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FUNCTIONAL DYE OBTAINED FROM JABUTICABA FRUIT (Myrciaria spp.)

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***Abstract*—** The search for alternative sources of natural pigments has stimulated the development of research in various tropical fruits, including jabuticaba. Besides the ability to impart color, to be rich in anthocyanins and polyphenols non-anthocyanin, this fruit also has antioxidant capacity. The objective of this research was to characterize and evaluate the stability of dyes made from peel of jabuticaba. The natural pigments of this fruit were associated with two stabilizers vehicles (maltodextrin and arabic gum), submitted to two dehydration processes (atomization and lyophilization) and exposed to light at a temperature of 25 ± 1 °C, compared with control samples not exposed to light, stored at the same temperature. The stability was evaluated by analysis of anthocyanin, polyphenol, total antioxidant activity and colorimetric characteristics during the storage time being determined regression curve and the degradation kinetics of each. The hydroalcoholic extract of jabuticaba peels showed 48.06 ± 5.76 mg anthocyanins/100g extract, 636.23 ± 0.48 mg of gallic acid/100g of extract and 723 ± 37 mg trolox/100g extract. The dyes show high anthocyanin content, with higher degradation in samples stored under light incidence at 25 °C. Comparing the three proportions of both carbohydrates used, anthocyanin pigments were more stable when used only carbohydrate maltodextrin in the ratio of 30%. Regarding the drying method, freeze-drying led to lower initial loss, however the formulations obtained by spray drying showed to be more stable during storage under both dark and light incidence. Jabuticaba peel was presented as a good source of natural pigments with high levels of bioactive compounds and satisfactory stability under the conditions studied, which leads to consider such fruit as a viable alternative in obtaining dyes.

***Keywords*—** functional food, anthocyanins, natural dye, tropical fruit.

I. INTRODUCTION

Color is an important sensory attribute to the consumer, being a determining factor in the choice of food. In the food industry, dyes are added to restore the original color lost during processing. However, it is increasingly reduced the amount of allowed synthetic dyes, because of their toxicities The jabuticaba is a native Brazilian fruit grown mainly in some states in the Southeast region of the country (MELETTI, 2000). It is a climacteric fruit (CORRÊA; PINTO; ONO, 2007) which has reddish bark and bittersweet pulp (LIMA et al., 2008), used for the jellies production, wines, vinegars and liqueurs as for fresh consumption (DONADIO, 2000). Has high anthocyanin content, mainly in the peel (TERCI, 2004). The search for viable natural pigment sources is a challenge for the food industry. These compounds, in addition to color property, also have functional properties, bringing beneficial effects on the health of those who consume. The objective of this research was to characterize and evaluate the stability of dyes made from jabuticaba peels.

II. MATERIAL AND METHODS

Extract dye

Anthocyanin extract was obtained from the bark, macerating in 70% ethanol acidified with HCl, pH 2.0, for 48 hours at temperature around 30 °C and protected from light, according to the methodology described by Constant (2003). The extract was filtered immediately and concentrated in a rotary evaporator under reduced pressure at temperature of 38 ± 1 °C, until a final volume corresponding to 20% of the original volume and 8.0 °Brix.
The dyes extracts were dried by atomization (spray drying) and freeze drying (freezedryer) using as a vehicle the carbohydrate maltodextrin and arabic gum.
The anthocyanin extracts subjected to atomization process were used 30% maltodextrin, 15% maltodextrin + 15% arabic gum; 30% arabic gum.

Characterization of raw materials: anthocyanin extracts and formulated dyes

Determining the total antioxidant activity were performed (AAT) (LARRAURIET al., 1997), total extractable polyphenols (PET) (LARRAURI et al., 1997), anthocyanins (FULEKI and FRANCIS, 1969) and characterization colorimetric in peels of fruits, in anthocyanin extracts and formulated dyes (CONSTANT, 2003), latter being subjected to stability testing by exposure and non-exposure to light, to check the degradation of these compounds during 21 days of storage.
Colorant stability test was performed by storing a part of the dye formulated into petri dishes under fluorescent light, with controlled temperature (25 ± 2 °C). The other part was stored protected from light and temperature of 10 ± 2 °C.

