136.92 ± 0.19), but also its high fiber ($34.95 \pm 0.46\%$) and protein ($6.61 \pm 0.02\%$) content. Therefore, orange peel flour is suitable for incorporation as food ingredient considering its techno-functional properties and nutritional characteristics

Keywords: Orange peel, Convective drying, Browning index, Composition.

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Effect of the inoculum concentration on the growth kinetics of *Pichia fermentans* in solid substrate fermentation

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Abstract

Solid substrate fermentation (SSF) is carried out in the total or almost total absence of free water using natural or inert supports [1]. Inert supports make it necessary to add a nutrient medium to develop the microorganism [2]. This work aimed to characterize the growth kinetics of the yeast *Pichia fermentans* in SSF using a simple culture medium, polyurethane foam (PUF) as inert support, and different concentrations of inoculum to start the fermentation. Eight glass fermentation columns were coupled to bubble columns to supply 75 mL/min airflow to each column. Bubble columns contained 60 mL of filtered water, while fermentation columns contained 3 g of PUF with 30 mL of 10% cane molasses as culture medium [3,4]. Inoculum concentrations of 3×10^6 , 3×10^7 , and 3×10^8 cells/mL were assayed. Fermentations were monitored 24 hours by sampling every 3 hours. Biomass concentration, carbon dioxide production, and total reducing sugar concentration were determined [5]. The exponential growth phase began at 18 h for inoculum concentrations of 3×10^6 and 3×10^7 cells/mL, but the stationary phase was not observed. On the other hand, when fermentation columns were inoculated with 3×10^8 cells/mL, the exponential phase occurred between 3 and 6 hours, the stationary phase lasted from 6 to 12 hours, and the death phase began at 12 hours. These results will allow solid substrate fermentation with *Pichia fermentans* to obtain volatile products such as aroma compounds

Keywords: Solid Substrate Fermentation, *Pichia fermentans*, Cane molasses, Polyurethane foam.

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Analysis of the growth of *Geobacter sulfurreducens* in whey of fresh and fermented cheese, supplemented with acetate

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Abstract

Bacteria are microorganisms that can live in any ecological niche, which makes them very versatile. A group of bacteria of the *Geobacter* genus has been identified, which during their metabolism, generate a flow of electrons that are expelled outside the cell by means of conductive threads [1]. Although this bacterium was discovered in the 1980s, the study of its bioelectrical behavior and growth on various substrates has not yet been fully analyzed. It is important to mention that the optimal growth conditions of the bacteria guarantee a better response in the generation of bioelectricity. Within optimal conditions, the substrate or nutrient plays a key role in the physiology of the microorganism. That is why it is required to grow this type of bacteria in different substrates, one of the proposed substrates is cheese whey (residue from the cheese industry and highly polluting the environment). The growth and viability of *Geobacter sulfurreducens* (ATCC 51573) cells was analyzed during 3 days of incubation at 34°C. work was done with 100 ml volumes of: a) fermented cheese whey supplemented with acetate; b) fresh cheese whey supplemented with acetate and c) control group for both cases. All work was done in triplicate. The initial inoculum had a concentration of 1×10^4 cells/ml of *G. sulfurreducens*. It was observed that the bacteria grow on both substrates, maintaining a small preference for the fresh substrate. The bacterium had two logarithmic growth cycles, reaching 1×10^6 cells/ml with a viability of 95%. These results show that *G. sulfurreducens* can grow in fresh or fermented cheese whey supplemented with acetate. Furthermore, it can be used in a microbial fuel cell (MFC) where the bacteria through their metabolism generate energy. It is worth mentioning that the substrate is one of the important parameters in a MFC.

Keywords: microorganism, *Geobacter*, cheese whey, viability

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Influence of NaCl, acetic acid, and oregano essential oil on quality properties of marinated rabbit meat

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Abstract

Rabbit meat has been considered lean meat due to its low fat and high protein content [1]. The consumption of rabbit meat-based foods represents a potential sector for economic development in different areas of Mexico [2]. Among the processes that add value to meat, rabbit is the marinating. This consists of adding salt, acids, essential oils, herbs, and other compounds used to improve the physicochemical and organoleptic properties of meat and its derivatives [3]. In the present work, the influence of NaCl, acetic acid, and oregano essential oil concentration (OEO) on the quality properties of rabbit meat was studied using the response surface methodology. For this purpose, a rotatable compound central design with three factors, salt (1-2% (w/v)), acetic acid (0.5-2 % (v/v)), and OEO (0.5-1 %v/v), was used to determine their effect on color, marinade uptake, pH, hardness, and cooking losses of the meat for 120 minutes of marinating. Results showed a significant effect of the three factors and their interaction on pH and hardness (P-value < 0.05) with high regression coefficient R² of 0.99 and 0.93 respectively. There was no significant effect of the OEO in ΔE and cooking losses variables. High concentrations of salt and low contents of acetic acid in the brine decrease the hardness of the meat. Optimum conditions of the marinating process were 1.90% (w/v) NaCl, 1.90 % (v/v) acetic acid and 0.51% (v/v) essential oil. The factors evaluated in this study improved the physicochemical properties of rabbit meat, therefore these can be a potential application in the transformation of rabbit meat with a positive impact on its commercialization.

Keywords: Optimization, Acid marination, Essential oil, Salting, Meat quality

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Sustainable dehydration of blueberries (*Vaccinium corymbosum*) using low relative humidities.

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Abstract

The most common preservation technique is dehydration with forced hot air (ACF); however, this technique represents an important consumption of electrical energy and can result in a significant loss of phenolic compounds [1]. Dehydration in environments with low relative humidity (RH) generated with supersaturated salt solutions may be an alternative. The objective was to evaluate dehydration in low RH systems on the phytochemical profile of berries compared to the ACF system. Dehydration with ACF was carried out at 52 °C; while the low RH systems were carried out at room temperature with the use of supersaturated solutions of MgCl₂, K₂CO₃ and NaCl (33, 43 and 75 %RH, respectively). The electrical energy consumption was calculated for both drying systems. A methanolic extract was obtained from the dried fruits to quantify the concentration of total phenols (FT, by Folin Ciocalteu), anthocyanins (by pH differential) and antioxidant capacity (CA; radical -DPPH). In addition, proximate analysis (AOAC) and a sensory preference test were performed with untrained panelists. The dehydration time in ACF was 45 h, while in the systems with 33 and 43 %RH it was 18 days and for 75 %RH 32 days. The electrical energy consumption in ACF was 100% higher compared to those at low RH. In spite of the times, the blueberries dehydrated in low RH environments retained up to 64 % FT, 55 % more anthocyanins, and 65 % higher CA with respect to the samples dehydrated in ACF; they were also 70 % more preferred by the panelists. No statistical differences were found in their bromatological composition between the samples dehydrated in both systems. The findings show the potential of using low RH environments for blueberry dehydration, being a sustainable option for not using electrical energy, as well as for the preservation of phytochemical compounds.

Keywords: Blueberries, phytochemical compounds, low relative humidity

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Effect of addition of emulsifying agents on the rheological stability of avocado oil-based emulsion gels.

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Abstract

Currently, consumers are increasingly aware of the relationship between diet and health, which is why the consumption of low-fat foods has increased in the last decade [1]. The food industries have chosen to reformulate their products by totally or partially replacing the less favorable ingredients for consumers health, as is case of animal fat in meat products [1]. Among the options that have been investigated for their ability to generate the same functions of animal fat in sausages are emulsion gels or oleogels, which are soft matter systems made up of vegetable oils with the addition of emulsifying agents [2]. The objective of this work was to study the effect of the concentration of emulsifying agents on the rheological behavior and stability of avocado oil-based emulsion gels. Emulsion gels were made with avocado oil (30%), soybean oil (20%), soybean protein (5%), inulin (16.5%), soybean lecithin (1%) and water, as emulsifying agents were used a mixture of emulsifiers (1% sodium tripolyphosphate, 1% carrageenan and 1% sodium caseinate) [3] and stearic acid (3, 8 and 14%) [4]. The rheological study showed a non-Newtonian behavior in the gels. All the gels presented higher values of the storage modulus (G') than those of loss (G''). The formulations with higher values of stearic acid (8 to 14%) showed a dominant G' forming a gel-like structure, high content of stearic acid allow a better coalescence of the oily phase and adequate gel formation [5, 6]. The addition of stearic acid increased the stability of gel by 25% (from 3 to 14 % of stearic acid concentration). In conclusion, the increase in the concentration of stearic acid increases the rheological stability, being 8% the appropriate to add in meat emulsions made with avocado oil-based gels. The importance of the gels and emulsifiers studied show the possibility of enhancing the use of avocado oil for food emulsions

