



Passion fruit peel flour – Technological properties and application in food products



Emanuela Monteiro Coelho ^{a, b}, Raquel Guttierrez Gomes ^c, Bruna A. Souza Machado ^d, Roseane Santos Oliveira ^d, Marcos dos Santos Lima ^a, Luciana Cavalcanti de Azêvedo ^{a, *}, Marcelo A. Umsza Guez ^b

^a Department of Food Technology, Federal Institute of Sertão Pernambucano, BR 407 Km 08 Jardim São Paulo, 56314-520, Petrolina, Pernambuco, Brazil

^b Department of Science in Food, Federal University of Bahia, Av Ademar de Barros, s/n, Campus Ondina, 40170-115, Salvador, Bahia, Brazil

^c State University of Maringa, Av Colombo, 5790, Cidade Universitaria, 97020-900, Maringa, Parana, Brazil

^d Food Technology, Senai CIMATEC, Av. Orlando Gomes, 1845, Piatã, 41650-010, Salvador, Bahia, Brazil

ARTICLE INFO

Article history:

Received 19 April 2016

Received in revised form

1 July 2016

Accepted 24 July 2016

Available online 25 July 2016

Keywords:

Thickener

Stabilizer

Gelling agent

Emulsifier

Passiflora edulis

Chemical compounds:

Carrageenan (PubChem CID 6850766)

Xanthan gum (PubChem CID 7107)

Pectins (PubChem CID 441476)

ABSTRACT

The peel of passion fruit is rich in fiber which has properties comparable to food additives. Thus, in this study, the technological properties of flour obtained from yellow passion fruit peel were determined and compared to those of five commercial additives. Two flour samples were prepared from passion fruit shells through a modified process in order to evaluate their potential use as a stabilizing agent, emulsifier, thickener and gelling agent. These characteristics were then compared to those of low and high methoxyl pectins, xanthan gum, guar gum and carrageenan. The flour samples obtained have significant stabilizing capacity, as they were able to hinder particle settling when applied to nectars. Another positive feature observed was the emulsifying potential, showing similar results to additives commonly used in mayonnaise, such as xanthan and guar gums. The flour samples also showed good properties as a thickening and gelling agent in ice cream toppings and structured fruit. The results demonstrate that flour produced from passion fruit peel can be used to replace the commercial hydrocolloids studied since, besides being obtained through simple procedures and associated with low cost, the flour samples showed similar technical characteristics with regard to their stabilizing, emulsifying, thickening and gelling power.

© 2016 Elsevier Ltd. All rights reserved.

1. Introduction

The passion fruit vine belongs to the family Passifloraceae and genus *Passiflora*. It is a native plant of tropical America and is cultivated in regions with a tropical or subtropical climate (Kishore, Pathak, Shuklar, & Bhar, 2011).

Passion fruit industrialization is generally aimed at juice and nectar production. In this process, 54,000 tons of by-products, such as seeds and peel, are generated per year in Brazil. Albedo (or pith), the main peel component, is rich in fiber and pectin, and can be used as an ingredient in the preparation of functional foods. Furthermore, it can be added to products that require an increase in viscosity (López-Vargas, Fernández-López, Pérez-Álvarez, & Viuda-Martos, 2013).

Fiber has some properties comparable to food additives which act as thickening or gelling agents and stabilizers of emulsions and foams. In addition, it is a fat mimetic. Moreover, it has swelling capacity and can increase water retention, properties which are essential for the preparation of creams, sweets and frozen desserts, among other food products (Ayala-Zavala et al., 2011; <http://www.sciencedirect.com/science/article/pii/S0963996913000823> Martinez et al., 2012). Elleuch et al. (2011) reported that, in addition to the previously mentioned characteristics, fiber can modify the textural properties, prevent syneresis and improve the shelf-life of foods such as sweets, soups and dairy and bakery products.

The main reason for the widespread use of hydrocolloids in foods is their ability to alter the viscosity and texture of the products (Marcotte, Hoshahili, & Ramaswamy, 2001; Saha & Bhattacharya, 2010). Hydrocolloids, such as xanthan gum, carrageenan, guar gum and pectin, are generally used in foods due to

* Corresponding author.

E-mail address: luciana.cavalcanti@ifsertao-pe.edu.br (L.C. de Azêvedo).

their thickening, stabilizing, gelling and emulsifying properties, among others (Codex Alimentarius, 2015).

The literature reports several studies on passion fruit peel flour carried out to investigate, for instance, pectin extraction (Kliemann et al., 2009; Pinheiro et al., 2008; Seixas et al., 2014; Yapo & Koffi, 2006; Yapo, 2009), addition to functional beverages (Pineli et al., 2015) and the preparation of flexible films for food products (Nascimento, Calado, & Carvalho, 2012). However, the application of raw flour as a hydrocolloid agent is still little explored.

In this context, the aim of this study was to prepare food products using commercial additives and passion fruit peel flours, in order to evaluate the technological properties of the flour samples with regard to their thickening, stabilizing, emulsifying and gelling power.

2. Material and methods

2.1. Raw material

Passion fruit peel was used to prepare two flour samples. The first was obtained by maceration in water for 12 h, applying an adapted version of the methodology described by Oliveira, Nascimento, Borges, Ribeiro, and Ruback (2002), and is referred to herein as treated flour (TF). The second sample, not subjected to maceration, is referred to as untreated flour (UF).

