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Formulation and evaluation of a pineapple and strawberry pasteurized pulp mix

Formulación y evaluación de una pulpa mix de piña y frutilla pasteurizada

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ABSTRACT

Research purpose was to formulate and evaluate a pulp from pineapple and strawberry, which were selected due to high consumption in the province of Chimborazo, since they provide pleasant organoleptic characteristics to the final consumer. Pulp properties were moisture content between 83% to 88%, moreover pH content of 4.65, Vitamin C content of 0.03 and Iron content of 33.32, we have found. In relation to the microbiological analysis we obtained absence of total coliforms, absence of fecal coliforms, Molds and yeasts 70, an antioxidant activity was determined and total polyphenols of (10-58 mg/ 100 g). Mixture Fruits were subjected to experimental design with two-factorial experiment where Treatment 3 with 60% pineapple and 30% strawberry is the one that had the best response. The product stands out for its antioxidant capacity and maintains a close relationship with the photochemical components, specifically the phenolic compounds.

Keywords: Pulp; antioxidant activity; polyphenols; pulps; photochemical.

RESUMEN

El propósito de la investigación fue formular y evaluar una pulpa generada a partir de piña y fresa, frutas que se seleccionaron debido al alto consumo en la provincia de Chimborazo, ya que proporcionan características organolépticas agradables al consumidor final. El contenido de humedad estuvo entre 83% y 88%, además, se encontró un contenido de pH de 4,65, un contenido de vitamina C de 0,03 y un contenido de hierro de 33,32. En relación con el análisis microbiológico, obtuvimos ausencia de coliformes totales, ausencia de coliformes fecales, mohos y levaduras 70, se determinó una actividad antioxidante y polifenoles totales de (10-58 mg/ 100 g). Utilizamos la piña y la fresa para la investigación, frutas que fueron sometidas a procesos experimentales. En la investigación se aplicó un diseño de dos factores entre los factores fruta y porcentaje de mezcla, donde el Tratamiento 3 con 60% de piña y 30% de fresa fue el que tuvo la mejor respuesta. El producto destaca por su capacidad antioxidante y mantiene una estrecha relación con los componentes fotoquímicos, específicamente los compuestos fenólicos.

Palabras clave: Pulpa; actividad antioxidante; polifenoles; pulpas; fotoquímico.

1. Introduction

In Ecuador, the pulp-making industry gained importance in the last ten years in the hands of new entrepreneurs who visualized the possibility of producing semi-industrial pulp from the most common and desired fruits in the country. Entrepreneurs thought about to improve quality of life, focusing on people health from a nutritional point of view (FAO, 2011; CEPAL *et al.*, 2015). One industries were created under the taking advantage premise of the region tropical fruits availability, in order to add value through its industrial transformation.

The possibilities of promoting the tropical and exotic fruits used and its consumption will depend to an extent of knowledge available on how the industrialization processes affect their main chemical, physical, nutritional and functional characteristics, in order, to get a guide for the industrial processes where the fruits will be subjected (FAO, 2010; Glas et al., 2015).

At present, the genetic potential and the production optimal conditions are not sufficient to maintain a prosper in commercial relationships, since they must be competitive in a global context (markets opening and countries integration). Being one of the reasons for the industrial development increase in Ecuador, which parallels changes in consumption habits and the advancement of science and technology (Viteri, 1999). Fruits are important vitamins, organic acids,

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fibers and essential minerals sources for bones and teeth development. The current market trend demands natural products with a greater shelf life; where frozen storage is an appropriate alternative to increase the shelf life (Reyes-Carmona *et al*., 2006). The soft drinks consumption tendency in Ecuadorian is oriented to the natural juices consumption. That is reason, our research is generated, formulating a pineapple and strawberry mixed pulp based on combinations of different percentages, which will then be subjected to an organoleptic analysis by a group of tasters that will determine the best treatment. Furthermore, pulp will be subjected to the physical-chemical and microbiological analyzes, and the results obtained compared with the NTE INEN 2337 (Decker, 1997). This product, which stands out for providing the consumer with energy, ensures the content quality due to transparency in the stock market. The consumed sometimes buy a fresh fruit, which is apparently good (due to its external presentation), but sometimes discovers problems in the pulp such as unpleasant colors, flavors and smells, very green or stunned pulp, parasites, etc. (Vit and González, 2004). That is reason why, the customer will be sure of those who buy with a packed pulp. The antioxidant capacity of a mixture is not given only by the antioxidant capacities sum of each components; it also depends on the micro-environment, where the compound is found. When the compounds interact with each other synergistic or inhibitory effects can occur (Sánchez-Moreno, 2002).