Keywords: gel, rheology, stearic acid, vegetable oils

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Biodegradable films produced from residues of nixtamalization of popcorn

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Abstract

Nejayote and pericarp derived from nixtamalization could be an environmental problem [1], therefore there is a research interest about the reuse of these residues such as new compostable and environmental-friendly materials [2]. The aim of this work was to create and characterize (thickness, water solubility, water adsorption capacity, and color) biodegradable films using residues of nejayote and pericarp of nixtamalized popcorn. Three types of films were compared: nejayote, pericarp and nejayote-pericarp films. Results showed that pericarp films are thicker ($0.27\pm 0.02\text{mm}$), more transparent ($L=94.75\pm 2.21$) and had higher water absorption capacity ($162.60\pm 14.05\%$) than nejayote and nejayote-pericarp films, and also they had lower water solubility ($22.62\pm 1.78\%$) and degradation time (10.6 days). A novelty of this study was to propose an alternative of the use of nejayote and pericarp in a film creating compostable films, which degradation time was 12 days.

Keywords: Nixtamalization, nejayote, film, pericarp, structure, degradability

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Influence of Drying and Extraction Technology on the Chemical Profile and Antioxidant Property of Mexican Mango Byproduct

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Abstract

In recent years, the research for bioactive extracts from agroindustrial waste has become a growing trend. In Mexico, mango processing waste constitutes approximately 600,000 tons per year [1]. Mango peels and seeds contain these components, such as polyphenols [2]. Polyphenolic compounds are natural bioactive that have biological activities, such as antioxidant, antimicrobial and antiinflammatory [3]. The objective of this study was obtaining antioxidant bioactive extracts from Ataulfo mango seed. The influence of two drying methods (convection and lyophilization) and four extraction techniques (water bath, ultrasound, microwave, and enzymatic) were investigated for their total polyphenol content and antioxidant activity (DPPH and ABTS). The HPLC–MS analysis was also developed. The results showed that lyophilization drying and ultrasound extraction are the most efficient methods with a phenolic content of 29.45 mg GAE/g and antioxidant activity of 97.47% (DPPH) and 289.87 mg TE/g (ABTS) that was higher than reported in fruits that are a good source of antioxidants. (EAE) revealed a high polyphenol content and ABTS antioxidant activity, although DPPH antioxidant activity was lower than ultrasound and microwave. HPLC–MS analysis revealed the presence of 16 compounds. Our results demonstrate that bioactive extracts with powerful antioxidant activity can be obtained from by-products of mango processing using the appropriate technology.

Keywords: Phenolic compounds, Antioxidant activity, Mango seed, Extraction.

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Conditioning of agro-industrial residues for producing enzymes, additives and chemical precursors

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Abstract

Since 2016 Mexico has produced annually 38.37 million tons every year of agricultural products such as sugar cane bagasse, pineapple, lemon, banana, and prickly pear. Residues of these products represent around 40% of the total production. Structurally these residues are conformed by different polysaccharides that form a complex network bounded by lignin. Therefore, before using them as raw materials for obtaining enzymes, additives, and chemical precursors, it is necessary perform a conditioning treatment to make polysaccharides available. This work will develop a general review of the most common treatments used for agricultural residues. Also, it will show results about using conditioned material to produce some enzymes and organic acids. Agricultural residues were conditioned by drying, washing, ultrasound, and size reduction. In a solid-state culture using 1.84 mm particles of sun-dried prickly pear peels, *Aspergillus niger* produced eight-fold more xylanases and twice more laccases than those obtained on 1.09 mm of wave-dried particles. On the other side, the resulting lignocellulases-rich multienzymatic extract obtained by a mixed solid-state culture with *Trametes versicolor* and *A. niger* was used to saccharify banana and pineapple peels, conditioned only by washing. With saccharification treatment, we obtained yields of 0.21 and 0.58 g reducing sugars/g peel, respectively. By using ultrasonic treatment before saccharification of pineapple peel, the production of reducing sugars improved about 10%. Some subproducts of those bioprocesses that use conditioned residues can be a source of bioactive compounds with therapeutical properties. Therefore, focusing on the conditioning of agricultural materials will allow extensive use in environmentally friendly bioprocesses.

Keywords: Polysaccharides, Bioprocesses, solid-state culture, saccharification.

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Effects of solid-state fermentation of pineapple by-products with *L. plantarum*, *L. rhamnosus* and *A. oryzae* on the production of antioxidant and anti-inflammatory compounds

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Abstract

The increase in metabolic alterations derived from an inadequate diet has highlighted the need to consume more nutritious and healthy foods that can also provide added value in the prevention of non-communicable diseases [1]. There is an alarming increase in the amount of food waste caused by bad management in several stages of the supply chain. Interestingly, most of the crop residues are rich in bioactive compounds that can be used to prevent metabolic-related diseases. Pineapple is a fruit rich in bioactive compounds that have the potential to prevent these diseases but is also incredibly wasted [2]. Different strategies have been developed to take advantage of these residues and use them as functional ingredients in some foods. A nutraceutical enrichment technique is solid-state fermentation (SSF) [3,4]. SSF has the potential to be an easy-to-scale method to produce bioactive compounds from pineapple. In this work, the effects of SSF of pineapple peels with *L. plantarum* (LP), *L. rhamnosus* (LR), and *A. oryzae* (AO) on the release of phenolic compounds and their antioxidant and anti-inflammatory activities were evaluated. Pineapple peel extracts after SSF had an increase in the release of phenolic compounds (248.11% with LP, 182% with AO, and 180.10% with LR), which led to an increase in the cellular antioxidant (81.94% with LR) and anti-inflammatory potential (62% with LR) compared to non-fermented extracts. SSF of pineapple peels with LP, LR, and AO thrives a new approach to produce bioactive compounds that have anti-inflammatory and antioxidant properties. Which can be the precursors for novel biofortified and nutraceutical-enriched foods that meet the needs of the most demanding and health-conscious consumers.

Keywords: antioxidant, anti-inflammatory, fermentation, lactobacillus, pineapple.

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Effect of the particle size on the content of lignocelulosic compounds from onion peel *Allium cepa*

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Abstract

The onion (*Allium cepa*), is an herbaceous plant belonging to the Amaryllidaceae family. It is one of the most used vegetables in the culinary field of Mexico, with a production of up to 1.5 million tons during 2020. However, approximately one third of the production end up as agro-industrial waste which is not treated properly and leads to environmental problems. On the other hand, several studies have shown that onion peel is a potential source of lignocellulosic compounds, being cellulose used as a source of sugars for fermentations and syrups, production of growth culture, batteries from piezoelectric materials, paper manufacturing, among many others [1]. Due to this, the present work seeks to study the lignocellulosic material from onion peel and use it to produce value-added products. The methodology is based on the extraction of lignocellulosic material in the peel by the Kraft method and its analysis by Fourier Transform Infrared Spectrometry (FTIR) (Agilent, Cary 630, Santa Clara, United States) to determine organic functional groups. The results obtained from the infrared spectra show peaks with less definition depending on the particle size at the frequency of 3600-3300 cm^{-1} , corresponding to OH-bonds associated to cellulose and hemicellulose, and at 1740-1730 cm^{-1} corresponding to C=O bonds of hemicellulose and lignin [2]. These values are comparable with those of timber sources [3], so it is feasible to evaluate possible uses from this agro-industrial waste material.

