Movilidad de Estudiantes

La movilidad de estudiantes adscritos al programa de Doctorado en Ciencias en Ingeniería Bioquímica ofertado por el TecNM/Instituto Tecnológico de Durango, es parte esencial de la formación, además de estar establecido como un requisito dentro de los lineamientos generales de Posgrado del TecNM, en tal sentido se muestra los datos de movilidad, junto con los productos asociados a dicha movilidad. Se observa que en general, la movilidad ha sido relevante, ya que el 88.57% de los estudiantes ha llevado a cabo estancias de investigación, sin embargo, la obtención de un artículo de investigación suele ser el resultado final de un trabajo arduo de concepción, ejecución y análisis, que en este caso ha sido menos satisfactorio, al tener alrededor de un 35% de estudiantes con al menos un artículo, resultado de su estancia de investigación. A pesar de lo anterior, es importante mencionar que al realizar el cálculo con respecto al total de estudiantes graduados, el porcentaje sube al 40%, lo cual habla de que el llevar a cabo una estancia, que en la mayoría de los casos es de alrededor de tres meses, no solo provee al estudiante de una forma distinta de hacer las cosas, sino que además genera un producto de impacto en el quehacer científico. Las evidencias son mostradas, posterior al Cuadro 1, en el orden en el cual aparecen citadas en dicho Cuadro..

Cuadro 1. Movilidad de estudiantes del Programa de Doctorado en Ciencias en Ingeniería Bioquímica.

NOMBRE ALUMNO/EGRESADO	**Institución donde se realizó la movilidad**	**Producto o resultado**
Varela Santos Elizabeth del Carmen	Universidad del Bio-Bio, Chile	Articulo
Hernández Santos Betsabé	Universidad de Antioquial	
Núñez Ramírez Diola Marina	Universidad de Sao Paulo	
Martell Nevárez María Angélica Hernández Carbajal Gerardo	Universidad Federal de Parana	Artículo
Delgado Nieblas Carlos Iván	Universidad de Sao Paulo - Pirassusunga	Articulo
Rodríguez Sifuentes Lucio	Universidad Estatal de Georgia	Artículo
Rodríguez Miranda Jesús	Universidad de Bonn	
Martínez García Juan José	Universidad de Salamanca	
Rodríguez González Víctor Manuel	Universidad de las Islas Baleares	Artículo
Díaz Campillo Miguel Jaime	Universidad Politécnica de Valencia	

Araiza Rosales Elia Esther		
Fileto Pérez Héctor Alonso	Universidad de Oregon, Portland	
Cervantes Cardoza Verónica	CSIC-ICTAN	Artículo
Sánchez Burgos Jorge Alberto*	Texas A&M University	Artículo
Camacho Hernández Irma Leticia*	Universidad de Salamanca	
Álvarez Álvarez Carlos *		
Cisneros de la Cueva Sergio	DBZ- Alemania	
Díaz Barbosa Dante Yamid*	Universidad Estatal de Nuevo México	
Ordaz Díaz Luis Alberto	Universidad Estatal de Arizona	
Reyes Jáquez Damián	Universidad Estatal de Nuevo México	Artículo
Cisneros Quintero Suria *	Hospital Reina Sofia – Madrid	
Hernández Lira Juan Carlos	CIAT- Colombia	
Pámanes Carrasco Gerardo Antonio	Universidad Estatal de Nuevo México	
Farías Cervantes Vania Sbeyde	Universidad Estatal de Nuevo México	
Guerra Rosas María Inés	Universidad de Lleida, España	Artículo
Navarro Cortez Ricardo Omar	Universidad Estatal de Nuevo México	
Ortega Valdez Karla María	Universidad Estatal de Nuevo México	
Robles Ozuna Luis Enrique	Universidad Politécnica de Valencia	
Santiago Adame Rubén*	Universidad Complutense de Madrid	
Escalante Estrada Violeta Eréndira*		

Troncoso Reyes Nalleli	ICTAN -CSIC	Artículo
Torres Velázquez Diana Sofía	Universidad de Chile	
Cordero Soto Itza Nallely	Agro Paris – Sud	
Vázquez Cabral Blanca Denis	Universidad Europea de Madrid	Artículo
Vázquez Ortega Perla Guadalupe	CSIC-Instituto de Catálisis y Petroleoquímica	Artículo
Mauricio Antonio Ramos Osuna		
Brenda Paloma Gómez Lozano		

Evidencias

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Effect of high hydrostatic pressure (HHP) processing on physicochemical properties, bioactive compounds and shelf-life of pomegranate juice

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ABSTRACT

The aim of the present study was to evaluate the effect high hydrostatic pressure (HHP) processing (350–550 MPa for 30, 90 and 150 s) on microbial quality as well as physico-chemical and bioactive compounds of pomegranate juices during 35 days of storage at 4 °C. Antioxidant activity, phenolic content and color values (L^*, a^* and ΔE) were determined. The microbiological results showed that HHP-treatment at or over 350 MPa for 150 s resulted in a reduction of the microbial load around 4.0 log cycles, and were sufficient to keep microbial populations investigated below the detection limit during the whole storage period. Therefore, these treatments were able to extend the microbiological shelf-life of pomegranate juice stored at 4 °C for more than 35 days. All HHP-treated samples showed a slight reduction in antioxidant capacity during storage time. Phenolic content increased significantly ($p<0.05$) between 3.38% and 11.99% for treated samples with 350 MPa and 550 MPa at day 0. The ΔE values, which are an indicator of total color difference, showed that there were significant differences ($p<0.05$) in color between untreated and treated samples and showed a significant decrease ($p<0.05$) in ΔE values during storage time. The highest color difference was obtained at day 35 for 550 MPa for 90 s. These results clearly demonstrate that the color stability of pomegranate juice depends on the processing conditions. During the first 15 days, the pH, °Brix and titratable acid were not significantly affected by high pressure processing.