On the other hand, it is necessary to consider tests some drawbacks, such as adaptability in response to increased oxidative stress (Singleton *et al.*, 1999). Research purpose was to formulate and evaluate a pulp generated from pineapple and strawberry, which were selected for their high consumption in the province of Chimborazo, since they provide pleasant organoleptic characteristics to the final consumer (Satué-Gracia *et al.*, 1997).

2. Material and methods

The research was carried out in the food processing laboratories of the Eloy Alfaro Technological Institute, located at kilometer in 25, Riobamba-Guaranda way and the microbiological, chemical and physical analysis were carried out in the SAQMIC Food Laboratory.

The raw materials were acquired in the Producers Market of the city of Riobamba, Province of Chimborazo. The experimental design is illustrated in Table 1.

The sensory analysis is based on the parameters described in Table 2.

Table 1. Experimental design

Product	Treatment 1	Treatment 2	Treatment 3
Pineapple	80%	70%	60%
Strawberry	20%	30%	40%

Table 2. Sensory analysis Parameters

Treatment	Parameter
Colour	Like very much Like little Neither like nor dislike Dislike little Dislike a lot
Taste	Like very much Like little Neither like nor dislike Dislike little Dislike a lot
Odor	Like very much Like little Neither like nor dislike Dislike little Dislike a lot
Viscosity	Like very much Like little Neither like nor dislike Dislike little Dislike a lot
Acceptability	Like very much Like little Neither like nor dislike Dislike little Dislike a lot

The numerical values, according to their relative importance and pulp quality: color, smell, taste, viscosity and durability. They are based on a descriptive analysis used to control the quality in the industry, for which analytical judges are required duly selected and trained, which measure the sensory attributes intensity that make up the food.

The graphic details the basic steps that were carried out to obtain the pulp. Dimensioning these resources properly is one of the main problems to consider when starting a process and should be reviewed periodically.

Microbiological analysis

It was elaborated by SAQMIC (Chemical and Microbiological Analytical Services), based on the INEN N°: 2337-2008 standard for Juices, Pulps, Concentrates, Nectars, Fruit and Vegetable Drinks.

Physical analysis

It was elaborated by SAQMIC (Chemical and Microbiological Analytical Services).

The process is determined in the diagram presented in Figure 1.

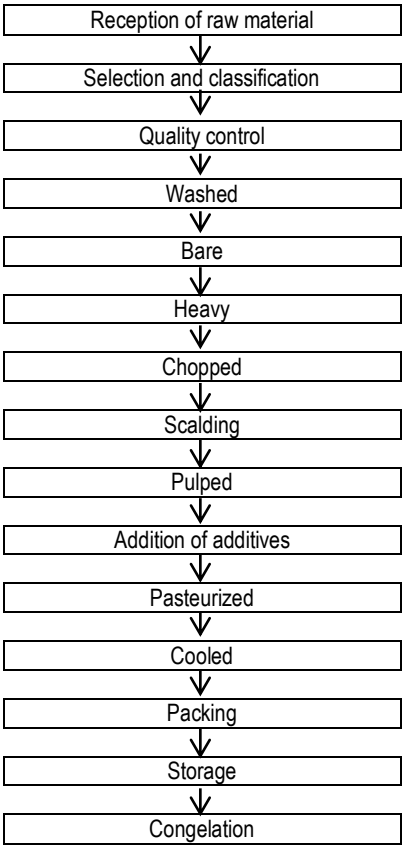

Figure 1. Blocks diagram in the process.