Keywords: Agro-industrial waste, onion peel, lignocellulosic residues, *Allium cepa*, FTIR

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Cocoa Syrup: Obtaining and Determining of Sugars and Organic Acids Concentration using High Performance Liquid Chromatography (HPLC)

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Abstract

Cocoa mucilage exudate (CME) is a by-product with high energy and nutritional value [2] thanks to its content of sugars and organic acids (15% w/w) [1]. Its commercialization is limited by its moisture content. This contribution aims to establish the effect of CME dehydration on the concentration of sugars and organic acids measured by HPLC. A 2² factorial design was developed. Temperature (60 and 70 °C) and pH (4 and 5) were varied. Soluble solids were concentrated from 14±0.5 to 71±0.5 °Brix. For analytical determination, separation was done with isocratic elution. An aqueous solution (0.1% phosphoric acid) was used as the mobile phase on a Supelcogel C610-H column with refractive index detectors for sugars and diodes for organic acids. Concentrations increased during the transformation of CME into syrup. Values (initial/final): glucose (66.823±0.003/275.688±0.018 g/L), sucrose (18.272±0.003/145.856±0.020 g/L), fructose (72.981±0.008/299.773±0.031g/L), citric acid (7.583±0.015/55.164±1.559 g/L), malic acid (4.800±0.009/32.521±2.127 g/L), lactic acid (0.345 ± 0.008/2.195±0.237 g/L), tartaric acid (0.346±0.006/1.773±0.081 g/L) and fumaric acid (0.007±7.975x10⁻⁵/0.024±0.003 g/L) were obtained. Process conditions did not show significant differences ($p<0.05$) on the concentrations, indicating the viability of temperature and pH conditions studied. Additionally, the presence of 5-(hydroxymethyl)furfural was evaluated. Analytical conditions used confirmed that this anti-nutrient is not formed in detectable quantities. The energy and nutritional value increases with the transformation of CME into syrup, providing a circular economy alternative for the food industry [3].

Keywords: Cocoa mucilage exudate, sugars, organic acids, circular economy.

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Sustainable Establishment of Strawberry Cultivation in Xicotepec de Juárez

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Abstract

Based on the sustainable agriculture approach, the establishment of strawberry cultivation in Xicotepec, Puebla, was analyzed, identifying independent variables that contribute to the development of cultivation in the area. The integrated management of strawberry under a sustainable approach promotes the use of local resources, with an impact on the reduction of production costs, generation of economy, reduction of the use of commercial fertilizers and environmental impact [1, 2]. Under qualitative and quantitative methodology, a comparative analysis of two substrate formulations (local and commercial) and two types of fertilization was carried out: organic (local resources) and conventional (commercial). The data was statistically analyzed with comparison of means through the weekly collection of crop data, evaluating five variables in its two dimensions. The results did not show significant difference in the studied variables, except in the number of stems; this variable showed greater differences in the fertilization treatment with local substrate ($t = 3.05$, $p = 0.05$) compared to fertilization in commercial substrate ($t = 1.83$, $p = 0.05$). Height increase was greater under fertilization conditions with commercial substrates ($t = 3.89$ cm) against local substrates ($t = 2.1$ cm) without showing significant difference. It was found that the use of commercial substrates and fertilizers allows to obtain better results. However, they do not differ statistically in the results obtained with the organic fertilization treatment and local substrate, except for the number of stems. Therefore, the use of local substrates must be accompanied by organic fertilization to generate development and sustainable integrated management of strawberry cultivation in Xicotepec..

Keywords: local substrates, sustainable, integrated management, organic fertilization.

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Cultivation of *Spirulina platensis* using 2nd and 3rd generation for carbohydrate enrich biomass with high value-added bioproduct

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Abstract

This work established a cultivation technique for *Spirulina platensis* using agave bagasse hydrolysate and *Sargassum* wastewater in Zarrouk's medium for carbohydrate enrich biomass. This experiment used *Sargassum* wastewater and agave bagasse hydrolysate in Zarrouk's medium in a 3L bubble column photobioreactor to cultivate carbohydrate-rich *Spirulina platensis* biomass. Optical density was used to calculate cell concentration every 48 h. The 14 days biomass was extracted by centrifuge and dried in an incubator (60-70 °C for one day). Dried biomass was used to analyze carbohydrates, proteins, and pigments. A high biomass yield of 1.13 ± 0.098 g/L and 0.96 ± 0.02 g/L with high carbohydrate of 53.36 ± 1.31 % (w/w) and 42.28 ± 0.98 % (w/w) were obtained in agave hydrolysate and *Sargassum* wastewater, respectively, as compared to 0.96 ± 0.00 g/L and 16.06 ± 0.07 %, w/w obtained in the control medium. Additionally, *Sargassum* wastewater promoted phycocyanin content (0.36 mg/mL) compared to agave hydrolysate (0.09 mg/mL). Still, the amount of phycocyanin is more petite in both waste than control flask (0.58 mg/mL). *Spirulina platensis* was successfully cultivated in agave hydrolysate and *Sargassum* wastewater in Zarrouk's medium than in control and promoted phycocyanin content, which is economically feasible.

Keywords: Microalgae, Bioethanol, Pretreatment, Enzymatic saccharification, Fermentation

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Production of phycocyanin by freezing and unfrozen method from *Spirulina platensis* - promising microalgal biomass

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Abstract

Within the third generation, the biorefinery is the use of microalgae biomass, having potential in terms of its possible applications in food and bioenergy areas [1]. This microalgal biomass is rich in carbohydrates, lipids, protein, and pigments among others. Within the pigments are chlorophyll and phycocyanin, the latter being of great interest due to its properties, this type of pigment is present in high yield in *Spirulina platensis*. Which are cyanobacteria of economic interest [2]. In 2013 it was approved for use in food by the FDA which increased its use in that industry. *Spirulina platensis* was cultivated using the Zarrouk medium for 14 days in a photobioreactor. After obtaining the biomass, three periods of freezing and thawing were performed for 45 minutes. Subsequently, centrifugation was performed at 6000 rpm for 15 minutes, where it was possible to observe the phycocyanin present in the biomass. Once obtained, it was decanted to separate it from the biomass and again centrifuged at 6000 rpm for 10 minutes. The pigment obtained was determined its maximum absorption is at 620 nm. As well as its yield with a total of 190 mg/L. This demonstrates that high added value compounds such as phycocyanin can be produced through a biorefinery concept.

Keywords: Pigments, Third-generation biorefinery, *Spirulina platensis*, extraction.

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Palm flour (*Opuntia ficus-indica* (L.) Miller) as a novel ingredient in talharim fresh pasta: cooking time e texture profile

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Abstract

Palm cladodes dried and ground into flour can be included in pasta, increasing nutrient concentration and allowing innovative products with potential value-added [1]. This work aimed to apply the palm flour dehydrated by non-ionizing radiation in a microwave (810 W) in the partial replacement of wheat flour at 0 (P), 5 (P5), 10 (P10), 15 (P15) and 20 % (P20) in fresh pasta type talharim. The data was evaluated through the analysis of variance and the Tukey test ($P < 0.05$). The optimal cooking time ranged between 7.29 ± 0.04 and 9.42 ± 0.08 minutes, with an increase by adding palm flour, which also influenced the texture properties of the pasta. Concerning the pasta elasticity, it can be observed that there was a loss of elasticity of the raw fresh pasta only for P20 (9.59 ± 0.66 N), and the other samples did not have a difference between them (~ 12.83 N). However, the elasticity of the cooked pasta showed a decrease (P0= 3.91 ± 0.24 N, P5= 3.19 ± 0.39 N and P10-P20= ~ 2.16 N). P10 resulted in higher values for firmness and work of shear, with 27.29 ± 7.79 N (raw) and 15.15 ± 1.17 N (cooked) and 22.94 ± 9.90 N/s (raw) and 18.8 ± 3.03 N/s (cooked), respectively, but did not differ from P5 and P15. For adhesiveness, P0 (-0.81 ± 0.04 N) and P5 (-1.56 ± 0.36 N) showed lower values and significantly differed from the other formulations concerning the raw pasta. About the cooked pasta, P0 (-2.97 ± 0.66 N) and P20 (-2.45 ± 0.21 N) stand out, which were less sticky. In general, P15 was highlighted compared to other formulations as a function of higher cooking time, elasticity, firmness and work of shear and less sticky (higher adhesive values). However, a dilution of the gluten proteins occurs with wheat flour replacement with palm flour. The hydrocolloids from palm cladodes mimic the viscoelastic network [2], resulting in an *al dente* pasta.

Keywords: Gluten, Hydrocolloids, Innovation, New products, Texture.

