



Quality Control of the Buriti oil (*Mauritia flexuosa* L. f.) for Use in 3-Phase Oil Formulation for Skin Hydration

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Abstract

Introduction: The Buriti (*Mauritia flexuosa* L. f.) is a Brazilian native palm tree. Its fruit has a hard shell and scaly covering a soft and oily pulp. Buriti oil is rich in oleic acid, also being considered natural source of beta-carotene, one of the most powerful antioxidants, becoming an excellent alternative for the cosmetic and pharmaceutical industry.

Methods: The fruits collected in the State Forest Antimary (Bujari city, Acre – Brazil) were processed, dried and then the oil was extracted by cold mechanical pressing. Chromatographic analyzes and the following physico-chemical analyses, according to the AOCS norms, were performed: Acid Index (AI), Peroxide Index (PI) and Saponification Index (SI). Samples of different batches were submitted to the gas chromatograph.

Results: After verified the excellent quality of the oil, a formulation of a three-phase oil for the skin hydration was prepared. From the physical and chemical analyzes, the average results for each parameter were compared with them limit by the RDC-270 ANVISA standard.

Conclusion: These results demonstrated that the analyzed oils have great composition for using in cosmetics; it is an excellent raw material for the production of three-phase oil, when accompanied with other elements, such as mineral oil and propylene glycol, which has the capacity of hydration and smoothness of the skin.

Keywords: Chromatography, Physical Chemistry, Oleaginous, Cosmetic, Hydration

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Introduction

Acre has extractive tradition, projecting it as one of the states that strives for conserving their forests, which is rich in timber and non-timber species and has immense economic potential for traditional populations. Products from Amazon species with non-timber potential have been important for diversifying the production and represent significant additional income for extractive populations. The application of the oils in the food and cosmetics industry has great appeal and thus excellent source of income for those who live in the forest and its natural wealth. For this study, among the various species of oil, *Mauritia flexuosa* L. f. more popularly known as

buriti, has stood out.

The Buriti (*Mauritia flexuosa* L. f.) is a palm tree from the Palmae or Arecaceae family and Lepidocarycidae subfamily. In natural occurrence in Brazil are on the following states: Acre, Pará, Amazonas, Maranhão, Piauí, Bahia, Ceará and Tocantins.¹

The buriti's fruits have a hard shell, scaly and reddish. Due to the abundance of the fruit pulp, it is possible to extract proper amount of oil. The buriti oil has in it composition the following fatty acids: oleic and palmitic in addition to vitamin C (ascorbic acid) and carotenoids.²

The use of fruits and vegetables carotenoids in diets is a healthy habit. While some carotenoids, such as beta-



carotene, can be converted into vitamin A, in the organism of those who consume them; others are associated to promote a reduction of cancer risk and some chronic degenerative diseases development.³

The lipid fractions of buriti oil, compared with olive oil and canola oil, two of the most widely oils used in the human diet due to the fact they are beneficial for health, was verified that the buriti oil contains higher levels of oleic acid and approximately four times more linolenic acid than the olive oil.⁴

Furthermore, buriti oil is considered a natural source of beta-carotene (30 mg/100 g of pulp), exceeding five times the carrots (6.6 mg/100 g). Beta-carotene, which is one of the most powerful antioxidants and known for its great capacity for cell renewal, it could also be used as an excellent natural body and facial skin scrub. In addition, the cosmetic industry can also use the buriti oil as an efficient sunscreen, due to its capacity to absorb light radiation in the visible and ultraviolet range, sunscreen at the same time that reduces skin dryness by avoiding water loss. Another possible use of buriti oil in the cosmetic industry is in anti-aging products because it increases the skin's elasticity reducing the wrinkles.⁵

The use of oils and plant extracts for the production of phytocosmetics, mainly from Amazonian biodiversity, is a trend that today covers the cosmetic industry mundial.⁶

Buriti oil hydrates the skin and promotes a healthy look because of the restructuring of the lipid layer, increasing its elasticity and protecting the dryness caused by the sun and UV-B radiation.⁷

Thus, the aim of this study is to characterize the physicochemical and chromatographic properties of buriti oil for use as ingredient in the development of a new formulation of a three-phase oil for skin hydration.

Methods

Plant Collecting

The buriti's fruits were collected at the State Forest Antimary, Bujari city, State of Acre, in an area of second growth and bottomland. The entire study area was georeferenced, and then completed field report. For capturing images, we used a Sony photographic camera, DSC-S1900 model. Once collected, the fruits were conducted for the nursery of the *Fundação de Tecnologia do Estado do Acre* (FUNTAC) and processed for further analysis (Figure 1).