Chemical analysis

It was elaborated by SAQMIC (Chemical and Microbiological Analytical Services).

Total Phenols Determination

For the implementation of the Folin and Ciocalteu, (1927), a calibration curve was previously constructed by making successive dilutions from a concentrated solution of 1000 mg.L^{-1} of gallic acid. From this solution, 10 ml of each of the diluted solutions of increasing concentrations of gallic acid between 5 and 25 mg.L^{-1} were prepared. For this determination, 40 µl of the sample was taken in a 10 ml volumetric flask and add 500 µl of Folin and Ciocalteu (1827). It was resting with protected from light for 10 minutes. Once this time has ended, 500 µl of 10% sodium carbonate solution is added. It is homogenized and placed in darkness for 2 hours, to finish was measurement of observance at 765 nm against the reagent blank.

Determination of Antioxidant Activity

FRAP Method (Ferric ion reducing antioxidant Power): The reduction of 2,4,6-Tripiridyltriazine Ferric (TPTZ) to a product colored by the activity of antioxidant compounds is measured (Halvorsen *et al.*, 2002). A calibration curve was constructed by making successive dilutions from a concentrated solution of 1000 mg.L^{-1} of gallic acid. From this solution, 10 ml of the diluted solutions were used, increasing the gallic acid concentrations between 5 and 25 mg.L^{-1}. For this determination, 80 µl of sample was taken in a 10 ml volumetric flask and 5 ml of FRAP solution was added, and distilled water was added to the mixture. It is allowed to stand, in an oven at 37 °C, for 30 minutes and the absorbance is read at a wavelength of 593 nm against white. For this determination, in a 10 mL flask, where, 80 µL of sample, 5 mL of FRAP solution was added. It was left to rest, in a dark chamber at 37 °C, for 30 min. To finally measure the absorbance at a wavelength of 593 nm against white (Prior and CAO, 1999).

3. Results y discussion

It performed the sensory analysis based on the scheme in Table 2 to determine the best treatment, which was number three with the mixture of 60% pineapple and 40% strawberry.

Nowadays investigation and development of new products, the sensorial evaluation of the characteristics of raw materials and the product obtained from them is very important. Martínez et al. (2003) studied sensorial characterization in orange fibers (*Citrus sinensis*), tangerine (*Citrus reticulata*), lemon (*Citrus limon*), pineapple (*Ananas comosus*), passion fruit (*Passiflora edulis*) and mango (*Mangifera indica*) through descriptive tests, with the purpose of generating taste and texture profiles in order to create product formulations that would satisfy to the consumers. These authors considering that the fibers are pleasant in sensorial terms as well as a good source of the total diet fiber, the residues generated in the processing of fruits in Colombia can be well exploited in the development of new nutritional and pharmaceutical products.

According to García *et al.* (2011) the quality is a complex attribute of necessary knowledge for fruit crop and postharvest in its different forms of consumption. They researched to determine pineapple (*Ananas comosus*) quality properties Cayena Lisa variety stored under environmental conditions. During the analysis (50 fruits, stored 9 days, evaluating 5 daily) weight loss, firmness, pH, touch firmness, aroma and general appearance were determined relating each property in the storage time through the calculation tool Excel, Microsoft Office 2007. As main results, the ripeness stages through a colorimetric diagram, as well as, the optimal recommended period (from 5th to 7th days of being stored) for fresh fruit consumption were already established, while from 8th on the fruit is considered

able to be industrially processed. All the studied properties demonstrated high dependence in relation to the storage time.

Table 3 and Figure 2 presents the sensory analysis results, in which it determines that T3 is the best acceptance, taking into account the described parameters.

Table 3. Sensory analysis

Treatment	Colour	Taste	Odor	Viscosity	Acceptability
T1	39	35	42	36	40
T2	40	42	38	32	39
T3	40	37	43	38	43

According to the sensory analysis carried out, T3 is determined as the best treatment. Taking into account that this method is innate in man and is the one who makes the value judgment.