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Polyhydroxyalkanoates from pear (*Pyrus communis* L.) waste by *Bacillus subtilis*

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Abstract

Polyhydroxyalkanoates (PHA) are bio-plastics, which have similar characteristics to petroleum-derived polymers [1], and since the production of plastics is massive, and with slow degradation [2], it is necessary to carry out studies on biodegradable and environmentally friendly products. Therefore, the aim of this work was to evaluate the polyhydroxyalkanoates (PHA) production from pear waste by *Bacillus subtilis* in submerged cultivation. Bioprocess was carried out for 72 h at 35°C, pH 7, 200 rpm, and at different substrate concentrations (pear waste flour) (5, 10 y 15 %). Sampling was at 24, 48, and 72 h. Results showed that the maximum PHA production was at 5% (55 mg/L) and at 10% (53 mg/L) at 48 h and 24 h respectively. Growth kinetics indicates that *Bacillus subtilis* requires more time for optimal growth, therefore more studies about this bioprocess are necessary to find the maximum PHA production by this microorganism using pear waste.

Keywords: PHA, *Bacillus subtilis*, waste pear, bio-plastics.

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Intensification of glucose production from high-pressure treated agave bagasse at high solid loading biomass under biorefinery

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Abstract

Agave bagasse is a promising and interesting raw material for the development of second-generation biorefineries. However, the intrinsic resistance (recalcitrance) of lignocellulose biomass to enzymatic hydrolysis is a barrier to its effective conversion into fermentable sugars. Therefore, an autohydrolysis process under subcritical conditions is an alternative to provide the fractionation of biomass in terms of biorefinery concept. In this work, agave bagasse as a feedstock was subjected to the autohydrolysis pretreatment at controlled operational conditions (180°C - 50 min), providing fractionation of biomass > 37.5 % glucan content in the pretreated solid phase (cellulose+lignin fraction). Also, a kinetic modeling of hemicellulose fraction (liquid phase after the pretreatment) for the depolymerization has been studied, considering a linear kinetic mechanism. At high temperature and long severity, 200°C for 50 min was able to solubilize the maximum concentration of xylan into oligosaccharides, which was reported only to be 0.65 g/L. CO₂-H₂O pretreatment at 180°C for 50 min provide the fractionation of 43.29 % glucan fraction. During the enzymatic hydrolysis, the cellulolytic hydrolysis process improved the glucose concentration by 40.98 g/L at 72 h with a saccharification yield conversion of 82.58%. The energy efficiency (η) during the autohydrolysis pretreatment was determined (1.039 g_{sugars}/MJ). The design and development of this process will allow establishing optimal operating conditions and energy efficiency for the development of biorefineries with an impact on the circular bioeconomy. The outcomes shown that agave bagasse enzymatic hydrolysis in a horizontal bioreactor at a solid loading of 20 (% w/v) delivers significant glucose concentration was 134.6 g/L in 72 h for hydrothermal pretreated agave and CSTR was only able to generate 119.9 g/L of glucose concentration. Utilizing a horizontal bioreactor may be a potential strategy to get over mass transfer constraints, by improving rheological properties, mixing of enzymes, and allows for uniform heat transmission along with less energy consumption in comparison of continuous stirred tank bioreactor.

Keywords: CO₂-H₂O pretreatment · Biomass · Hydrothermal pretreatment Biorefinery High solid loading · Circular bioeconomy

Texture properties of gels from starch blends of *Sechium edule* and *Phaseolus vulgaris*

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Abstract

The present research aimed to investigate texture properties of binary gels from *Sechium edule* starch (S-Starch) and *Phaseolus vulgaris* starch (Pv-Starch). The swelling power (SP) of the S-Starch and Pv-Starch was studied at different temperatures (60 -90 °C) [1]. The gel texture properties of S-Starch, Pv-Starch and blends of gels at different concentrations: 3, 5, 6, 7, 9, and 11% (w/w) were measured. Starch suspension was prepared by heating at 95 °C with continuous stirring for 15 min by immediately cooling under tap water [2]. The gel was placed in beaker (50 ml). Then, the gel was stored at 4°C for 12 hours at equilibrated to room temperature (20°C) before measurement. Texture profile analysis (TPA) of starch gels was carried out using a texture analyzer (Brookfield CT3) [3]. The data were subjected to one-way analysis of variance (ANOVA) and compared using Tukey test ($\alpha = 0.05$). The results showed that SP value for all starches increased as the temperature increased. SStarch showed notably higher SP at temperatures beyond 80 °C. On the other hand, Pv- Starch exhibited lower SP. As the concentration of starch increased from 3 % to 11 %, hardness also increased. The TPA result showed that Pv-Starch can form much stronger gel than S-Starch. Gels of blends of S-starch and Pv-Starch showed firmness values lower than Pv-starch individual. These results suggest that gels of blends of starch can be used in product formulation where soft texture.

Keywords: *Sechium edule* starch, *Phaseolus vulgaris* starch, swelling power, hardness

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Evaluation of enzymatic hydrolysis on sorghum bagasse for biomass fractionation

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Abstract

Sweet sorghum bagasse is an agroindustrial residue that, due to its chemical composition, can be recovered to produce various materials with high added value, such as lactic acid (L.A.) [1]. The objective of this work was to evaluate the enzymatic hydrolysis process to produce L.A. using sorghum bagasse as raw material by applying hydrothermal treatments. The pretreated biomass uses as substrate and non-pretreated biomass as the control. The tests were first carried out at flask level with a working volume of 25 mL and 50 mL, 50°C, and 150 rpm, at 1% and 8% (w/v) solid load. A 50mM citrate buffer (pH=4.8) uses a commercial cellulase/hemicellulase ratio of 1:2 (v/v), with 10 and 15 FPU/g being the cellulase loading rate, respectively. Additionally, the process was scaled in a bioreactor with a total volume of 550 mL, at a solids load of 8%, 150 mL of the working volume and 15 FPU/g, under the same pH conditions previously mentioned enzyme and kinetics. The results of the enzymatic hydrolysis for 1% (w/v) of hydrolyzed solids load demonstrate the susceptibility of the biomass to enzymatic digestion with a maximum production of 4.23 ± 0.18 g/L. In the flask test at 8% (w/v) solids load the maximum concentration found was 34.27 ± 0.50 g/L and 34.57% yield, and in bioreactor was found 79.85 ± 0.82 g/L and 80.45% yield. The test for 8% (w/v) in bioreactor showed an improvement in yield and glucose concentration, this because of the proper homogenization of the elements in the hydrolysis. Pretreated BSD demonstrates susceptibility to enzymatic digestion. But also, the analysis showed that the absorption capacity of the water in the biomass does not allow to obtain a higher yield of glucose conversion, for which it was necessary to apply different strategies.

Keywords: Biorefinery, pretreatment, sweet sorghum bagasse, enzymatic hydrolysis,

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Second generation biofuel production from vegetable oil

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Abstract

One liter of used oil could contaminate up to 40,000 liters of drinking water. It also hardens when cold, which can clog pipes and tubes. The main problem lies in the contamination of urban wastewater. Due to its agglutinating characteristic, fat generates balls that produce important blockages in the headwaters of the sewage network pipes. These biowastes are a breeding ground for the multiplication of germs that affect how complicated and expensive their sanitation is, so there is a huge danger of negatively impacting the health of the population, the life of ecosystems, and the environment [1]. This project has focused on the disposal of used vegetable oil in region VI of the state of Puebla, Mexico, which is generated in homes, restaurants, or even in the factories that use it. The aim objective of this research is to obtain second-generation biofuel using used vegetable oil as raw material and methanol and ethanol as reagents to produce biodiesel, to contribute to sustainable development. The results showed that for every 200 mL of vegetable oil used, 160 mL of biodiesel is obtained, and the rest corresponds to glycerin. Regarding the final density obtained by biodiesel, it presents values within the normal values for biodiesel (0.86 g/mL). The preliminary tests carried out with ethanol and methanol to obtain biodiesel from used vegetable oil allow us to conclude that the methodology used is viable for obtaining biodiesel. The impact of this work would be directly reflected in promoting the development of bioenergetics that allows contributing to energy diversification and sustainable development, as conditions that allow continuous improvement in the state of Puebla, Mexico, without putting food security and sovereignty of the society at risk.

Keywords: Biofuel, Biodiesel, Used Vegetable Oil, Methanol, Ethanol.

