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THE INFLUENCE OF CHILLING STORAGE ON COLOR, pH AND ACIDITY OF FRUIT SMOOTHIE BEVERAGES

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Abstract

Recently, for increasing smoothies shelf life, food industries used thermal processing, which has been shown in some studies to affect the sensorial and physic-chemical properties of these products.
Color, flavor, texture and physico-chemical properties of food products have an important role in correlation with taste, sensory perception and consumer acceptance. These are critical quality attributes affecting the acceptability of fruits, fresh or processed, thus being of major concern in product design.
The aim of this study is to observe the influence of chilling storage on color, pH and acidity of some products based on mixtures of pressed and squeezed fruits without adding preservatives or stabilizers.
For this purpose, some mixtures of several pressed fruit like apples-pears, peaches-mango and sour cherry –bananas were purchased from a local market. These mixtures were stored in climate chamber at 5^0C, the color, pH and acidity being analyzed throughout the 27 days chilling storage period. During chilling storage the lightness index, L, yellowness index, b and the redness index, a, were measured and it was observed color changes for all of fruit smoothie samples. pH and acidity values*, showed that the fruit smoothie samples registered insignificant changes in this comparative study between the same samples after different chilling storage period.*

Keywords*: color, fruit smoothie, chilling storage, shelf life*

INTRODUCTION

Nowadays, there is a strong tendency toward consumption of fresh foods using minimal processing or reducing chemical preservatives. Juices directly obtained from fruits (not from concentrate), distributed through the refrigerated chain with a relatively short shelf-life are good examples of this (Esteve, Frigola, Rodrigo, & Rodrigo, 2005).
Smoothies are an example of this trend to increase the consumption of vegetables and fruits, as an alternative and/or a complement to fresh products. Smoothies were first introduced in 1960 in United States. Further, they re-emerged worldwide in 2000 (Titus, 2008). The manufacture of smoothies is based on the use of a mixture of fruits and vegetables, after removing seeds and peel, which are processed into pulp or puree (Qian, 2006). In most of the cases, the selection of the mixtures is based on the sensorial characteristics like colour, flavour, texture and, trying at the same time to ensure high concentration of nutrients with low energy content (Watzl, 2008).
The Food Standards Agency (FSA) has established its message that a minimum of five portions of fruit and vegetables a day contributes towards a healthy diet (FSA, 2010).
Also, scientific evidences encouraged the consumption of vegetables and fruits to prevent chronic pathologies such as hypertension (Dauchet et al., 2007), coronary heart diseases and the risk of stroke (He et al., 2007).
Unfortunately, the daily intake of vegetables and fruits is estimated to be lower than the doses recommended by the World Health Organization (WHO), and Food and Agriculture Organization (FAO) (www.who.int/; www.fao.org/).
The demand for high quality fruits, which provide healthful substances, high nutritional values and first-rate taste, highlights the importance of methodologies able to monitor quality along the postharvest chain from the field to the consumer.

The aim of this study is to observe the influence of chilling storage on color, pH and acidity of some products based on mixtures of pressed and squeezed fruit without preservatives or stabilizers, throughout the shelf life period.

MATERIALS AND METHODS

Samples

The fruit smoothie beverages like apples-pears, peaches-mango and sour cherry –bananas without preservatives or stabilizers, were purchased from a local market. These products were stored in climate chamber at 5^0C and monitoring. After 6, 13, 20 and 27 chilling storage days since production date, the samples were analysed.
Every time, two bottles from each type of smoothie were opened for duplicate measurements.

Physico-chemical analysis

pH determination

pH was determined with a pH meter WTW INOLAB 720 series type with automatic temperature compensator, whose pH domain is between 0,00-14.00, with a precision of ± 0,01.

Titratable acidity (TA)

Titratable acidity was determined by titrating 10 g of homogenized smoothie sample with 0.1 N NaOH to an end point of pH 7.3 using Schott automatic titrator type Titronic basic. TA was analyzed in triplicate and expressed as citric acid/100 g product.

Color

Color assessment of the samples was conducted at room temperature using a HunterLab colorimeter, Miniscan XE Plus. This instrument was calibrated using the black and white tiles provided. Instrumental color was measured using Illuminant D65 and 10^0 observer angle. Smoothies were filled into a low reflectance sample container and placed over the colorimeter chamber. For each sample of smoothie, measurements were made in ten different points and results were averaged. Therefore the total color change (ΔE) was calculated with the following equation (Hunter Lab, (1996)):

$$\Delta E = [(\Delta L)^2 + (\Delta a)^2 + (\Delta b)^2]^{1/2}.$$

RESULTS AND DISCUSSIONS

pH and acidity evolution

The obtained results showed that the pH and acidity values of smoothie samples like apples-pears, peaches-mango and sour cherry – bananas without preservatives or stabilizers, were recorded insignificant changes throughout the chilling storage period, as can be seen in Figures 1 and 2.

