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EDIBLE COATINGS BASED ON RED PROPOLIS, THE MICROBIOLOGICAL EVALUATION OF BANANA PRATA ANÃ

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ABSTRACT

The banana, monocotiledônea belongs to the order Scitaminales, family Musaceae, subfamily Musoideae, genus Musa. Propolis is a resinous substance produced by bees through the collection of secondary metabolites of flora and its complex chemical composition and varied. Because of the fruit in natura are highly perishable, post-harvest losses represent a major problem, which can be minimized with the use of new methodologies in the harvest of fruits. Before this, this research aimed to develop and evaluate the behavior of coatings in different concentrations of red propolis applied in banana Prataanã. Fruits were acquired in local commerce of the city of Pombal-PB, sanitized and sanitized and after dried, it was applied coatings. The bananas stored at 7ºC temperature showed better results in relation to conservation and life, in relation to the temperature of 30ºC. It was observed that before the results obtained for microbiological analyzes, the fruits of banana Prata were fit for consumption during the entire period of storage of samples, in both temperatures (7ºC and 30ºC), demonstrating that the use of edible coatings based on red propolis coupled to a process of sanitization, is a viable alternative for the conservation of banana Prataanã.

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INTRODUCTION

In natura fruits are highly perishable and different factors can affect and be related to their preservation, since their harvest, when they begin a series of processes that will influence the quality of the product, and consequently in their losses to the consumer (LEMOS *et al*., 2008). The production of fruits in Brazil is featured in the international market, because due to its great climatic diversity, the country produces fruits that are adapted to different climates (VIVIANI; LEAL, 2007).

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Among the fruits with greater productivity, is the banana, which has great importance in world supply (DA SILVA BARROS *et al*., 2016). To be a climate fruit, banana undergoes profound transformations biochemical changes after the harvest, highlighting, such as metabolic phenomenon of greater importance, respiration (OLIVEIRA JUNIOR, *et al*., 2017). Thus, with the aim of prolonging the life and slowing senescence of these fruits, there are many treatments that associated with cooling, have been studied and used, such as the use of protective packaging and coating with edible films. These methods aim to control the mass loss through transpiration and reduce gaseous changes caused by breathing. Formed from a suspension of a thickening agent, the coating can be applied in the fruit forming a film around her, as well,

the same will act as a barrier to gas exchanges and loss of water vapor, modifying the atmosphere and slowing down the ripening of the fruit (RODRIGUES, 2015). In addition to acting as a barrier to moisture loss and reduce the respiration of the fruit, the use of coatings can prevent microbiological and chemical contamination. It is also important to highlight that the films promote permeable barriers that reduce the volatilization of flavorings (FAI *et al*., 2008). In view of the expansive practice the use of edible coatings to increase the shelf life of fruits and vegetables, there is the possibility of using a natural product, as for example the propolis. Collected by bees from cloacal shoots and buds of many plants, the propolis is a resinous substance, which possesses diverse coloration and consistency and is considered one of the most heterogeneous mixtures found in natural sources, where more than 300 constituents have already been identified and/or are characterized in different samples. It is used by the bees to repair the combs of honey, embalm dead insects, to close some gaps, as well as to protect their hive from invasion of microorganisms (CABRAL *et al*. 2009). The Brazilian propolis is classified in accordance with the geographical region of origin, chemical composition and vegetation from which it was removed. The propolis more recent, is called "red propolis", being classified as 13º type, mainly found on the coast of north and northeast regions, is still little studied (DAUGSCH *et al*. 2007). Given the above, and knowing that the propolis has high potential antimicrobial, this research aimed to develop and evaluate the behavior of coatings in different concentrations of red propolis applied in banana Prataanã, where the main factor was the shelf life of fruits, by comparing the retention times and the implementation of appropriate temperature in the microbiological evaluation.