Buriti Oil Extraction

The fruits were processed firstly with manual pulping using knife and then the mature and complete fruits were separated. Afterwards, the pulp along with the peel was conducted by weighing and drying in a kiln at 48 hours at 40°C. The oil was extracted by cold mechanical pressing. After extraction, the buriti oil was filtered vacuum to remove the waste and then the oil was stored in an amber

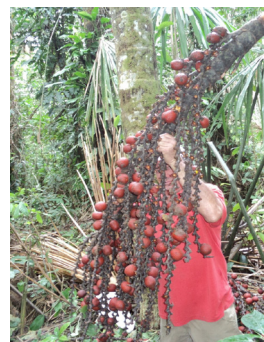


Figure 1. Harvest of buriti (*Mauritia Flexuosa* L. f) fruits. (Source: Personal Collection).

bottle and reserved for carrying out physical and chemical analysis (Figures 2A-C).

Physicochemical Analysis

The physicochemical analyzes were performed in specific equipment for each test, as follows: Refraction

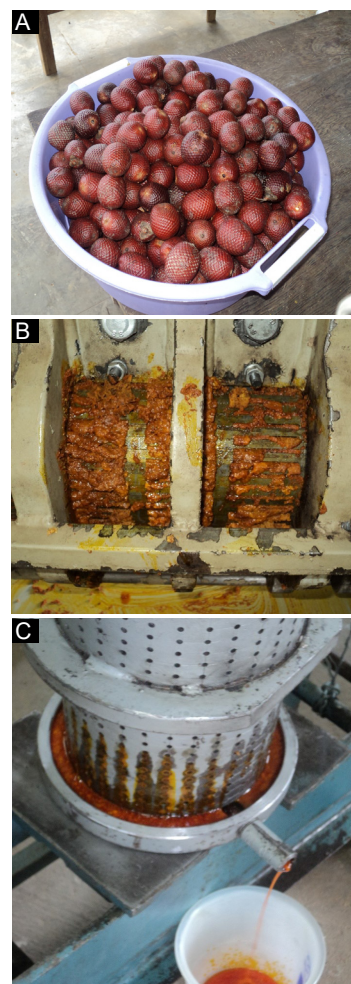


Figure 2. (A) Harvested buriti (*Mauritia Flexuosa* L. f) fruits. (B) Mechanical pressing of buriti (*Mauritia Flexuosa* L. f) pulp for oil extraction. (C) Manual pressing of buriti (*Mauritia Flexuosa* L. f) pulp for oil extraction. (Source: Personal Collection).

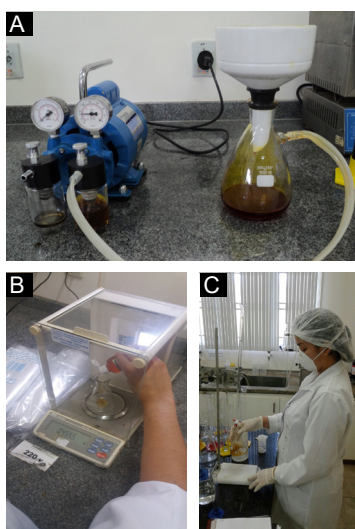


Figure 3. (A) Vacuum filtration of buriti oil. (B) Weigh the buriti oil to run the analysis. (C) Running physical and chemical analysis of buriti oil (Source: Personal Collection).

(refractometer ABBE type: WYA trademark BIOBRIX), density (densitometer 30PX - Mettler Toledo).

The ACID VALUE, Peroxide Index, Iodine Index and Saponification Index were carried out by testing according to the Official Methods Standards and Recommended Practices of the AOCS (Figures 3A-C).

Chromatographic Analysis

A buriti oil sample was sent to the Natural Products Laboratory - PN1 Far-Manguinhos, Oswaldo Cruz Foundation (Fiocruz), in Rio de Janeiro, and analyzed by gas chromatography coupled to mass spectrum (GC-MS) Agilent Technologies model 6890N.

Three-Phase Oil Formulation

To perform the formulation were used the following ingredients and its proportions:

Phase I

Mineral oil USP 20,8%

Buriti oil 12,5%

Phase II

Silicone oil 33,3%

Phase III

Dipropylene glycol 20,8%

Buriti essence 12,5%

Red water dye: 6 drops

Three-Phase Oil Method of Preparation

The mineral oil was placed in the bottom of a vessel, the buriti oil was added and then the oils were thoroughly mixed. With the help of a funnel the mixture was placed in a flask and the silicone oil was added. Subsequently, the dipropylene glycol was added to another container,

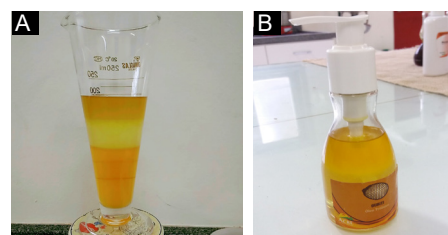


Figure 4. (A) Finished 3-phase buriti oil. (B) Packed and labeled three-phase buriti oil (Source: Personal Collection).

with the buriti essence and the red water dye. At the end the entire product was stirred and the three phases were observed very clearly. Important Note: For proper product effectiveness it is necessary to stir well before use in order to allow the mix of the oil phases and provide better skin hydration (Figure 4).