Industrial relevance: This paper provides information of storage stability of pomegranate juice after pressure treatments which is quite scarce. In database collected, criteria for commercial production of high quality pomegranate juice with safety requirements could be established.

1. Introduction

Pomegranate (*Punica granatum*, Punicaceae) is highly valued mainly due to its exceptional and unique sensory and nutritional properties (López-Rubira, Conesa, Allende, & Artés, 2005). Polyphenols are the major class of pomegranate phytochemicals, including flavonoids (anthocyanins), condensed tannins (proanthocyanidins) and hydrolysable tannins (ellagitannins and gallotannins) (Jaiswal, DerMarderosian, & Porter, 2009). It has been reported that consumption of pomegranate fruits has nutritional and medical benefits, including reduced oxidative stress, atherogenic modifications to LDL, and platelet aggregation, as well as anticancer, antibacterial, and antiviral activities (Qu, Pan, & Ma, 2010). Therefore, there is a need for alternative methods of processing which can increase microbiological stability and preserve nutritional and bioactive characteristics (Patras, Brunton, Da Pieve, & Butler, 2009). Consumer demand for freshly squeezed fruit juices is increasing, but such products are susceptible to spoilage and thus have a limited shelf-life (Buzrul, Hami, Largeteau, & Demazeau, 2008). Thermal processing (pasteurization) is the most commonly used preservation technique to extend the shelf life of juices. However, this process may have adverse effects on sensory and nutritional values of juices (Plaza et al., 2006).Therefore, color quality of anthocyanin containing juices is undesirably lost during thermal process (Patras, Brunton, O'Donnell, & Tiwari, 2010). Food scientists and the food industry are therefore searching for novel methods, which can destroy undesirable microorganisms with less adverse effects on product quality. Several methods have been investigated for extending the shelf life of food. Non-thermal processing technologies for food preservation and safety are gaining widespread acceptance throughout the food industry. An example is high hydrostatic pressure (HHP) technology, which has been identified as a method for inactivating microorganisms (Patterson, 2005) and the processing temperature does not increase beyond 40 °C (Welti-Chanes, Ochoa-Velasco, & Guerrero-Beltrán, 2009). This technology transmits isostatic pressure instantly to the product,

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A N I N T E R N A T I O N A L J O U R N A L

Screening of Native Yeast from *Agave duranguensis* Fermentation for Isoamyl Acetate Production

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ABSTRACT

In this work, fifty yeast strains, isolated from the spontaneous alcoholic fermentation of Agave duranguensis *to produce mezcal, were tested using the double coupling system. These yeasts were from the genera* Pichia, Torulaspora, Saccharomyces, Kluyveromyces, Deckera, Hanseniaspora*, and* Candida*.* P. fermentans *ITD00165 was the best isoamyl acetate producer, yielding 0.38 g/L of ester after incubation for 24 h, while* K. marxianus *ITD00211 produced 0.32 g/L of ester. Thus* P. fermentans *ITD00165 could be considered as an excellent choice for use in optimization studies of the culture medium and bioreactor operating conditions to develop a process for biotechnological production of isoamyl acetate.*

Key words: Banana aroma, Food additive, Native yeast strains

INTRODUCTION

A vast array of compounds, such as alcohols, esters, fatty acids, and sulphur compounds may be responsible for the flavor of foods (Gratfield. 1988; Dubal et al. 2008; Krings 1998). Food processing can cause a weak aroma in the final product, hence, it is necessary to use the additives (Lemos et al. 2010). Most of these compounds are produced by the chemical synthesis, but a rapid shift to biosynthesis is taking place (Janssens et al. 1992) because consumers have developed a tendency to prefer the food with a "natural" label (Janssens et al. 1992; Lemos et al. 2010). Isoamyl acetate is an ester with great interest in the food industry. It has a consumption of 74,000 kg per year due to its characteristic banana smell (Torres et al. 2009).

Yeasts produce esters by esterification of alcohols with acetyl co-enzyme A (Verstrepen et al. 2003). Two genes coding for the enzyme alcohol acetyltransferase have been identified in *Saccharomyces cerevisiae* (Mason and Dufour. 2000). This enzyme catalyzes the reaction between acetyl co-enzyme A and alcohols. Yeasts also produce enzymes with ester hydrolase activity and the balance between these two antagonistic enzyme activities determines the final concentration of isoamyl acetate in the fermentation system (Inoue et al. 1997; Fukuda et al. 1998; Yoshimoto et al. 1999; Rojas et al. 2001). Oda (1996) developed a system for the production of esters, called a doubled coupled system (DCS),

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Elaboration of functional snack foods using raw materials rich in carotenoids and dietary fiber: effects of extrusion processing

Elaboración de alimentos botana funcionales utilizando materias primas ricas en carotenoides y fibra dietaria: efectos del proceso de extrusión

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This research studied the effect of extrusion temperature (ET, 93.45–140.55°C), moisture content (MC, 21.27–34.73%), and the winter squash flour content (WSF, 0.43–15.57%) on physicochemical characteristics and content of bioactive compounds of third-generation (3G) snack foods expanded by microwave heating. The ingredients used for their elaboration were corn starch, whole-grain yellow corn and winter squash flours. A single-screw extruder was employed, and the response surface methodology was applied. The lowest bulk density and the highest water solubility index (WSI) and water absorption index, occurred at high ET with low MC. The highest values of total carotenoids and dietary fiber (total and soluble) were obtained at high WSF and ET. Furthermore, when the WSF was increased, the color L* value diminished, whereas b* value and WSI increased. These results suggest that it is possible to elaborate 3G snack foods with acceptable physicochemical characteristics and excellent bioactive compounds content, improving their potential health benefits.