MATERIAL AND METHODS

In this study, experiments were carried out, which allowed determining the performance of the coatings prepared with the red propolis in two concentrations of 3% and 5%. The experiments were carried out in the Laboratories of the Technological Vocational Center (CVT) da Universidade Federal de Campina Grande, campus Pombal. The coatings were produced according to the formulations expressed in Table 1, according to their characterization, where we analyzed the following physico-chemical parameters: pH, acidity, moisture content, ash content and total soluble solids determined according to the methodology of the Institute Adolf Lutz (2008); and microbiological: total coliforms and thermotolerant, filamentous fungi and yeasts, *Staphylococcus* spp. and *Salmonella* sp., according to the methodology of Silva, 2010.

Table 1 - Coatings formulations of the basis of red propolis

Formulation OF COATINGS	
1 formulation (3%)	2 formulation (5%)
3 grams of red propolis;	5 grams of red propolis;
110 mL distilledwater;	110 mL distilledwater;
10 grams of starch;	10 grams of starch;
8 mL ofglycerol;	8 mL of glycerol;

The fruits of banana Prataanã were purchased in local commerce of the city of Pombal-PB, and passed through a pre-wash in tap water with neutral detergent, then were separated randomly, to be submitted to sanitization. Soon, it was used a solution of sodium hypochlorite at 200mg/L, where the fruits were immersed in Sanitizante solution for 40 minutes, which served to monitor the effectiveness of the process. Then were performed for drainage and rinse in clean water. After properly sanitized and dried, the fruits were immersed in solution filmogênica (coating), (Figure 1), and suspended for drying at room temperature (30ºC (±2). After drying, the fruits were placed in disposable trays identified and stored the temperatures of 7°C and 30°C in an oven BOD. For comparison purposes, it was used to control a sample without coating for each temperature.

Source: Author itself

Figure 1. The process of applying coatings in banana Prataanã, for later storage

The samples for evaluation properly coated, were taken at the following times: T0, T1, T2, T3, T4, T5, T6 and T7 every three days, during 21 days and were evaluated for their microbiological characteristics (total coliforms and thermotolerant, filamentous fungi and yeasts, *Staphylococcus* spp.and *Salmonella* sp.) following the methodology of Silva, 2010). All tests were performed with three replicates each. The experimental design was a completely randomized design (DIC) with 3 replications and distribution factorial (3x2x7): 3 treatments, two temperatures and seven periods of storage. The results were analyzed using analysis of variance (ANOVA) and the averages were compared by the Tukey test at 5% significance level. Regression analyzes were performed using the statistical analysis program Sisvar (Ferreira, 2000).

RESULTS AND DISCUSSION

Characterization of Coatings: Figure 2 presents the coatings duly formulated with 3% and 5% of the gross red propolis, respectively.

Source: Author itself

Figure 2. Edible coatings prepared with 3% and 5% of the gross red propolis

In accordance with microbiological results obtained for the coatings prepared with 3% and 5% of the crude propolis, for all parameters, we can observe that the coatings prepared were able to be applied in the fruit without risks to human health, since they did not have any type of contamination, thus proving the efficiency in the preparation and handling, as well as the efficiency of good manufacturing practices. The mean values of the results of the physical-chemical analysis for pH, total soluble solids (TSS) (ºBrix), acidity, moisture (%) and ash (%) are presented in Table 2. It should be noted that there was a significant difference at 5% level of significance between the different formulations for pH, moisture and ash. According to Rodrigues *et al*. (2015), the variation of pH can cause a decrease in the capacity of emulsification and forming film, therefore, this parameter can be studied with the purpose of observing if the pH influence the homogeneity of the matrix filmogênica. The same study, obtained results of pH close to neutrality, for movies to ipod red propolis extract. The averages for total soluble solids does not vary between both formulations, although the F2 has a greater quantity of red propolis. It is possible to observe a difference in acidity content between the formulations F1 and F2, where the formulation with a greater quantity of propolis presented an average greater than the formulation with a smaller quantity (0.59 and 0.46, respectively), being directly related to the results of pH. Table 2 also presents, siginificativa difference between the results found for moisture, where the averages varied from 81.92 to 80.93 for F1 and F2, at the level of 5% of significance. The ash content ranged between 0.086% and 0.106% formulation F1 and F2, respectively, as shown in Table 2, presenting itself in this way a low amount of minerals present in the formulations studied, indicating median content of dry matter.