Preliminary Stability Testing of 3-Phase Buriti's Oil

After formulation the three-phase buriti oil was manufactured, some preliminary stability tests were conducted just after the product was manufactured and after 30 days. The parameters analyzed in the sample were: appearance, color, odor, pH and density, presented as the arithmetic average of the values obtained from tests performed in triplicate. To develop pH tests, an aqueous 10% dispersion (m/m) was made of the tested sample in freshly distilled water and used digital pH-meter. To determine the density it was used a glass pycnometer coupled with thermometer, previously empty.

Results and Discussion

Physicochemical Analysis

According to tests performed in the Laboratório de Produtos Naturais - FUNTAC, the following values were obtained (Tables 1 and 2).

The acid index is a good parameter for measuring oil's degradation. In this study, five batches of buriti oil were used as samples. The results for acidity index, in all batches, were below the limit established as permitted, according to some researched references. It is known that a high number for acid indicates that the oil or fat is suffering breaks in its carbon chain, releasing its main compounds, which are the fatty acids. The peroxide value is a very sensitive indicator, present at the initial oxidation stages and it is as a result of the destruction of fat soluble and essential fatty acids vitamins, besides the formation of by-products with odor and strong disagreeable taste. The amounts of peroxide and saponification values obtained in the different vegetable oils samples, also presented values below the limits set by regulation of the DRC, nº 270, September 22, 2005 ANVISA. This legislation is specific for vegetable oils in which it aims to establish values of the physico-chemical parameters of references depending on the various extraction processes methods.

Table 1. Results of Buriti oil Physicochemical Analysis

Buriti Batches Samples	AI mgKOH/g	PI MeqO2/kg	II I ₂ /100g	SI mgKOH/g	RI (25°C)	Density (g/mL)
01	2.39	3.72	70.79	192.97	1.466	0.9093
02	2.14	2.87	59.57	197.45	1.466	0.9044
03	1.91	3.56	81.43	189.06	1.465	0.9066
04	1.10	3.89	78.64	187.13	1.465	0.9053
05	2.75	2.23	69.27	201.28	1.466	0.9058

AI = Acid Index, PI = Peroxide Index, II = Iodine Index, SI = Saponification Index and RI = Refractive Index.

Table 2. Parameters Determined by ANVISA for Vegetable Oils

Analyzed Parameters	Average Values	ANVISA RDC-270
Acid Index	2.05 (MgKOH/g)	MAX 4.0 (MgKOH/g)
Peroxide Index	3.24 (meqO2/kg)	MAX 15.0 (meqO2/kg)
Saponification Index	193.56 (MgKOH/g)	MAX 250.0 (MgKOH/g)

Table 3. Results of the Buriti Oil Chemical Composition Obtained Through the GC-EM Chromatogram for the 5 Different Batches Samples

Fatty Acids (Formula)	Batche 01 (%)	Batche 02 (%)	Batche 03 (%)	Batche 04 (%)	Batche 05 (%)
C18: 1	64.37	58.42	69.05	62.88	59.94
C18:2	5.75	3.76	2.89	2.30	3.22
C16:0	14.75	15.32	10.76	12.14	16.27

Table 4. Results of the Physical-Chemical and Organoleptic Tests of the 3-Phase Buriti Oil Stability Test

Color	Odor	General Aspect	pH	Density
Yellow/Orange	Proper	Oily	between 6.0 and 7.0	0.9428 at 20°C

Chromatographic Analysis CG-EM

The results of the chromatographic analysis of the batches of buriti oil are presented in Table 3.

In chromatographic evaluation of CG/EM, the majority of components presents in the buriti oil were by far oleic acid (C18:1) and palmitic acid (C16:0).

These results show the oil quality, which results from a suitable collection of maturation, pulping, drying, extraction and storage. Thus, there is the preservation of the oil characteristics and its high stability due to the presence monounsaturated fatty acids in their carbon chain, and thus less likely to oxidative reactions. These factors demonstrate the analyzed oils have great composition for use in cosmetics, been an excellent raw material for the production of three-phase oil, when accompanied with other elements such as mineral oil and propylene glycol, which increase the capacity of hydration and smoothness of the skin.

Preliminary Stability testing of 3-Phase Buriti Oil

The results of the preliminary stability tests performed for

30 days after the formulation of the three-phase buriti oil are presented in Table 4.

The stability study provides information about the product performance at a certain time interval, compared to environmental conditions that the product could be submitted from manufacturing to the end of validity.⁸

The 3-phase buriti oil was tested in the Natural Products Laboratory at FUNTAC by pharmacists and pharmacy students working with the intern. This lab team verified the extreme sense of hydration, softness and protection offered to the skin, in addition to offer a pleasant and refreshing fragrance.

Conclusion

From the study, it was verified that the buriti oil samples are within the parameters established by ANVISA RDC-270, indicating that its features and high stability allow its implementation as raw material for phytocosmetics production.

This result is in agreement with what was presented in previous studies,⁹ where it was verified that the elaboration

and development of new prototypes using the region's oilseeds as input is a challenging activity, but of essential social and economic importance for the population. In this way, it can help increasing the income generation of extractive communities that work with the collection and extraction of vegetable oils, but can also be an ally in the sustainable use of the forest.

Competing Interests

None.

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