Keywords: functional snacks; extrusion; third-generation snacks; carotenoids compounds; dietary fiber

Esta investigación estudió el efecto de la temperatura de extrusión (TE, 93,45–140,55°C), del contenido de humedad (CH, 21,27–34,73%), y del contenido de harina de calabaza (HCAL, 0,43–15,57%) sobre características fisicoquímicas y contenido de compuestos bioactivos de alimentos botana de tercera generación (3G) expandidos por microondas. Se utilizaron como ingredientes para su elaboración almidón de maíz, harinas de maíz amarillo integral y harinas de calabaza. Se utilizó un extrusor de tornillo simple, siendo aplicada la metodología de superficie de respuesta. La menor densidad aparente y el mayor índice de solubilidad en agua (ISA) e índice de absorción de agua se obtuvieron a altas TE y bajos CH. Los mayores valores de carotenoides totales y fibra dietaria (total y soluble) se presentaron a altos HCAL y TE. Además, al aumentar HCAL disminuyó el valor de L* de color, mientras que aumentó el valor de b* e ISA. Los resultados obtenidos sugieren que es posible elaborar alimentos botana 3G con características fisicoquímicas aceptables y excelente contenido de compuestos bioactivos, mejorando sus beneficios potenciales en la salud.

Palabras claves: Botanas funcionales; extrusión; botanas de tercera generación; compuestos carotenoides; fibra dietaria

Introduction

Extrusion cooking technology is a versatile and efficient process for converting raw materials into finished food products. Food extruders provide thermo-mechanical energy (shear) needed to cause physico-chemical changes of foods, implying mixing and homogenization (Anton & Luciano, 2007). Extrusion technology plays a very important role in modern industrial production of snacks, especially those produced from corn, wheat, and rice. Snack foods are mainly made from cereals, and are widely available, becoming an important part of the global diet. Among these kind of foods, third-generation (3G) snack foods have become an important part of the American diet (Ernoult, Moraru, & Kokini, 2002). This type of snack, unlike the products directly expanded, is not ready to eat when it is expelled from the extruder, in which case it is referred to as pellet. Pellet facilitates handling because a large amount of the product as pellet occupies a small storage volume (Hollingsworth, 2001). The pellet can be expanded later by various heating methods such as frying, hot-air oven, or microwave heating. This latter method has gained popularity among consumers because it is relatively cheap and easy to prepare at home and, once expanded, the final products have low oil content (Bastos-Cardoso, Zazueta-Morales, Martínez-Bustos, & Kil-Chang, 2007). In the microwave heating, the microwave energy heats the pellet by vibrational energy directed to the moisture contained within. This heating generates the superheated steam that causes the pellets to expand and form a porous structure. Maximum expansion of 3G snacks takes place at 10–12% of moisture content (MC) of the pellets (Boischot, Moraru, & Kokini, 2003). There have been investigations where microwave has been used to expand this type of snacks and some reports about 3G snacks have focused on the effect of processing on different physical and physicochemical characteristics (Gimeno, Moraru, & Kokini, 2004; Lee, Lim, Lim, & Lim, 2000). In extruded snack foods, physical parameters as bulk density (BD), expansion index, and texture have shown to be appropriate quality parameters (Chessari & Sellahewa, 2000; O'Shea, Arendt, & Gallagher, 2013). On the other hand, other studies have focused on the improvement of nutritional or nutraceutical properties of 3G snacks, by incorporating raw materials

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Identification of a yeast strain as a potential stuck wine fermentation restarter: a kinetic characterization

Identificatión de una cepa de levadura con potencial de reiniciar fermentaciones vínicas estancadas: una caracterización cinética

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Restarter yeast strains are used to consume residual sugar (mainly fructose) in stuck wine fermentations. Forty-three yeast strains were evaluated initially. Strain ITD-00068 showed the highest values for the maximum growth rate, maximum fructose consumption rate, and maximum ethanol production rate (0.143, 0.268, and 0.231 h^{-1}, respectively). Therefore, it was selected for further molecular and kinetic analyses. RFLP analysis identified this isolate as *Saccharomyces cerevisiae*. Strain ITD-00068 consumed 100% and 36% of the fructose present (at 20°C and 30°C, respectively), when cultured in medium with 12% (v/v) ethanol. The fructose consumption rate was reduced by 97% at 30°C, when ethanol was initially present in the media. *S. cerevisiae* ITD-00068 was tested in stuck fermentation conditions and was able to complete fermentation in 144 h in a commercial red wine, demonstrating that *S. cerevisiae* ITD-00068 is a potential candidate for use as a restarter in wine stuck fermentation at 20°C.

Keywords: fructose consumption; alcoholic fermentation of agave; mezcal

Las cepas de levadura reiniciadoras se utilizan para consumir los azúcares residuales (principalmente fructosa) en fermentaciones de vino estancadas. La selección de cepas inició a partir de 43 cepas de levadura. La cepa ITD-00068 mostró los valores más altos de las tasas máximas de crecimiento, consumo de fructosa y producción de etanol (0,143, 0,268, and 0,231 h^{-1}, respectivamente). Por lo tanto, fue seleccionada para los posteriores análisis moleculares y cinéticos. Una vez saleccionada, la cepa fue identificada por medio RFLP's como *Saccharomyces cerevisiae*. La cepa ITD-00068 consumió 100% y 36% de la fructosa presente (a 20°C y 30°C, respectivamente) cuando se cultivó en un medio con una concentración inicial de 12% (v/v) de etanol. La tasa de consumo de fructosa se redujo en un 97% a 30°C, cuando el etanol estuvo presente desde el inicio en el medio de cultivo. *S. cerevisiae* ITD-00068 se ensayó en condiciones de fermentación estancada y fue capaz de completar la fermentación en 144 h en un vino tinto comercial, lo que demuestra que *S. cerevisiae* ITD-00068 es un candidato potencial para su uso como un reiniciador en la fermentación estancada a 20°C.