Microbiological conditions of fruits per storage time

The fruits of banana Prataanã stored at room temperature 30ºC, gained weight loss more quickly, soon after 12 days of storage, the same acquired unwanted appearance, where the bananas with and without coating began to enter in a state of senescence, therefore, discarded. None of the analyzed samples showed the presence of *Salmonella sp*, which shows that the processes of sanitization, during the handling of the fruits and the application of coatings were effective. These results respaltam that samples are analyzed within the standards established by the National Agency of Sanitary Surveillance (BRAZIL, 2001).

Of the 36 samples analyzed, only in the sample of bananas coated with 3% of gross red propolis, at time 0, there was the presence of coliforms at 35ºC (0.91 NMP/g), Coliforms at 45ºC (0.36 MPN/g) and *Staphylococcus* spp (3.33 log10 UFC/g). These results, however, may be an indication of contamination in the process of handling or through the utensils used in manipulation, since in all other samples these microorganisms were absent. It is common to be based on Resolution No. 12 of 02 January 2001 (Brazil, 2001), which recommends the microbiological standards for fruit and vegetables *in natura*, prepared (peeled, selected or Truckload), sanificadas, chilled, intended for direct consumption, absence of *Salmonella* sp. in 25g, and a maximum of 5x10² Coliforms at 45ºC.

Silva (2002) explains that should be considered suspect those foods that make microbial load in the order of 106 UFC/g, when intended for human consumption, because there may be the presence of pathogenic microorganisms and/ or deteriorantes, which causes loss in nutritional value, the organoleptic characteristics and interest for these foods and mainly causing damage to the health of the consumer. Soon, the results obtained for these parameters, offers no risk to human health, being able to consumption. Table 3 shows the count of filamentous fungi and yeasts, these are presented as a function of time, where it can be observed that 41.66% of the samples analyzed, there was the presence of these microorganisms. The count of filamentous fungi and yeasts ranged from 1.67 to 8,9x10² UFC/g where the maximum obtained was for the coating 5% at 30ºC, Time 2. Fungi and yeasts that develop into foods can considerably reduce the nutritional values of the product, and despite the moisture conditions favoring the development of microrgarnismos, the current law (Brazil, 2001) does not establish standards for filamentous fungi and yeasts for fruits and vegetables.

Conclusions

The coatings produced found themselves able to be applied in the fruits, since according to the microbiological analyzes performed, both formulations showed no contamination. Considering that the propolis is a substance with high potential antimicrobial, the results for microbiological analyzes performed in the fruits coated were satisfactory, since the fruits were stored for a long period of time. Soon, they were found within the values recommended by current legislation, not offering therefore, risks to the health of the consumer.

Table 2. The average values obtained for the physico-chemical characterization of formulations of coatings

	PH	SST(ºBrix)	Acidity	Moisture (%)	Ash (%)
F1	4,52th	3a	0,46the	The 81,92	The 0,082
F2	4,34b	3a	0,59the	80,93b	0,106b

[A, b.] medium followed by the same letters in column do not differ statistically by Tukey test at 5% probability.

Table 3. Counting of filamentous fungi and yeasts in function of the storage time and temperature

Time	Filamentous fungi and yeasts (UFC/g)					
	Controlsa mpleat 30ºC	Fruits coated - 3% propolis - to 30ºC	Fruits coated - 5% propolis - to 30ºC	Controlsa mpleto 7ºC	Fruits coated - 3% propolis - to 7ºC	Fruits coated - 5% propolis - to 7ºC
0	3.3X10¹	5,5X10²	3.3	1.7X10²	5,2X10²	1.8X10²
1	3,4X10²	Absent	8,9X10²	1.67	8,3X10²	2x10¹
2	Absent	Absent	Absent	Absent	Absent	Absent
3	Absent	Absent	1.5X10¹	Absent	Absent	Absent
4	Absent	Absent	Absent	Absent	Absent	Absent
5	-	-	-	Absent	1.6X10²	Absent
6	-	-	-	3.7X10²	1.67	Absent

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