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Evaluation of the physicochemical, mechanical and barrier properties of edible films of native and oxidized mountain's yam (*Dioscorea remotiflora*) starch added with different plasticizers and vegetable oils

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Abstract

Mountain's yam (*Dioscorea remotiflora*) is an endemic tubercle of the Pacific and central Mexico, its rich carbohydrate content, greater than 19 %, like potato [1], makes it a viable source of starch for use in the food industry [2] and for the development of edible films for food preservation. The objective of the present study was to evaluate the physicochemical, mechanical and barrier properties of edible films as a function of the type of starch (native or oxidized), plasticizers (glycerol and sorbitol) and vegetable oils (coconut and oleic acid). Oxidized starch formed more transparent films than those of native and combined native/oxidized starches that were opaque. Solubility, water vapor permeability and the mechanical property of elongation percentage were influenced by both plasticizer and starch type. Films with glycerol and oxidized starch were more soluble (58.6 – 64.8 %) than the other formulations (51.95 – 58.61 %). Water vapor permeability (P_c) was lower (0.0043-0.0049 g/m·s·Pa) in oxidized starch and higher with the combined starches (0.0060- 0.0064 g/m·s·Pa). The use of sorbitol promoted higher elongation (21.7-34.2 %) than that of glycerol (13.9-21%); same as, the use of native starch. Whereas the addition of vegetable oils increased thickness and decreased water vapor permeabilities of the films. In conclusion, films prepared with oxidized starch isolated from mountain's yam may be used as edible films for food preservation, since this promoted better color, surface uniformity and less water migration. Likewise, the use of unsaturated fatty acids, mainly oleic acid helped to reduce the water vapor without affecting the percentage of elongation or the maximum tension of the films.

Keywords: edible films, hill sweet potato, oxidized starch, vegetable oils.

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Chemical composition, phytic acid content, and residual polyphenol oxidase of precooked flour from mountain´s yam (*Dioscorea remotiflora*)

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Abstract

The mountain´s yam (*Dioscorea remotiflora*) tubers are rich in carbohydrates and other essential compounds for human nutrition [1], but they also contain anti-nutritional compounds such as phytic acid or enzymes that deteriorate food quality; therefore, adequate cooking is required to minimize detrimental compounds, while preserving food nutrients. The objective of this investigation was to obtain flour from precooked yam tubers at different times and temperatures. Flours were evaluated on their chemical composition [2], phytic acid content, residual polyphenol oxidase (PPO) activity, morphology, and X-ray diffraction patterns. From our results, the moisture content (7.38 and 10.04%) and particle size ($\leq 210 \mu\text{m}$) were within the standard Mexican regulations for flours [3]. The chemical composition varied depending on the temperature and cooking time. Some treatments showed a significant ($p < 0.05$) reduction on phytic acid and residual PPO activity as low as 4.67 mg/L (25 min/85.5 °C) and 43.47% (35 min/91 °C). The micrographs of the raw flour showed the presence of intact granules and small fragments derived from the milling process, while the precooked flours exhibited amorphous regions due to the gelatinization of the starch granules. Besides, the X-ray diffraction patterns of raw and precooked flours showed more pronounced peaks at $2\theta = 17^\circ$. In conclusion, precooked yam flours with low anti-nutritional compounds and fast cooking times, could be an alternative to conventional flours, for different technological purposes.

Keywords: *Dioscorea remotiflora*, flour, precooking, physicochemical characterization.

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Spray drying of sour orange juice (*Citrus aurantium*) cultivated in the Huasteca Potosina.

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Abstract

Sour orange (*Citrus aurantium*) is native to Southeast Asia and is cultivated in several countries, including Mexico; however, it is not consumed directly due to its acidity, but it is consumed in food processing and as a medicinal use [1]. The objective of this work was to determine the best drying conditions, making use of an anti-caking agent to obtain a high yield of dehydrated sour orange juice. The characterization of the orange juice was carried out by determining Total Solids (TS) and °Brix. Subsequently, sour orange juice dehydration was carried out by spray drying [2] in a mini-Spray Dryer, using maltodextrin and calcium carbonate as anti-caking agent, also the Box-Behnken experimental design developed in Statistica 7 software was used, analyzing its results through a Tukey test. The variables studied were inlet air temperature, anti-caking agent concentration, sample flow rate, maltodextrin concentration and yield, yield being the response variable obtained from spray drying. The characterization of the orange juice resulted in values of 6% TS and 9.9 °Brix, in spray drying results of up to 88% dry juice yield were obtained, this yield was obtained at conditions of 160°C, 9% and 0.75% temperature, flow and CaCO₃ respectively; however, Tukey's test determined that there were no significant differences in yield between each of the drying methods. In conclusion, the use of maltodextrin with calcium carbonate showed a high yield and was able to avoid agglomeration of the dehydrated orange juice. Further studies are required to demonstrate whether there were changes in the chemical and organoleptic composition of the obtained dehydrated products.

Keywords: Sour orange, *Citrus aurantium*, Spray drying, Anti-caking agent.

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Vermicompost from water hyacinth (*Eichhornia crassipes*) as sole substrate

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Abstract

Water hyacinth (WH) is considered a plant-based threat to freshwater ecosystems in tropical and subtropical regions. This floating plant has a very high growth rate and quickly forms dense masses in the areas where it grows. The density of these masses is such that they completely block navigation and cause choking of the environment, which has disastrous environmental and economic consequences [1]. Complete eradication of the infestation by WH is not feasible; nevertheless, there is another possible approach: utilization of the plant. WH constitutes an available reserve of lignocellulosic biomass that can be integrated into various processes. One of these processes is vermicomposting, in which earthworms consume the organic matter and produce high-quality fertilizers. The objective of this work was to propose an alternative for the sustainable management of WH through the vermicomposting process. The Californian red earthworm (*Eisenia foetida*) was used to carry out the process, and four types of vermicomposters were studied: a rearing foot, a traditional ditch and two piston flow type reactors. The drained and chopped lily was placed in the equipment without an additional pre-composting process. Samples were taken from each batch produced to analyze the quality of the vermicompost. Through this procedure, 3 tons of water lily were treated to produce vermicompost that can have direct benefits by selling the product and indirect benefits, such as the release of areas infested by the plant that can be navigable again, which will favor human activities of economic importance such as fishing and tourism.

Keywords: vermicomposting, earthworm, sustainable.

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Vermicompost from water hyacinth (*Eichhornia crassipes*) as sole substrate

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Abstract

The abundant presence and rapid growth of the water hyacinth (WH) in water bodies generate socio-economic and environmental problems in navigation, recreational and fishing channels, in hydroelectric plants, in addition, the WH has a very high rate of evapotranspiration, contributing to the desiccation of water bodies [1]. WH contains up to 3.2% nitrogen (dry mass) and a C/N ratio of 15, which means that it can be used as a substrate in a variety of biological processes. One of these processes is composting, which consists of the aerobic decomposition of biomass that converts organic matter into a stable, hygienic product. The use of compost in soils improves their water retention capacity, aeration, and nutrient retention capacity; stimulates microbiological activity, lowering, in the same way, the need to use chemical fertilizers. The objective of the work was to design a composting process on a small and medium scale for the sustainable management of the water lily. The composting was carried out in a battery of 5 composters in a series of 1m³ each, containing up to 500kg of chopped WH (small scale), in addition, composting piles of 2mx1.4mx0.9m (length, width, height) were built, representing approximately 2 tons of water lily (medium scale). In both cases (composters and piles) a stable product was obtained after 16 weeks of processing. Through this process, more than 20 tons of WH have been treated to produce compost. This work constitutes a strategy for the sustainable management of WH that can be replicated in sites with an overabundance of this aquatic plant.

Keywords: composting, scaling, sustainable, soil fertilizer

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Comparative analysis of the caffeine content of roasted coffee under different preparation methods

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Abstract

The coffee infusion, known as "coffee", has distinctive sensory attributes and the content of chemical compounds, such as caffeine, can be different according to the degree of roasting. The preparation coffee is different among coffee companies and Mexican regulations [1,2,3,4]. The objective of this project is to quantify the caffeine content in extracts of ground coffee arabica with different roasting degrees (light, medium and dark), coupled to the preparation process established in NMX-F-013-2000 [5]; NOM-218-SSA1- 2011 [6] and the instructions of a coffee company. First procedure, the caffeine content was determined under the protocol of NOM-218-SSA1-2011, the caffeine content in the medium roast (0.1287 ± 0.0282 mg/100mL) compared to green coffee (0.0910 ± 0.0008 mg/100mL) increased significantly ($p < 0.05$), and there is no significant difference between the roasted coffee extracts. On the other hand, coffee extracts obtained from a drip coffee maker (Taurus Medea 1 Cup), with 5 g of ground roasted coffee and 150 mL of water where analyzed, showing an equal caffeine content under these conditions; light roast (0.115 mg/100mL), medium (0.098 mg/100mL) and dark (0.103 mg/100mL). In conclusion, the caffeine content in the roasted coffee extracts under different extraction conditions is equal, therefore, the methods used with variation in the infusion time does not affect the chemical composition of the coffee. The coffee company that provided the coffee beans can assure that the mode of preparation that it suggests in its products, provides the same caffeine content according to the procedure of the Mexican norms.