In order to obtain the flour samples, the peel was cut into strips of approximately 1 cm. These were then dried in a dryer with forced air circulation at 50 °C until reaching constant weight (model Meloni - PE 30, Brazil). The dried strips were grinded in an industrial blender and sieved until flour samples with particles smaller than 150 µm were obtained.

2.2. Rheological analysis of hydrocolloids

The rheological parameters of the hydrocolloids under study (carrageenan – CAR (INS 407), guar gum – GUA (INS 412), xanthan gum – XAN (INS 415) (Sigma-Aldrich, USA) and low (LMP) and high (HMP) methoxyl pectins (INS 440) (CPKelco, USA)) and the passion fruit peel flours (UF and TF) were obtained in triplicate, at 25 °C, using a cone and plate rheometer (Thermo Scientific, model MARS III). An increase in the shear stress was obtained by increasing the rotation, through continuous variation of the cone angular velocity. Shear gradients from 0 to 700 s⁻¹ were applied for 30 s, with a C60 cone-plate and 0.5 ml of sample. Thus, ascending and descending curves were obtained. The strain rate was determined using a computer program (RheoWin Data Manager, by Thermo) employing Eqs. (1) and (2):

$$\gamma = \omega / \sin \theta \quad (1)$$

$$\tau = \frac{T}{\frac{2}{3} \pi r^3} \quad (2)$$

where γ = shear rate (1/s), T = shear stress (Pa), ω = angular speed of the cone (rpm) and θ = cone angle.

The rheological behavior was determined using the power law rheological model ($K = \tau \gamma^n$) with the aid of Origin software (version 6.0).

2.3. Product preparation, technological assessment and instrumental analysis

In order to determine the technological properties of the two flours (UF and TF), four different products were developed (nectar, structured fruit, passion fruit ice cream syrup and mayonnaise). Eight formulations were produced for each product with different types of additives and they were analyzed in triplicate. Five formulations contained commercial additives (hydrocolloids), that is, carrageenan (CAR), guar gum (GUA), xanthan gum (XAN) and low (LMP) and high (HMP) methoxyl pectins. The sixth formulation contained UF, the seventh contained TF and the eighth formulation was the control, without hydrocolloid addition, referred to herein as CTL.

2.3.1. Flour stabilizing power when added to passion fruit nectars

The passion fruit nectar was prepared with a concentration of 20% pulp and 80% distilled water. The addition of other ingredients was calculated on a 100% basis, with 11% soluble solids (°Brix) and 0.1% of each additive, according to the standard methods established for nectar (Brazil, 2003, 2013).

The stabilizing power of the additives was assessed applying an adapted version of the methodology described by Babbar, Aggarwal, and Oberoi (2015), by calculating the percentage of suspension (cloud) in the nectar. The cloud volume was measured every 30 min for the first 8 h and then every hour until stabilization. Samples were kept under refrigeration for seven days. Calculations were performed using Eq. (3):

$$\%Suspension = \left[\frac{(H_{jb} - H_c) \times 100}{H_{jb}} \right] \quad (3)$$

where H_{jb} = height of juice in the bottle and H_c = height of cloud.

2.3.2. Emulsifying power of flours added to mayonnaise and color analysis

Mayonnaise was prepared using oil, eggs and salt, plus 0.05% citric acid and 0.1% of each additive, according to standard methods established in Brazilian regulations (Brazil, 2007). The emulsifying power of each formulation was evaluated considering the texture profile, using a CT3 10K texturometer (Brookfield, USA) with a TA15/1000 tapered tip. Analysis was conducted at room temperature with 10 g samples, which were placed in porcelain capsules and analyzed in triplicate. For the evaluation, a TPA-type parameter was determined applying a load of 4 g, velocity of 2 mm/s and target value of 4.0 mm. The parameters determined were hardness, adhesion strength, adhesiveness, cohesiveness and gumminess.

Color analysis was also conducted using a MiniScan EZ digital colorimeter (Hunterlab, USA) and CIE Lab L*, a* and b* system, where L* denotes lightness and ranges from 0 (black) to 100 (white), and a* and b* denote opposite dimensions, ranging from green (–) to red (+) and from blue (–) to yellow (+), respectively.

2.3.3. Thickening power and water activity assessment of flours added to passion fruit syrup

Passion fruit syrup for ice cream topping was prepared with 10% pulp and 90% water (100% mixture) and 30% sugar, 0.05% citric acid and 0.1% of additives under study were added to the syrup. The mixture was concentrated at a temperature of 180 °C, until reaching 60° Brix.

The thickening power was determined by viscosity analysis in a Ford viscosity cup (Omicron, Brazil) with a No. 4 orifice at 20 °C. Viscosity analysis involves determining the time the sample takes to drain. Calculations were performed through an equation provided by the manufacturer (equation Eq. (4)), using the Centistoke

¹ Departamento de Pós-graduação em Ciências em Alimentos, Universidade Federal da Bahia, Av. Ademar de Barros, s/n, Campus Ondina, CEP: 40170-115, Salvador, Bahia, Brazil.

Download English Version:

<https://daneshyari.com/en/article/604010>

Download Persian Version:

<https://daneshyari.com/article/604010>

[Daneshyari.com](https://daneshyari.com)