Palabras claves: consumo de fructosa; fermentación alcohólica de agave; mezcal

Introduction

Wine production is a complex process where yeasts (principally *Saccharomyces cerevisiae*) transform sugars present in grape juice into ethanol, CO_2, and other important metabolites associated with organoleptic qualities (Pérez-Coello, Briones-Pérez, Ubeda-Iranzo, & Martin-Alvarez, 1999). One of the most common problems associated with wine production is stuck fermentation that results when yeast stop metabolic activities and sugars present in grape juice are not completely fermented (Bisson, 1999). Unmetabolized sugars result in lower ethanol yields and contamination of the final product with nocive microorganisms. In addition, a sweet flavor is undesirable in dry wines (Berthels, Cordero-Otero, Bauer, Thevelein, & Pretorius, 2004).

Several factors including nutrient deficiencies and the presence of toxic compounds have been identified as causes leading to stuck fermentation and may act synchronously in yeast cells (Alexandre & Charpentier, 1998; Bisson, 1999; Dombek & Ingram, 1986; Ingram & Buttke, 1984; Mauricio, Guijo, & Ortega, 1991; Pampulha & Loureiro-Dias, 1990; Salmon, 1989). Ethanol toxicity is one of the most important causes of this problem (Alexandre & Charpentier, 1998; Bisson, 1999). As fermentation proceeds, ethanol concentrations increase and some yeast strains may be unable to survive under these conditions. At the same time, ethanol results in decreased sugar consumption (Ansanay-Galeote, Blondin, Dequin, & Sablayrolles, 2001). During wine fermentation, wine yeasts co-ferment glucose and fructose (sugars present in grape juice). Yeasts usually prefer glucose instead of fructose (Berthels, Cordero-Otero, Bauer, Pretorius, & Thevelein, 2008; Berthels et al., 2004; Tronchoni, Gamero, Arroyo-López, Barrio, & Querol, 2009), and accumulating fructose concentrations result in the development of stuck fermentation (Bisson & Butzke, 2000). It is known that in *S. cerevisiae* glucose and fructose are transported into the cell by the same proteins (Reifenberger, Freidel, & Ciriacy, 1995;

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Effects of pasteurization on bioactive polysaccharide acemannan and cell wall polymers from *Aloe barbadensis* Miller

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ABSTRACT

Physico-chemical modifications promoted by pasteurization treatments, performed at 65, 75 and 85 °C, for 15 and 25 min, on acemannan, the main bioactive polysaccharide from Aloe vera (*Aloe barbadensis* Miller) parenchyma, and cell wall polymers (CWP) were evaluated. The fresh Aloe samples were characterized by a relatively low content of acemannan (107–139 mg/g dm) probably due to the irrigation system used for its cultivation. Pasteurization seemed to increase the yields in acemannan content. However this effect was probably due to the decrease observed in ethanol-soluble mannose for all treatments. Deacetylation and loss of galactose side-chains might have contributed to the formation of new hydrogen bonds between mannose oligosaccharides and the long chains of acemannan. On the other hand, fresh Aloes exhibited a high content of pectic polysacharides, mainly homogalacturonans, accounting for up to 59% of total CWP. Further, pasteurization also affected the CWP, mainly the pectic moieties, in two different ways. On the one hand, a slight degradation of pectins was observed for samples treated at 65 °C which may be due to enzymatic degradation. On the other hand, the marked decrease in the pectic polymers (mainly homogalacturonans), observed for samples treated at 85 °C, may be due to their thermal degradation. Compositional and structural modifications on the different polysaccharide types were reflected by the significant changes occurring in the related functional properties, such as swelling (Sw), water retention capacity (WRC), and fat adsorption capacity (FAC). Swelling values were "exceptionally" high for fresh Aloe samples (over 200 mL water/g alcohol insoluble residue (AIR)), and pasteurized samples exhibited even higher Sw values. WRC and FAC values were also very high and exhibited similar trends; only samples pasteurized at 85 °C presented a significant decrease in comparison to the values determined for fresh samples.

1. Introduction

Aloe vera is one of the oldest healing plants known to mankind. Many authors have considered Aloe to be a member of the Liliaceae family, although, according to Rodríguez, Darias, and Díaz (2010), it comes from a family of its own called Aloaceae. However, this plant is related to plants such as onion, garlic, and asparagus, which are known to have medicinal properties (Lawless & Allan, 2000). Most of these plants originated in the dry regions of Africa, Asia, and Southern Europe, especially in the Mediterranean regions (Urch, 1999). Due to the numerous beneficial effects attributed to the Aloe plant, its production is an emerging industry for making cosmetics, functional food, and drugs (Eshun & He, 2004), and due to its medicinal properties it is being cultivated in other areas with different climatic conditions. In fact, Mexico is the main producer of Aloe, followed by Latin America, China, Thailand, and the United States (Rodríguez, 2004). There are over 360 known species of Aloe, but *Aloe barbadensis* Miller, also known as Aloe vera Linné or Aloe vulgaris Lamark is the most popular and the most widely cultivated (Rodríguez et al., 2010; Urch, 1999).