Degradation kinetics of phenolic compounds and anthocyanin pigments

To evaluate the stability of anthocyanin pigments of jabuticaba dyes, absorbance measurements at 535 nm were used to calculate the value k (degradation rate) and half-life (t1/2), the values were used as parameters for estimating the stability against the action of light (PERIN, 1998).

III. RESULTS AND DISCUSSION

The extracts hydroalcoholic of jabuticaba peels showed 48.06 ± 5.76 mg/100g anthocyanin extract, 636.23 ± 0.48 mg of gallic acid/100g of extract and 723 ± 37 mg Trolox/100g extract.
The degradation rates (k) and the respective half-life ($t_{1/2}$) polyphenols with the dye are shown in table 1. The half-life time was longer in the dark for most of the formulations, as expected, caused by a deleterious effect on anthocyanins.

Table 1 - k degradation constant (h^{-1}) and half-life $t_{1/2}$ (h) of the polyphenol content in jabuticaba dye in the presence of light, at 25 ± 2 °C and in the absence of light, 10 ± 2 °C for 21 days.

Carbohydrates	Polyphenols			
	Light, at 25 ± 2°C		Non-light, at 10 ± 2 °C	
	k (h^{-1})	$t_{1/2}$ (h)	k (h^{-1})	$t_{1/2}$ (h)
L-MDGA[1]	$6{,}0x10^{-4}$	1155,25	$1{,}49x10^{-4}$	4657,93
A-MD[2]	$7{,}0x10^{-4}$	990,21	$7{,}0x10^{-4}$	990,21
A-MDGA[3]	$7{,}0x10^{-4}$	990,21	$1{,}0x10^{-4}$	6931,47
A-GA[4]	$2{,}2x10^{-3}$	315,07	$1{,}0x10^{-3}$	693,15

[1]L-MDGA: Lyophilized Extract: 15% maltodextrin + 15% arabic gum.
[2] A-MD: Atomized Extract: 30% maltodextrin.
[3]A-MDGA: Atomized Extract: 15% maltodextrin + 15% arabic gum.
[4]A-GA: Atomized Extract: 30% arabic gum.

Formulation A-MD presented even t½ in light and dark, confirmed the advantage of the concurrent use of both carbohydrates and heat in the ability to stabilize the pigment of this fruit. The effect of light was not decisive in stabilizing this formulation. According Magalhães Neto (1997), the combined use of gum arabic and maltodextrin as carriers have the ability to stabilize the system during the drying atomizer, increasing the temperature at which changes occur in the physical properties by slowing the kinetics of some reactions. The rate of degradation and the half-life according Constant (2003), are very dependent on parameters and factors such as how the pigments were obtained, handled and stored, and the anthocyanin source.
The colorimetric parameters obtained are shown in table 2.

Table 2 - Colorimetric parameters of degradation for the dyes formulated of jabuticaba in light exposition, at 25 ± 2 °C.

Colorimetric parameters	Jabuticaba			
	L-MDGA	A-MD	A-MDGA	A-GA
Δa*	-2,93	-6,79	-11,49	-18,05
Δb*	-2,11	-6,39	-5,28	-5,80
ΔL*	-0,1	-1,75	-3,35	-0,25
ΔE*	3,61	9,48	13,07	18,96

All formulations showed Δa * negative, indicating loss of red color. Similarly was observed with Δb *, negative values with blue color gain, which indicates degradation of anthocyanins. ΔL * was also negative in all samples, indicating the loss of luminosity of them during storage period (Table 2). The greater color variation (ΔE *) was observed in atomized samples which just used arabic gum as a stabilizer vehicle.

IV. CONCLUSION

The jabuticaba peels were presented as good sources of natural pigments with high levels of bioactive compounds and satisfactory stability under the conditions studied, which leads to consider such fruit as a viable alternative in obtaining dyes. The light had a deleterious effect on all formulations. Regarding the drying method, freeze-drying led to lower initial loss, however the formulations obtained by spray drying showed to be more stable during storage under both dark and light incidence.

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