Keywords: Coffee, Roasting, Caffeine, Preparation.

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Biogas production from water hyacinth (*Eichhornia crassipes*)

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Abstract

Water hyacinth (WH) is the most aggressive floating aquatic plant. It is considered among the 100 worst invasive alien species [1]. WH can double its biomass in 6 to 18 days with a high density (above 60 kg/m²) under favorable conditions of temperature and nutrient availability. Once WH is present in a water body, it is very difficult to eradicate it. Different strategies have been developed to reduce problems associated with the infestation in water bodies by WH, among them, removal by mechanical methods, chemical application and biological control agents have been used. However, each of these has limitations [2]. Therefore, the objective of this study was to develop a method or a combination of methods to achieve control of WH obtaining products from its biomass. Due to its composition, WH can be used as a substrate in a variety of biotechnological processes. One of them is the production of biogas. This fuel is produced by anaerobic fermentation and contains a mixture of methane and carbon dioxide. Biogas can be used to produce heat (boilers), as a fuel, to generate electricity (engines or turbines), or even as a raw material. To produce biogas, the liquid fraction of WH obtained after pressing in a semi-industrial press was used. The WH juice is fed to a bioreactor with an operating volume of 2.7 m³ connected to a feeding side tank. Five hundred kg of WH were used for the start-up and stabilization of the bioreactor operating at an expected production capacity of up to 14 m³ of biogas per week.

Keywords: biogas, UASB, water hyacinth juice, sustainable process

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Conceptual design pilot plant to obtain leaves, peels, and sedes phenolic extracts of *Annona muricata*

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Abstract

The objective of the work was to conceptually design a pilot plant to extract phenolic compounds from leaves, peels, and seeds of *Annona muricata*. The design consisted of three parts: the location of the facilities using decision matrices and the Brown-Gibson method [1], the process was modeled using material and energy balances [2], and the layout of the plant was designed using matrix tables [3] and the estimation of the capital cost using the Hang and Lang factor [4]. The Castillo Industrial Park in the State of Jalisco, Mexico, was chosen with the macro location matrix, mainly considering the provision of services, transportation, security, and communications. The material balances of the process were carried out with a calculation base of 50 kg of each raw material. Yields were obtained for each lot. For a production per lot, results of 2.3%, 3.1%, and 4.5% of leaves, peels, and seeds, were calculated. The leading equipment process was quoted, and the fixed capital cost of the project was estimated at USD 1,044,000. In conclusion, the design of the pilot plant for the extraction of phenolic compounds from the leaves, husks, and seeds of *Annona muricata* makes it possible that the waste and by-products of the plants may have the potential for the development of new products and new technologies in the biotechnology and food industry with a high energy cost.

Keywords: *Annona muricata*, phenolic extracts, pilot-plant design, soursop leaves.

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Study of the velocity and temperature profiles in a spray drying chamber using CFD simulation

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Abstract

Spray drying is currently one of the most widely used drying methods, both as a way of preserving compounds present in a food, as well as a method of microencapsulating different components, such as aromas and even probiotic bacteria. However, even though it is one of the cheapest, fastest and most flexible methods, it still faces challenges for improvement, for example, in the yield of the powders produced [1,2]. Depending on the composition of the solution to be dehydrated, problems of stickiness on the walls of the drying chamber may occur to a lesser or greater extent, generating product losses. It is known that, for example, in the drying of fruit juices, stickiness problems are due to sugars and organic acids of low molecular weight, with low glass transition temperatures, for which they adhere to the walls of the drying chamber [3]. These particles form a deposit on the walls and act as agglutination zones for wet particles throughout the drying process. This problem can be addressed through computational fluid dynamics, works as a virtual laboratory that allows the study of different operating conditions, such as the distribution of velocities inside the drying chamber, as well as the profile of temperatures that can develop. For this reason, this work focuses on the simulation of a spray dryer on a laboratory scale, using COMSOL Multiphysics 4.3®, coupling the phenomena of heat and momentum transfer within the drying chamber, obtaining temperature and velocity profiles. This helps to understand the behavior of the system during the process inside the drying chamber and to establish its relationship with the operating conditions.

Keywords: spray drying, CFD modelling, heat and mass transfer, mass yield.

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Valorization of brewery spent grain fibers; as an alternative source for the production of nanocellulose.

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Abstract

During the brewing process, several wastes are generated, such as hops, yeast and brewery spent grain, the latter representing 85% of the total waste generated [1]. It is made up of proteins, lignin, hemicellulose and cellulose; this last constituent allows it to be used in various fields, like in the production of nanocellulose, which due to its properties and characteristics is used in the food area as an emulsifying agent, retain the small droplets of emulsions against coalescence. As a food additive in products rich in fiber and with low fat content, promotes sensory and chemical improvements. The aim of the present is to characterize cellulose nanofibers obtained by a microwave assisted treatment of brewery spent grain; standards TAPPI, FTIR and XRD were used for the characterization. The results obtained by FTIR shows the presence of cellulose, hemicellulose and lignin. Diffraction pattern of fibers shows two peaks characteristic of natural fibers; the peak at 19.93° denotes the presence of crystalline structural components in the evaluated fiber [2]. Conclusions. The results confirm the presence of cellulose in the fibers, this allows brewery spent grain to be considered as an alternative source for the extraction and production of nanocellulose.

Keywords: Agro-industrial waste, brewery spent grain, fiber, nanocellulose.

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Molecular Dynamics Simulation of Proteins Extracted from Black Soldier Fly Larvae used in Extrusion Processes

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Abstract

Insects like the Black Soldier Fly (BSF) are recently being studied as food sources to address concerns on meeting the food demand for the growing global population, as conventional production lines for meat protein such as cattle and aquaculture are currently unsustainable sources [1]; there have been studies evaluating the use of insect proteins for the production of extruded foods, such as expanded snack products and meat analogues. However, this field of study is still fairly recent and not much has been studied beyond digestibility and growth performance [2,3]. Molecular Dynamics Simulation is an *in silico* technique that allows for the study of molecular systems and predict macroscopic physical properties from microscopic properties like cohesive energy density, solubility (δ) and interaction (χ) parameters. OBJECTIVE: Determine δ and χ to evaluate the compatibility of protein extracted from BSF flour with starch from Corn flour through molecular dynamics simulations. METHODS. Modeling and simulation were carried out on ten (10) protein molecules and one (1) starch molecule using Materials Studio 8.0© software. Amorphous cells were constructed, and geometry optimization was performed on these systems to ensure similarity with real structures. The modeled systems were measured for their Hildebrand solubility parameter (δ) and Flory-Huggins interaction parameter (χ), to calculate potential miscibility between substances. RESULTS. Calculations for the Protein molecule systems yielded an average δ of 14.961MPa^{0.5}, whereas δ for Starch was calculated to be 30.895MPa^{0.5}. The large difference between both δ (>10) suggests BSF protein is incompatible with Corn starch. However, χ decreases as temperature increases, suggesting higher temperatures make these substances more compatible [4]. CONCLUSIONS It is predicted that a binary mix of BSF protein is incompatible with corn Starch, however, this is before considering the effect of the extreme extrusion temperatures, which could allow these two substances to form a stable mix.

Keywords: Extrusion, Protein, Starch, Molecular Dynamics Simulation.