Aloe vera gel is the mucilaginous gel obtained from the squeezing of the clear jelly-like substance of the parenchyma tissue. Aloe vera gel has been reported to have multiple beneficial properties for wound healing, including the abilities to penetrate and anesthetize tissue, preclude bacterial, fungal, and viral growth, act as an anti-inflammatory agent and enhance blood flow (Christiaki & Florou-Paneri, 2010). It is now known that the gel representing approximately 70–80% of the weight of the whole leaf, serves as

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Phenolic composition changes of processed common beans: their antioxidant and anti-inflammatory effects in intestinal cancer cells

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ABSTRACT

Four varieties of common beans, Negro 8025 (N), Bayo Victoria (BV), Pinto Durango (PD), and Pinto Saltillo (PS) were evaluated and compared for phenolic composition, antioxidant activity and anti-inflammatory effects by *in vitro* human intestinal cell model. Beans were processed by canning and boiling in open pot. Acetone/Water extracts were analyzed for phenolic composition by HPLC-PAD and HPLC-MS, screened for antioxidant activities, as lipid peroxidation inhibition and chelating capacities by inhibition of deoxi-D-ribose degradation. It was investigated their anticarcinogenic effect by inhibiting cell proliferation, decreasing interleukin-8 (IL-8), modulating interleukin-10 (IL-10), inhibiting tumor necrosis factor alpha (TNFα) and regulating nuclear factor kappa-light-chain-enhancer of activated B cells (NF-κβ). Canning induced antioxidant compounds in order N > PD > BV > PS associated with potential for scavenging hydroxyl radicals and metal chelating capacities. Effect of cooking on bioactive compounds was cultivar dependent, being more quantitative than qualitative due to release of bonded phenolics. Inhibition of cyclooxygenase-2 (COX-2), TNFα and NF-κβ was observed, and the induced expression of IL-10. Both effects were also cultivar and process dependent, particularly in PD beans.

1. Introduction

Legumes have become important in the human diet because of their nutritional properties, low cost and the physiological effects associated with its intake. The major legumes consumed in Latin America are common bean (*Phaseolus vulgaris* L.).

Currently, the consumption of this legume has changed due to different factors such as increasing availability of common bean varieties, regional and cultural changes associated with modern life as the lack of domestic time to cook them at home. The latter has led to the developing of convenience foods by the industry based on the four more preferred common bean varieties: Bayo, Pinto, Black and Peruvian. The most commercially offered presentation of common beans and the most requested by the consumers is the canned form (82.3%), and from these 52% are processed as whole seeds, being black beans the most demanded variety (Rodríguez-Licea, García-Salazar, Rebollar-Rebollar, & Cruz-Contreras, 2010).

Commercial acceptance of industrial products such as common beans depends directly on the adequate thermal processing and determination of the optimal cooking time. A well-designed thermal process, improves the palatability, texture and increased bioavailability of nutrients as a result of gelatinization of the starch, as well as to protein denaturation. Hence the importance of the type of bean processing, since it can significantly determine the effectiveness of its natural biological action, due to the release of bioactive compounds that play an important role in the antioxidant system of the organism (Champ, 2002; Rocha-Guzmán, González-Laredo, Ibarra-Pérez, Nava-Berumen, & Gallegos-Infante, 2007; Wolosiak et al., 2010). The antioxidant activity of polyphenols is the functional property of interest, as has been the target of numerous studies. Their chemical structure encloses in key positions a variable number of reactive hydroxyl groups, which allow the antioxidant to react and stabilize free radicals. Consequently, it is extremely important to determine the amount of polyphenols in legume species. The number of natural polyphenols has been estimated at almost half a million, and many of them occur as glycosides and polymers. However, the polyphenols bioactivity is attributed to aglycone fragments of its metabolites and not to sugars (Sakakibara, Honda, Nakagawa, Ashida, & Kanazawa, 2003).

Although there is a major emphasis on the antioxidant properties of phenolics, there are evidences (Williams, Spencer, & Rice-Evans, 2004) that flavonoids, as precursors and their *in vivo* metabolism products,

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Morphological and release characterization of nanoparticles formulated with poly (DL-lactide-co-glycolide) (PLGA) and lupeol: *In vitro* permeability and modulator effect on NF-κB in Caco-2 cell system stimulated with TNF-α

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ABSTRACT

Lupeol exhibits anti-inflammatory effects; unfortunately it shows low water solubility. An alternative to overcome this is the development of nanomaterials. Several methods for nanomaterial production are available. One of them is emulsification/solvent-evaporation. The objective of the present work was to evaluate physical properties, transport and *in vitro* modulator effects on NF-κB of poly (lactide-co-glycolide) (PLGA) nanoparticles loaded with lupeol. Nanonutraceuticals were prepared with 16% (w/v) of lupeol. Size distribution and morphology were measured by particle size analyzer and TEM. In vitro release of lupeol was studied by three different models: Higuchi, Siepmann & Peppas, and Power law. Transport of nanonutraceutical was studied in a Caco-2 cell model and by GC–MS. Modulator effect on NK-κB was studied by western blot analysis. Nanonutraceuticals were 10% larger than the nanoparticles without lupeol (372 vs 337 nm) and presented a broader size distribution (0.28 vs 0.22). TEM results displayed spherical structures with a broader size distribution. Entrapment efficiency of lupeol was 64.54% and it *in vitro* release data fitted well to the Power law and Higuchi equation ($R > 0.84–0.84$). Strong regulation of NF-κB of nanonutraceutical was observed. It was not observed any transport across the Caco-2 cell model at the different experimental conditions.