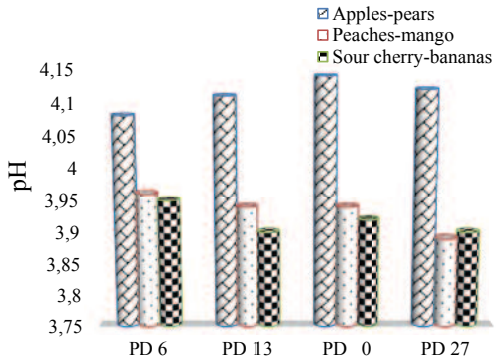

Figure 1. Variation of the pH values of the smoothie samples after the different chilling storage period, PD 6- after 6 chilling storage days PD 13- after 13 chilling storage days, PD 20- after 20 chilling storage days, PD 27- after 27 chilling storage days

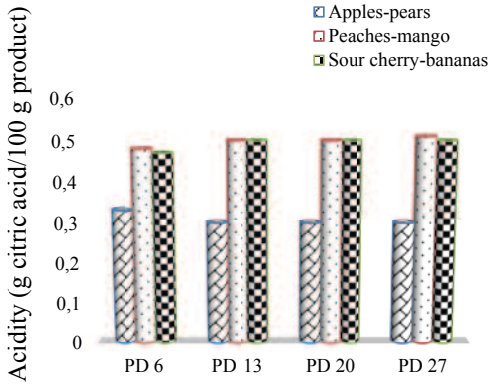

Figure 2. Variation of the tritratable acidity values of the smoothie samples after different chilling storage period, PD 6-after 6 chilling storage days, PD 13- after 13 chilling storage days, PD 20- after 20 chilling storage days, PD 27- after 27 chilling storage days

Color changes during chilling storage period

During the chilling storage period were not observed visually detectable color changes for any of the analysed smoothie samples. Changes were observed when the color characteristics were analysed with colorimeter Hunter Lab according to Universal Software V4.01 MiniScan^{TM} XE Plus program.

During chilling storage period, at 5^0C in climate chamber, the L (lightness), a (redness) and b (yellowness) values of apple-pear and peaches-mango smoothie samples tended to increase, indicating lower color changes, as can be observed in figures 3 and 4. For sour cherry-bananas smoothie samples, the L and b values tended to increase but values of a (redness) decrease during storage period, indicating a low discoloration of the samples (figure 5).

The ΔE values, which are an indicator of total color difference (table 1), showed that chilling storage at 5^0C affected insignificant color attributes of apples-pears, peaches-mango and sour cherry-bananas smoothie.

Table 1. Instrumental color variables of fruit smoothie samples throughout the chilling storage period at 5^0C in climate chamber

Samples	Analysis day	L	a	b	ΔE
Apples - pears	PD6	49.57	2.51	16.56	-
	PD13	50.11	2.78	16.99	0.74
	PD20	50.87	2.99	16.82	1.40
	PD27	49.28	2.8	16.7	0.43
Peaches - mango	PD 6	45.59	9.04	24.18	-
	PD13	45.71	9.49	24.32	0.48
	PD20	46.17	10.06	24.59	1.24
	PD27	45.99	9.92	24.52	1.02
Sour cherry - bananas	PD 6	36.85	18.76	8.33	-
	PD13	36.42	17.75	8.19	1.10
	PD20	37.79	17.83	8.79	1.40
	PD27	37.56	16.47	9.09	2.51