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Evaluation of culture media conditions for *Spirulina platensis*

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Abstract

The microalgae *Spirulina platensis* has been used throughout history by humans due to its nutritional content [1]. One of the key points for microalgae cultivation is the optimization of the media. In the first experiment, 2 treatments were evaluated, (T1) Zarrouk medium replacing the carbon source with 0.1 M carbonate buffer pH 9.2, and (T2) the same media composition but omitting the addition of trace metals. The kinetics of both treatments were compared against a Zarrouk culture control (TC). In the second experiment, 3 different NaNO₃ concentrations were evaluated: T1 (0.275 g/L), T2 (1.0 g/L), and T3 (2.5 g/L), and they were compared with a control TC (1.25 g/L). In both experiments, growth kinetics were performed, and the biomass at the final time was characterized. Microalgae showed better adaptation to T2 according to the results of the kinetic parameters and biomass production, followed by T1, while T3, shows lower biomass production, but with a higher growth rate than T1. For the evaluation of NaNO₃ concentrations, no significant differences in biomass production were found. Using carbonate buffer as a carbon source in the medium promotes the growth of the microalgae in the Zarrouk medium. *Spirulina platensis* can grow in the absence of trace metal. The results found in the evaluation of nitrogen sources indicated that this element can be reduced to economize the formulation of the medium without significantly affecting the development of the microalgae.

Keywords: Microalgae Biomass, Third generation biorefinery, Blue Biotechnology, system culture.

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Synthesis and evaluation of biopolymeric capsules obtained by spray drying as carriers of rhizobacteria that promote plant growth (*Bacillus mojavensis* and *Bacillus amyloliquefaciens*).

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Abstract

Agriculture faces important challenges nowadays to sustain the food, fiber and fuel needs of a growing global population while proposing a sustainable management agenda [1]. Most strategies for increasing crop yields have main focused on intensive use of agrochemicals. Unfortunately, indiscriminate use of agrochemicals led to soil deterioration, ecosystems contamination, and negative impacts in public health [2]. An eco-friendly alternative to accomplish sustainable agriculture is the use of biofertilizers which contain plant growthpromoting rhizobacteria (PGPR). In this study, *Bacillus amyloliquefaciens* were encapsulated within a chitosan matrix, and the biocompatibility and biodegradability tests were performed. In brief, a 24-hour culture of *B. amyloliquefaciens* were centrifugate at 2500 rpm for 10 min and the microorganism pellets were resuspended in a chitosan dispersion at 1% w/v. Then, the drying process was conducted at 140 °C in a MM-PSR pilot spray dryer (GEA-Niro, Denmark). For biocompatibility and biodegradability test, 1 g/L of biofertilizer capsules were mixed into specific medium and incubate at 30 °C for 48 h, the UFC were count and reducing sugars were determined. The capsules micrographs were obtained by SEM. The UFC count indicates an adequate survival rate for encapsulated PGPR. The increase release rate of reducing sugars indicated the satisfactorily chitosan matrix decomposition. The encapsulation of PGPR into a biopolymeric matrix by spray drying is promising method to obtain biofertilizers with potential applications on agriculture field. **Keywords:** Biofertilizers, plant growth-promoting rhizobacteria, *Bacillus*, spray drying.

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Effect of High Intensity Ultrasound and Transglutaminase Crosslinking on Functional, Rheological, and Structural Properties of Buttermilk Solutions

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Abstract

Buttermilk is the liquid released during butter production [1]. This byproduct contains novel components as complex lipids and proteins. The protein component ratio is similar to skim milk. The recovery and use of the ingredients from dairy effluents is an important topic to promote a circular economy. This work investigated the effect of transglutaminase (TGase) crosslinking condition and ultrasound treatment on the functional and rheological properties of buttermilk solutions. Buttermilk solution were subject to enzymatic crosslinking under sonication using an ultrasonic homogenizer at two amplitudes (15 and 30%), during 30 and 60 min using microbial TGase 1 U/g. The treated solutions were lyophilized and characterized in terms of functional properties (fat absorption capacity, solubility, aggregation, viscosity, and water absorption) . In the crosslinking process, ultrasound had a significant effect at decreasing solubility and increasing viscosity. TGase-induced buttermilk solutions coupled with ultrasound treatment could significantly influence protein conformations, consequently determining their specific functional properties. The HUIS treatment increase the Fat absorption capacity, while solubility and emulsifying activity index decreased. Results from Fourier infrared spectroscopy (FTIR) and free thiol groups concentration indicate the possible presence of protein aggregates. Then, Ultrasound could assist the enzymatic crosslinking process by TGase to optimize the utilization of buttermilk in the food industry.

Keywords: Transglutaminase, ultrasound, buttermilk, protein aggregates

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Adsorption isotherms and calculation of thermodynamic properties of dried chillies (*capsicum annum*)

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Abstract

The quality of dry foods is mainly determined by the water content, the content of active substances and the colour.[1] The study of thermodynamic properties allows evaluating the microstructure of foods, studying the adsorbed water and the physical phenomena that occur on its surface. [2] The objective of this work was the generation and evaluation of moisture adsorption isotherms and thermodynamic properties of dried costeño chili marketed in the central zone of the state of Veracruz, Mexico. The dried chili was analyzed at 20°C, 30°C and 40°C in an a_w range between 0.01 and 0.9. It was observed that the isotherms showed an increase in the equilibrium moisture content around an a_w of 0.65. Isotherms were modeled using the GAB and BET equations. The quality of fit was evaluated with the regression coefficient r_2 , with average values for the GAB model of 0.9815 and 0.9590 for the BET model, the GAB model fits better to the experimental data, these isotherms can be classified sigmoid (Type II) according to IUPAC which are the most common in foods. Similarly, the Gibbs free energy was calculated with a minimum value of -0.06843 (KJ/mol) at a X_e content of 5 g H₂O/g d.s., showing a spontaneity process and decreasing to a value of -1.7904 (KJ/mol) at an X_e of 50. These properties allow the modeling of the processing of this type of food, in addition to the estimation of energy requirements, and storage conditions.

Keywords: Isotherm, dried chili, water activity, GAB, isosteric heat

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Characterisation of a biofilter from cellulosic coffee waste and its evaluation in the removal of heavy metals and emerging pollutants present in wastewater samples.

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Abstract

Coffee production led by countries such as Brazil, Vietnam, Colombia and Indonesia has substantially increased in the last decade to meet the growing demand of this product in the world. Mexico is currently among the first ten global producers countries with about 515 million pounds of coffee [1]. However, just as its production occurs, in the same way a large amount of coffee waste is generated, and more than 90% of this residue is discarded into soil and water matrices, and thus representing a potential risk for environmental health [2]. This research aims to design and characterize a biofilter through reusing cellulosic materials obtained from different coffee wastes like spent coffee and coffee husk and evaluate their removal efficiencies for heavy metals such as Zn, Cr, Ni, Cu, Fe, As, Co that may range from 85% to 97% depending on pH and initial metal concentration. Biomaterials obtained from coffee wastes underwent different chemical treatments to be later characterized by FTIR and XRD analysis, evidencing a high availability of cellulose type I in their structures, making them a useful alternative to retain contaminants in water by adsorption [3]. Furthermore, the performed detection method for heavy metals present in water via fluorescence emission has added value to this research [4], which helps to demonstrate the high potential of cellulosic biosorbents and the effect of several factors like pH or pollutant dose to treat water samples efficiently. This work may have an important impact in the environmental research by giving enough evidence of agricultural residues as a feasible solution for the massive organic waste generation, contamination of water bodies and global safe water access. **Keywords:** Coffee Waste, Wastewater, Heavy Metals, Emerging Contaminants, Adsorption.

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Microencapsulation of *Hibiscus sabdariffa* extracts by spray drying with chitosan, sodium alginate, and agave fructans mixtures as wall material

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Abstract

The protection of chemical substances of biological origin has a high industrial interest in preserving their different functional properties, nutritional aspect, or sensory attributes. To achieve this, the interest compounds can be encapsulated by spray drying, using biopolymers and their mixtures as wall materials, guaranteeing adequate protection and thus increasing their shelf life and effectiveness¹. The object of the present work was to microencapsulate by spray drying an aqueous extract from *Hibiscus sabdariffa* (Hs) using mixtures of chitosan (Q), sodium alginate (S), and agave fructans (F) as wall material in different proportions, and the physicochemical evaluation of the powders obtained. All the powders had moisture content lower than 4%; the water activity was between 0.096 and 0.178, suggesting high stability during storage. Scanning electron microscopy (SEM) revealed a spherical, smooth and wrinkled microcapsule morphology characteristic of the biopolymers used as wall materials. Fourier-transform infrared (FTIR) showed characteristic peaks belonging to phenolic compounds (1100 and 1071 cm⁻¹); these signals indicated the presence of anthocyanins (cyanidin-3-O-sambubioside and delphinidin-3-O-sambubioside), which confirm that this wall materials can protect the active compounds of Hs. The mixture of 0.18%Q:0.66%A:3.33%F (w/v) presented more than 80% yields, employing a temperature of 120 °C. In conclusion, the results showed that the mixture 0.18%Q:0.66%A:3.33%F has a high capacity to encapsulate and protect *Hibiscus sabdariffa* extract phenolic compounds. Furthermore, the study of new polymeric blends as wall material is important for proposing new applications in different processes.