1. Introduction

Several natural compounds show biological effects, as the pentacyclic triterpenes. They are based on a 30-carbon skeleton comprising 5 six-membered rings (ursanes and lanostanes) or 4 six-membered rings and 1 five-membered ring (lupanes and hopanes) (Wal et al., 2011). They can be found in the balsam, and plant resins (Muffler et al., 2011); and usually in the diet, where a consumption of 250 mg per day is estimated for this compound (Saleem, 2009). One of them is lupeol, a lupane-type pentacyclic triterpene present in diverse plants such as Japanese pear, aloe leaf, mango pulp extract, ginseng oil, etc. (Siddique and Saleem, 2011).

Regarding to its anti-inflammatory effect, lupeol has shown inhibitory activities on pro-inflammatory cytokines such as IL-2, IFN-γ and TNF-α (Bani et al., 2006; Ahmad et al., 2010), IL-4, IL-5, eosinophils reduction (Vasconcelos et al., 2008) and effect against pro-inflammatory enzymes like iNOS and COX-2 (Saleem et al., 2004; Sánchez-Burgos et al., 2013).

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The Effect of Glandless Cottonseed Meal Content and Process Parameters on the Functional Properties of Snacks during Extrusion Cooking

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ABSTRACT

The results of the present study indicate that glandless cottonseed meal (CSM) can be incorporated in extruded corn flour snacks at a 10% content level, which increases snack protein content to 12.8% and reduce fat content to 6.2%. To improve snacks' nutritional quality, CSM and corn flour were extruded using a simple screw extruder. An expansion index (EI) ranging of 1.2 - 4.7 was obtained. Penetration force (PF) was 7 - 9 times harder than other extruded products. High extrusion temperature and high CSM concentrations decreased ($p < 0.05$) EI, water activity, and water absorption index. Higher CSM concentrations can be incorporated into extrudates if snacks are processed at higher extrusion moistures. CSM increased ($p < 0.05$) extrudates' PF giving them a unique crunchy texture. CSM decreased ($p < 0.05$) extrudates' water solubility index. Extrusion conditions used showed a 68.5% starch gelatinization, and a starch availability of more than 97%, which explains the high expansion index obtained.

Keywords: Cottonseed Meal; Extruded Snack; Functional Properties

1. Introduction

It is generally accepted today that, in order to adequately feed the world's rapidly expanding population, increasing amounts of plant proteins should be directly used in human diets. A feasible option is to use protein obtained from the cotton plant. Cotton should rank high among crop production priorities since it provides fiber, a renewable resource for garment manufacturing, as well as edible oil and protein for human consumption and animal feed [1]. However, it contains gossypol, a natural phenollic aldehyde that permeates cells and acts as an inhibitor for several dehydrogenase enzymes [2], it can cause negative effects on growth and reproductive performance, and it can also result in intestinal and internal organ abnormalities [3-5]. Glandless cottonseed flour could potentially be used as raw material for the production of texturized protein products. This is achieved by genetically eliminating the toxic compound gossypol from the cottonseed [6]. Cottonseed meal (CSM) is obtained by grinding the flakes once most of the cottonseed oil has been removed.

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Hominy is obtained through a process called nixtamalization, which is a traditional alkali treatment in which corn is precooked with $Ca(OH)_2$, conditioned for 6 - 18 h, and ground to produce corn flour (Gomez *et al.*, 1991). Tortilla and other corn products are made from corn flour [7-10]. During nixtamalization, partial starch gelatinization and retrogradation take place, while starch birefringence decreases [8-12]. Nixtamalization increases Lys/Iso ratio, Ca content, and protein digestibility and decreases aflatoxin contamination [13-17].

Extrusion is inexpensive, productive and requires low levels of energy [18]. Snacks can be extruded products [17]. Because starch gelatinization provides texture and structure to the end-product [19,20], it is possible to produce extrudates from pure starch or high starch content cereals. Because of cottonseed meal's relatively high protein and fat content and its low starch content, extrusion of cottonseed meal is complicated. Other results show that high protein legumes can be extruded, obtaining an expansion index ranging between 1.5 and 2 at 18% of moisture [21]. Expansion, in general, increases with higher extrusion moisture, pressure and temperature [22].

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Long-term stability of food-grade nanoemulsions from high methoxyl pectin containing essential oils

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ABSTRACT

Nanoemulsions have shown potential advantages over conventional emulsions due to their large active surface area, but are also susceptible to destabilization. Therefore, the purpose of this work was to assess the long-term stability (56 days) of nanoemulsions containing EOs (oregano, thyme, lemongrass or mandarin) stabilized by high methoxyl pectin and a non-ionic surfactant (Tween 80). The initial droplet size of nanoemulsion was below 50 nm regardless the EO type, which was confirmed by Transmission Electron Microscopy (TEM). Lemongrass and mandarin nanoemulsions remained optically transparent over time (56 days) and their droplet sizes were in the nano-range (between 11 and 18 nm), whereas the droplet size of oregano and thyme nanoemulsions increased up to 1000 nm probably due to Ostwald ripening. This fact induced creaming and a higher whiteness index in the latter nanoemulsions. The electrical charge (æ-potential) of nanoemulsions was negative due to the anionic nature of pectin molecule adsorbed at the oil-water interface, ranging between −6 and −15 mV depending on the EO type. However, lemongrass and mandarin nanoemulsions exhibited a more negative æ-potential than thyme or oregano EO indicating a stronger adsorption of pectin at the oil surface, and therefore a higher stability. The viscosity of nanoemulsions remained practically constant between 20 and 24 mPa s, during storage for all EOs. This work represents the starting point for future applications of nanoemulsions containing EOs to be incorporated in food products due to their high long-term stability.