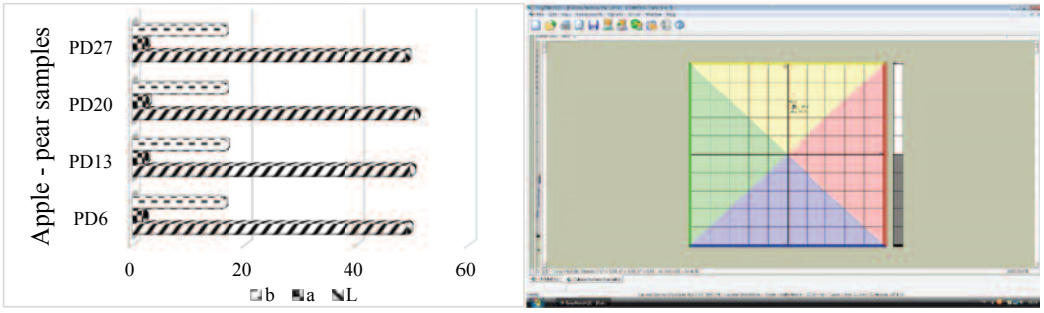

Figure 3. Graphical representation of the values of L, a, b, according to Universal Software V4.01 MiniScan^{TM} XE Plus program for apple - pear smoothie samples, PD 6-after 6 chilling storage days, PD 13- after 13 chilling storage days , PD 20- after 20 chilling storage days, PD 27- after 27 chilling storage days

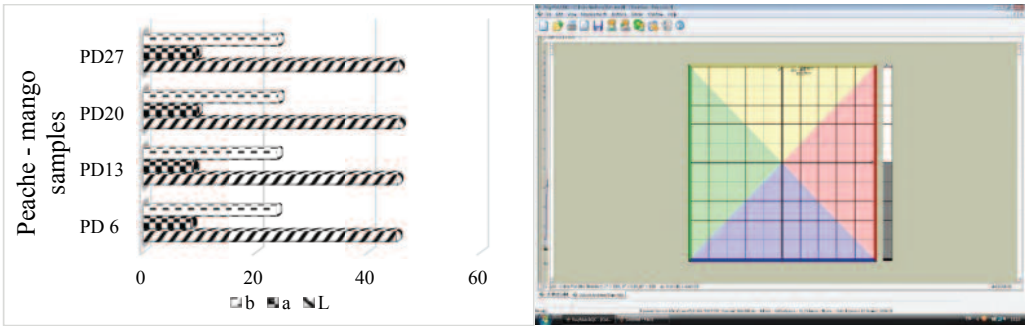

Figure 4. Graphical representation of the values of L, a, b, according to Universal Software V4.01 MiniScan^{TM} XE Plus program for peaches - mango smoothie samples, PD 6-after 6 chilling storage days, PD 13- after 13 chilling storage days, PD 20- after 20 chilling storage days, PD 27- after 27 chilling storage days

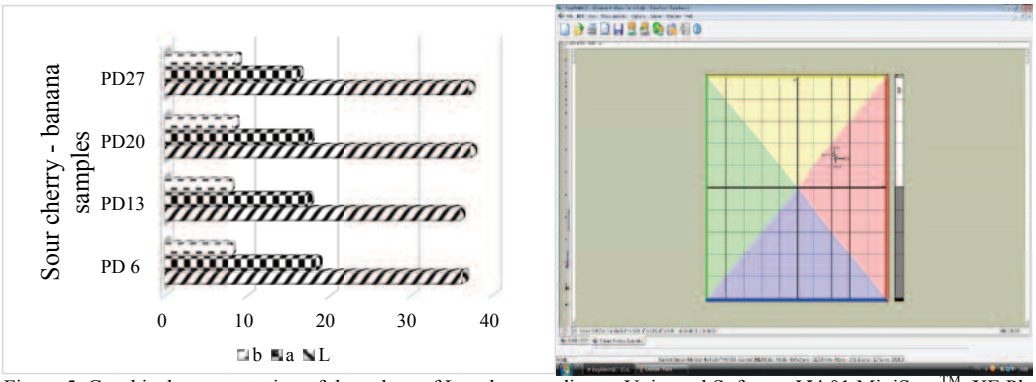

Figure 5. Graphical representation of the values of L, a, b, according to Universal Software V4.01 MiniScan™ XE Plus program for sour cherry - banana smoothie samples, PD 6-after 6 chilling storage days, PD 13- after 13 chilling storage days, PD 20- after 20 chilling storage days, PD 27- after 27 chilling storage days

CONCLUSIONS

The physico-chemical properties of food products have an important role in the creation of taste and sensory perception.

These are critical quality attributes affecting the acceptability of fruits, fresh or processed, thus being of major concern in new product design.

Selection of the smoothies is based on the colour, flavour, texture and, especially, ability to ensure high concentration of nutrients with low energy content.

During the chilling storage period were not visually detected any color changes for the smoothie samples analysed.

During the storage period the pH and acidity values of apples-pears, peaches-mango and sour cherry-bananas smoothies without preservatives or stabilizers, were recorded insignificant changes.

Also, insignificant changes were observed when color characteristics of apples-pears, peaches-mango and sour cherry-bananas smoothie were analysed with colorimeter Hunter Lab according to Universal Software V4.01 MiniScan™ XE Plus program.

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