García *et al.* (2011) compared the nutritional and physical characteristics of some fruit-based drinks of *Rubus glaucus* Benth, *Passiflora edulis* and *Ananas comosus*. She descriptived and comparative study, completely random. The nutritional composition of fruit-based drinks (juices, soft drinks and nectars), of fruits chosen from an indirect method was determined; moisture, density, pH, titratable acidity and refractometry were determined according to the standard methods of the Colombian Technical Standard; Standardized samples of beverages were prepared from Resolution 3929 of 2913 and a photographic record was made, showing the amount of fruit and sugar used Instituto Nacional de Nutrición (2001).

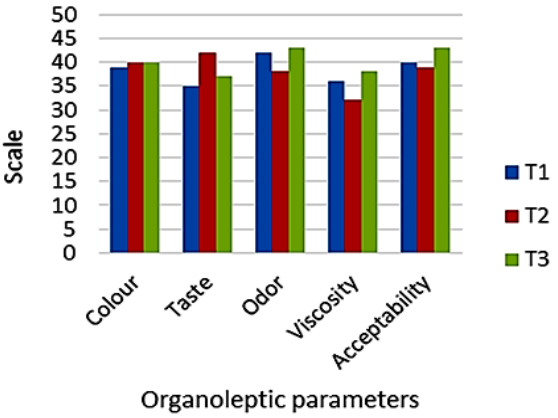

Figure 2. Sensory evaluation.

Table 4 presents physicochemical characteristics values, in which the referential value was obtain from NTE INEN 2337 and the data obtained from the product generated where it observes that the pH parameter is in the optimal range, and also, a growth in vitamin C and iron percentage.

Table 4. Physicochemical analysis

Determination	Units	Reference value	Sample Data
pH	Und	< 4.5	4.5
Vitamina C	%	--	0.03
Hierro	mg/Kg	Min -- Max 15.0	33.32

Table 5 determines the microbiological parameters analyzed, and they are according to reference value for that comply with the requirements of the regulations.

Table 5. Microbiological analysis

`	Method used	Reference value	Value found
Total coliforms	Poured on Plate	Min < 3 Max -----	Absence
Fecal coliforms	Most likely number	Min < 3 Max -----	Absence
Molds and yeasts	Sowing in Extension	Min 1.0*102 Max 1.0*103	70

The antioxidant and polyphenolic activity based on the FRAP and Folin and Ciocalteu (1927), method are shown in Table 6.

Table 6. Folin-Ciocalteu and FRP methods (mg.g^{-1})

Product	Folin-Ciocalteau 765nm	FRAP 593 nm
Pulp mix	55.7	25.9
Pineapple pulp	56.6	24.7
Strawberry pulp	55.3	27.6

It observed a high antioxidant activity and polyphenolic concentration, in the Table 6, it is important for the pulp preservation, avoiding oxidative degradation.

4. Conclusions

The fruits combination in the elaboration of pulps generates an opportunity to offer the market a quality product, since through its antioxidant capacity it maintains a close relationship with the phytochemical components and the polyphenolic compounds. The process was given in 2 stages formulation and analysis. Regarding the formulation according to the fruit variables and combination percentages, it concluded that treatment 3 was the best acceptance for a tasters group.

In relation to the physicochemical and micro-biological analyzes, comparative tables were made (4-5) where it was observed that the found values comply with the regulations.

The fruits combinations in the pulp give high levels of water, vitamin C and iron that help in the balance of the human body metabolism.

Among the chemical methods used to determine the antioxidant capacity (uptake of free radicals), the radical ABTS+ is one of the fastest, resulting in reproducible and consistent results. In addition, the ABTS has important advantages shows several absorption maximum and a good solubility, allowing the testing of both lipophilic and hydrophilic compounds (Villaño *et al*., 2004).

The polyphenols consumed in the diet are antioxidants that sequester free radicals and prevent biological oxidation, which is one of the main etiological factors of many chronic diseases such as heart attacks and other cardiac diseases; as well as, cancer, diabetes, cellular aging, etc.

Based on the bioactivity studied, the pineapple and strawberry pulp represents a resource with wide therapeutic use possibilities.

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