1. Introduction

Essential oils (EOs) are natural compounds found in aromatic plants and herbs as secondary metabolites that present antioxidant and antimicrobial activity and also have been widely used as functional ingredients in food as flavorings (Burt, 2004). However their incorporation in food products presents several limitations due to their low solubility and intense aroma at high concentrations (Sánchez-González, Vargas, González-Martínez, Chiralt, & Cháfer, 2011). The emulsification of EO is currently used for their dispersion into food products but their functionality and long-term stability largely depends on the oil droplet size and distribution (Tadros, Izquierdo, Esquena, & Solans, 2004). In this sense, nanoemulsions can be used as carriers of lipophilic bioactive compounds for their incorporation in food products. Nanoemulsions consist of at least one immiscible liquid dispersed in another with a surfactant (nonionic or polymeric) in the form of small droplets, with an average droplet size between 20 and 200 nm (Burguera & Burguera, 2012; Solans, Izquierdo, Nolla, Azemar, & Garcia-Celma, 2005; Wulff-Pérez, Torcello-Gómez, Gálvez-Ruíz, & Martín-Rodríguez, 2009). Nanoemulsions exhibit several advantages over conventional emulsions (Qian & McClements, 2011; Tadros, Izquierdo, Esquena, & Solans, 2004). First, they are optically transparent so they might be good candidates to be incorporated in clear drinks or beverages (Qian & McClements, 2011). Second, nanoemulsions are kinetically stable colloidal systems (Solans et al., 2005). Third, they present a high active surface area thus having a potentially higher functionality (Qian & McClements, 2011). There are several methods to form nanoemulsions, but high-energy methods are the most commonly used. They require specialized mechanical devices such as high-pressure homogenizers and ultrasounds capable of generating intense mechanical disruptive forces inducing the breakup of the oil droplets (Mason, Wilking, Meleson, Chang, &

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Effect of pre-treatment on physicochemical and structural properties, and the bioaccessibility of β-carotene in sweet potato flour

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ABSTRACT

The aim of this research was to evaluate the effect of microwave or steam pre-treatment of raw sweet potato on physicochemical and microstructural properties, and the bioaccessibility of β-carotene in sweet potato flour. This is the first report on using the *in vitro* digestion model suitable for food, as proposed in a consensus paper, to assess the bioaccessibility of β-carotene in sweet potato flour. The pre-treatments produced a rearrangement of the flour matrix (starch, protein and non-starch polysaccharides), which was greater by using microwaves (M6) conducting to a greater increase in the phase transition temperatures up to 4.14 °C, while the enthalpy presented the higher reduction (4.49 J/g), both parameters in respect to the control. The resistant starch fraction was not modified, with about 3% in all samples. Microwave (M6) and all the steam pre-treatments showed the higher bioaccessibility of β-carotene. This flour can be used in the development of new products with high β-carotene content.

1. Introduction

The sweet potato (*Ipomoea batatas* L.) is a root with positive attributes such as geographical variety in terms of production, adaptability to marginal conditions, a short production cycle, a high nutritional content and sensorial versatility in terms of flesh color, taste and texture. It is the sixth most important world crop, after rice, wheat, potato, corn and cassava (Faostat, 2013). While the Mexican climate is suited to its cultivation, the limited production options for the sweet potato and the lack of awareness of its nutritional properties have contributed to lags in production and industrialization. Depending on flesh color, the sweet potato is rich in β-carotene, anthocyanins, phenolic compounds, dietary fiber, ascorbic acid, folic acid and minerals (Grabowski, Truong, & Daubert, 2008; Woolfe, 1992). Numerous benefits, such as antioxidant, cardioprotective and anti-diabetic effects, have been attributed to sweet potato consumption, with the orange-fleshed sweet potato recognized for its pro-vitamin A activity, which contributes to preventing deficiencies of this vitamin (van Jaarsveld et al., 2005).

While sweet potato is generally consumed cooked, the dried form of the root is also used in the production of flour, which is used in the manufacture of bread and breakfast cereal products, as well as baby foods and alcoholic drinks (Grabowski, Truong, & Daubert, 2007; Teramoto, Hano, & Ueda, 1998; Truong & Avula, 2010; Wireko-Manu, Ellis, & Oduro, 2010). There is no standardized procedure for the production of sweet potato flour, but in some regions a blanching process is used before drying and then milling. Different dehydration methods have also been used, such as solar, rotary drum, tray and spray drying (Grabowski et al., 2007; Truong & Avula, 2010). On laboratory or commercial scales, sweet potatoes are treated with a sodium metabisulfite solution to inhibit enzymatic darkening (Aprianita, Purwandari, Watson, & Vasiljevic, 2009; Sablani & Mujumdar, 2007). The extraction of compounds using microwave radiation improves the yield, such as anthocyanins in the purple-fleshed sweet potato (Lu et al., 2010), and the retention of vitamins, such as thiamin and riboflavin in the orange-fleshed sweet potato (Dawkins & Lu, 1991). Furthermore, the use of microwave blanching on products such as rosemary (*Rosmarinus officinalis* L.) and marjoram (*Marjona hortensis* Moench.) has led to improved results in terms of color, ascorbic acid and chlorophyll retention compared to steam and water immersion pre-treatments (Singh, Raghavan, & Abraham, 1996). Although there is a large market for foodstuffs prepared with

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Oak kombucha protects against oxidative stress and inflammatory processes