.Keywords: Spray drying, *Hibiscus sabdariffa*, chitosan, sodium alginate, agave fructans.

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Effect of solids and yam starch (*Dioscorea rotundata*) content on the viscosity of sonicated pumpkin (*Cucurbita moschata*) juice

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Abstract

The pumpkin is a vegetable belonging to the Cucurbitaceae family with bioactive properties, which give it high medicinal value. In Colombia in 2017 harvested 10,480 ha and a production of 124,000 tons, however, it is a vegetable that has no technological application, which means that it does not generate added value [1], an alternative could be in the production of juices or included in other food matrices. One of the important aspects of juice industrialization is viscosity, due to its relevance within operational processes such as transport mechanisms [2]. This study aimed to evaluate the effect of solids content, yam starch addition, and ultrasound treatment on the viscosity of pumpkin juice. To achieve this, a Brookfield DV2T viscometer was used. Measurements were performed in the solids ranges of 8.4% to 7.5%. The solids were reduced through dilutions and the addition of starch was made to the juice containing the least amount of solids (7.5%) in a range of 1% to 6%. The ultrasound treatment was applied for 30 min at 200 W. The viscosity values ranged from 4155 cP to 404.33 cP when solids were reduced, and from 498.8 cP to 783.67 cP with the addition of starch, while the ultrasound treatment reduced viscosity values from 323500 cP to 70420.33 cP. The reduction of the solids content in the pumpkin juice exponentially reduces the viscosity, as does the treatment with ultrasound, which can reduce it by 4.5 times its initial value. This is the opposite of the effect of native starch, which increases viscosity values by 0.7 cP for each 2% of starch added. The treatments applied caused the viscosity to change in the samples, which is of great importance at the time of industrialization.

Keywords: Pumpkin, viscosity, yam starch, industrialization, Non-thermal technologies.

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Development of healthy snack-type food of plant origin and its sensory evaluation

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Abstract

Consumers' awareness of the connection between diet and health is growing [1]. The consumption of dehydrated fruit snacks leads to the highest prevalence in Mexico [2]. The development of snacks with vegetable ingredients represents an excellent opportunity to offer healthy food with high sensory acceptability. The objective of this study was to develop vegetable snacks made from a mixture of spinach and pineapple. The spinach was washed, disinfected, and blanched with diluted acetic acid. Pineapple was washed, disinfected, peeled, and blended. The spinach and the blended pineapple were processed in a food processor with 600 W power (10 %w/w spinach and 90 %w/w pineapple) for 1 min. Then the mixture was molded into rounded chips on trays and processed in a convective air forced food dehydrator for 5 h at 60 °C. Subsequently, a quantitative descriptive analysis was used to evaluate the attributes such as sweetness, acidity, crispness, and bitterness through a categorized 7-point scale. Then a focus group evaluation was performed with a hedonic 7- point scale. It is worthy to note that the crispness attribute is perceived as very intense; crispness is an advantage in this product as conventional dried fruits and vegetables tend to be difficult to bite. This investigation highlights the obtention of healthy snacks made from dehydrated vegetable ingredients with high sensory acceptability by the consumer.

Keywords: Snack, Vegetable, Acceptability, Healthy.

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Development of a vegan product using the residual calyces from wine production with *Hibiscus sabdariffa* from Wixárikas communities

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Abstract

In Mexico, 20% of the population has reduced or eliminated the consumption of meat or food derived from animals. [1] A vegan product was made utilizing hibiscus residual calyces from the elaboration of wine made at a Wixárika community. The objective of this study was to determine the shelf life of the vegan product. Shelf-life determination was carried out by performing an accelerated study by subjecting the product to temperatures of 4°, 15° and 25°C for a period of 28 days [2]. The physicochemical analysis carried out were moisture content, water activity (aw), pH and acidity, being this last one the key factor to the application of a mathematical model to calculate shelf life. Microbiological analyses were performed to determine the presence of mesophilic aerobic bacteria, coliform organisms, fungi and yeasts, where none of the three temperatures exceeded the limits suggested by NOM-093 [3]. An A-not-A test was carried out to analyze changes in the sensory properties as time passed using 10 judges per day, where significant difference was determined at days 10, 15 and 28 for 25°C, 15°C and 4°C. As mentioned, acidity values were used for the application of the Arrhenius equation, using the data obtained from the days where significant difference was found in A-not-A tests. The activation energy (Ea) to reach the limit value of acidity, was 9445.5 J/mol at a reaction order of 1.5. A model was used to calculate the time in which the product will be in the best conditions according to the storage temperature, obtaining as a result, for 4°C, 15°C and 25°C, it will be 33, 31 and 29 days respectively. This project seeks to have a social impact, achieving fair trade between the Wixárika community and promoting their production of the *Hibiscus sabdariffa* flower.

Keywords: *Hibiscus sabdariffa* flower, vegan product, shelf life, acidity.

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Development of a sugar-reduced hard candy with açai Pulp (*Euterpe oleracea*)

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Abstract

Different formulations were evaluated for the elaboration of a sugar-reduced hard candy with açai pulp also known as assaí, palm heart or manaca, which is a round oval shaped Berry of purplish colour widely distributed in the Amazon region [1]. Sucrose content in our candy was reduced by using substitute raw materials such as polydextrose and stevia, to obtain a low-calorie product compared to a conventional hard candy made with sucrose and glucosa that also receives sensory acceptance by untrained judges by using a hedonic scale test [2]. An energy intake of 1057 kcal was calculated with Atwater's factors in relation to an ordinary candy that provides 1728 kcal average per 100 g serving. Then, the product obtained could be called as "low-calorie" and "sugar-reduced" hard candy according to Mexican Official Standard NOM-086-SSA1-1994 [3]. Half the sugar was replaced by using polydextrose as texturizing agent and stevia as sweetener in a product showing the typical hard candy characteristics with a particular flavour because of açai pulp which additionally provides with mono- and poly-unsaturated fatty acids but also amino acids such as methionine, lysine, phenylalanine, and threonine [4].

Keywords: hard candy, polydextrose, stevia, sweetener, açai, low calorie

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Development of a vegan mayonnaise-type sauce based on Hass avocado oil and Sacha Inchi seed oil

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Abstract

In the last years, Colombia have becoming an important worldwide supplier of Sacha Inchi seed and Hass avocado, from can be obtained vegetable oils with high nutritional value [1,2]. Using them, two vegan mayonnaise-type sauces were designed, formulated and characterized in this work. Considering the high proportion of oil contained in the formulations, its technological and sensory quality was evaluated. For this purpose, a factorial experimental design was used varying the type of oil (Hass avocado oil and Sacha inchi seed oil), the proportion of oil (56%, 59% and 61%), and the proportion of emulsifier (33%, 35% and 37%) in the formulation. Each formulated mayonnaise and a comercial brand mayonnaise (control, for comparison purposes) were characterized by testing particle size, stability, rheology, and texture. Finally, a sensory analysis (with 39 people) was carried out to determine their consumer's acceptance. Six hedonic questions were asked, with a scale of 1 to 9 that informed the global acceptance, color, appearance, consistency, aroma and flavor. The results of the oil characterization indicated the purity of the products used and low levels of initial oxidation. From the mayonnaise characterization, it was found that different factors are significant in the stability, consistency index, firmness, consistency, and cohesiveness of the mayonnaises. Additionally, it was possible to determine the two formulations (56% of Hass avocado oil and 35% of emulsifier, and 59% of Sacha Inchi seed oil and 35% of emulsifier) closest in their properties to a commercial mayonnaise. In the sensory analysis, Sacha inchi mayonnaise was preferred (in terms of purchase and global acceptance). In avocado mayonnaise, color (yellowish) and consistency (low) were the worst characteristics rated. Thus, it was concluded that both oils can be used for the preparation of mayonnaise, however, Sacha Inchi seed oil has higher quality than Hass avocado pulp oil.

Keywords: PUFA, sauces, particle size, stability, sensory analysis.

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