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ABSTRACT

Black tea infusion is the common substrate for preparing kombucha; however other sources such as oak leaves infusions can be used for the same purpose. Almost any white oak species have been used for medicinal applications by some ethnic groups in Mexico and could be also suitable for preparing kombucha analogues from oak (KAO). The objective of this research was to investigate the antioxidant activity and anti-inflammatory effects of KAO by examining its modulation ability on macrophage-derived TNF-alpha and IL-6. Herbal infusions from oak and black tea were fermented by kombucha consortium during seven days at 28 °C. Chemical composition was determined by LC-ESI-MS/MS. The antioxidant activity of samples against oxidative damage caused by H_2O_2 in monocytes activated (macrophages) was explored. Additionally, it was determined the anti-inflammatory activity using lipopolysaccharide (LPS) - stimulated macrophages; in particular, the nitric oxide (NO), TNF-alpha, and IL-6 production was assessed. Levels of pro-inflammatory cytokines IL-6 and TNF-alpha were significantly reduced by the sample treatment. Likewise, NO production was lower in treatment with kombucha and KAO compared with LPS-stimulated macrophages. Fermented beverages of oak effectively down-regulated the production of NO, while pro-inflammatory cytokines (TNF-alpha and IL-6) in macrophages were stimulated with LPS. Additionally, phytochemical compounds present in KAO decrease oxidative stress.

1. Introduction

Some fermented foods have transcended their sources to become everyday products in more than one continent; fermentations involved in these foods are of enormous complexity, and their study has provided us a wealth of biotechnology knowledge. An attractive bioprocess consists on the degradation of glucose and fructose through the fermentation action of a bacterial and yeast consortium called Kombucha [6]. This Kombucha is a fermented beverage that has been traditionally consumed in China for over 2200 years. This ancient beverage is composed of two portions: a floating biofilm of cellulose and the sour liquid broth [4]. Several positive effects have been reported, including gastro protective effect of the culture broth and probiotic potential of the Kombucha microbiome [1,13]. In particular, in the culture broth the main metabolites identified are gluconic and glucuronic acids, glycerol, phenolic acids and caffeine; some are associated with beneficial effects on health. The two main classes of involved polyphenols are flavonoids and phenolic acids. Their chemical and structural modifications are due to biotransformation and metabolism by the kombucha consortium action, and have not been taken into account in previous studies of kombucha analogues obtained from other sources. The biotransformation of flavonoids has been a topic of research due to the interest in explaining the correlation between the beneficial properties of flavonoids and the structures of the active compounds. In Kombucha obtained from black tea, the

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Stabilization of dimeric β-glucosidase from *Aspergillus niger* via glutaraldehyde immobilization under different conditions

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ABSTRACT

The dimeric enzyme β-glucosidase from *Aspergillus niger* has been immobilized on different amino-agarose beads at pH 5 and 7, exploiting the versatility of glutaraldehyde. The stability of the free enzyme depended on enzyme concentration. Immobilization via ion exchange improved enzyme stability/activity, depending on the immobilization pH. However, the enzyme was desorbed in 75 mM NaCl at pH 7 and some stability/enzyme concentration dependence still existed.

Treatment: of these biocatalysts with glutaraldehyde increased enzyme stability (e.g. at pH 5, after incubation under conditions where the enzyme just ionically exchanged was fully inactivated, the activity of the glutaraldehyde treated enzyme remained unaltered). Immobilization on glutaraldehyde pre-activated supports yielded a higher increase in enzyme activity, but the stabilization was lower. While when measuring the enzyme activity at pH 4 there were no changes after immobilization, all immobilized enzymes were more active than the free enzyme at pH 6 and 7 (2–3 times). The Ki/Km ratio did not significantly decrease in any immobilized biocatalysts, and in some cases it worsened in a significant way (by a 9 fold factor using preactivated supports). The new biocatalysts are significantly more stable and avoid enzyme subunit desorption, being the immobilization pH a key point in their design.

1. Introduction

The demand for renewable energy sources has moved from biodiesel to bioethanol produced from lignocellulosic materials, the most abundant polymers in nature [1–4]. Lignocellulosic biomass is one of most promising renewable feedstocks for ethanol production, which is a suitable fuel, due to its high octane number, vaporization heat, and compatibility with motor vehicles [5]. The first step in the production of bioethanol is the hydrolysis of cellulose to get glucose. In this regard, the use of enzymes presents some advantages, like the prevention of side-reactions produced using acid catalysis that can hinder the fermentation process [1–4,6].

The enzymatic hydrolysis of cellulose is accomplished from the synergistic action of endoglucanases, exoglucanases I and II and β-glucosidases These enzymes are found commonly in fungal species (*Penicillium verruculosum, Trichoderma reesei, Aspergillus niger, Sporotrichum thermophile*) [7]. The first enzymatic hydrolytic steps are performed by endoglucanase and exoglucanase activities, and they produce elevated concentrations of cellobiose (a reducing sugar that is formed by two β glucose molecules linked by a β (1 → 4) bond), which is the substrate of β-glucosidase [8,9]. β-glucosidases may be applied in other processes such as fine chemicals and medicines production [10]. Thus, they are also used to produce the release of some glycosylated substances (like flavors or terpenes in wine and other products [11–18]) or the production of some glycosylic bonds [19–21]. The importance of β-glucosidases in industrial and environmental processes has been summarized in different reviews and investigations [22–24].

Thus, biocatalysis is a good option to transform cellulose into glucose, but some problems, such as the price and moderate enzyme stability under operational conditions are hindering their industrial implementation [25,26]. One solution to both problems may be enzyme immobilization. If the immobilized enzyme is stable enough, it may be reused, and that will decrease the final price of the biocatalyst [27–30]. A proper immobilization may improve enzyme stability via multipoint

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