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EVALUATION OF THE COMPOSITION OF ACAI BERRY OIL (*Euterpe oleracea)* SUBMITTED TO STERILIZATION

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ABSTRACT

Acai berry (*Euterpe oleracea*) is a native palm of Brazil, distributed for the entire Amazonian basin. Rich in essentials fatty acids (mainly oleic acid and linoleic acid), the Acai oil prevents abnormal conditions of the skin, as dermatitis and drying, and assists in the regeneration of the epidermis. Therefore, it is proposed a more effective topical administration of the Acai oil by its immobilization in BandGel® type hydrogels, which is crosslinked and sterilized by ionizing radiation. The objective of this work was to evaluate the composition of the oil when submitted to a sterilizing dose of ionizing radiation. The oil composition was determined by gas chromatography connected with mass spectrometry (GC-MS). The results showed a small decrease in the concentration of ester acids and increase of some main products, i.e., ethyl oleic and palmitic acids.

1. INTRODUCTION

The family of the palms (*Arecaceae*) is one of the largest families among the vegetals in the world and it is mainly characteristic of the tropical flora. The *Euterpe* kind encompasses about 28 species and occurs in Central and South America. Acai berry (*Euterpe oleracea*) is a native palm of Brazil, distributed by the entire Amazon basin. Rich in essentials fatty acids (mainly oleic and linoleic acid), phytosterols, anthocyanins and vitamin C the Acai berry is popularly used for diet due to its rich nutritional properties. As a result, the Acai Oil (*Euterpe oleracea pulp oil*) has been widely searched for use in cosmetic field, considering that this oil has the same properties of the fruit regarding the epidermis regeneration, the control of lipids action and the stimulus for the cicatrisation besides moistening and antirust properties [1].

Linoleic acid (Omega 6) and oleic acid (Omega 9), known as essential fatty acids, are not synthesized by the human organism, having to be supplied by the diet. Its deficiency cause abnormal conditions of the skin, i.e., dermatitis and drying, decrease of the regeneration capacity of the skin, increase of infections susceptibility and even increase of cholesterol level, among others. The extract of acai berry has approximately 12% of linoleic acid and 60% of oleic acid [2].

Polymeric hydrogels are materials with structure capable of absorbing a large amount of water and biological fluids. They can be cross-linked by chemical processes initiated by ionizing radiation or other conventional initiators. Crosslinking initiated by radicals produced by ionizing radiation encompasses the following advantages: chemical absence of catalysts and/or initiators which generates toxicity to the system; possibility of reactions at room temperature or even cryogenic temperatures; capability of

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controlling the process from the beginning to the end of the irradiation, and possibility for simultaneous crosslinking/degradation and sterilization in closed systems [3].

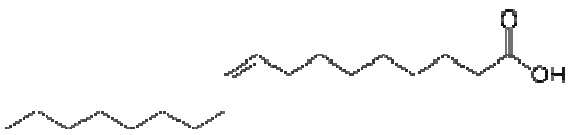
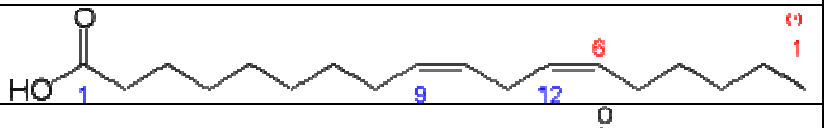
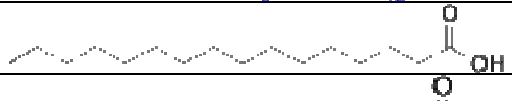
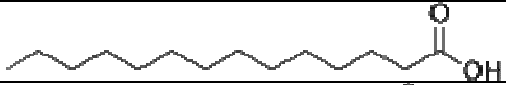
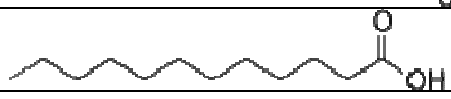
The polymeric hydrogels for topical applications offer the following advantages: absorption of exudates, barrier effect against microorganisms, high permeability for oxygen and control of drug release, among others [4]. The main features of a topical release systems is the presence of drugs and/or cosmetics substances in vehicles or devices in such way that they release the active compound in a previously settled controlled rate, during a established period of time and with adequate skin penetration [5].

This study has the purpose of evaluating the composition of Acai Oil *in natura* and after irradiation at 25 kGy dose. It is the first step of the development of a more effective topical administration of Acai oil by its immobilization in BandGel® type hydrogel.

2. METHODOLOGY

The Acai oil was conditioned in PVC bottle and irradiated by γ-rays from Co-60 up to 25 kGy of total dose. Irradiated and non-irradiated samples were submitted to liquid-liquid extraction with Chloroform (HPLC grade) in order to maximize the extraction of fatty acids. The dilution was carried through until reaching the concentration of 50μg/mL of Acai Oil in Chloroform. Table 1 shows the structure of some fatty acids usually found in Acai Oil.

Table 1. Chemical Structure of some fatty acids

Chemical Name	Chemical Structure
Oleic Acid	
Linoleic Acid	
Palmitic Acid	
Miristic Acid	
Lauric Acid	

Acai Oil composition was determined by GC-MS with a quadrupole mass analyser from Shimatzu, model QP 5000. The compounds were separate in a DB-5 column (30m x 0,25mm x 0,25μm). Its stationary phase was composed of (5%-Phenyl)-polymethylsiloxane, therefore, almost nonpolar. Helium was used as carrier gas and gave a column head pressure of 12 p.s.i. and an average flux of 1 mL/min. The operational conditions were as follow: 2 min hold at 75ºC (heating rate of 37.5ºC/min to

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75ºC), followed by heating rate of 15ºC/min until 200 ºC; heating rate of 20ºC/min until 250ºC with 2 min hold at 250ºC; detector temperature of 250ºC; helium as carrier gas with linear speed of 32cm/s; energy of 70 eV.
The identification of the volatile components was made by comparing the mass spectra of each CG peak at a characteristic retention time with the system libraries NIST-92 and literature.

3. RESULTS

The CG-MS chromatogram of the non-irradiated Acai Oil was shown in Figure 1. The main constituent was fatty acids saturated: palmitic, myristic and lauric and the insaturated ones: oleic and linoleic.

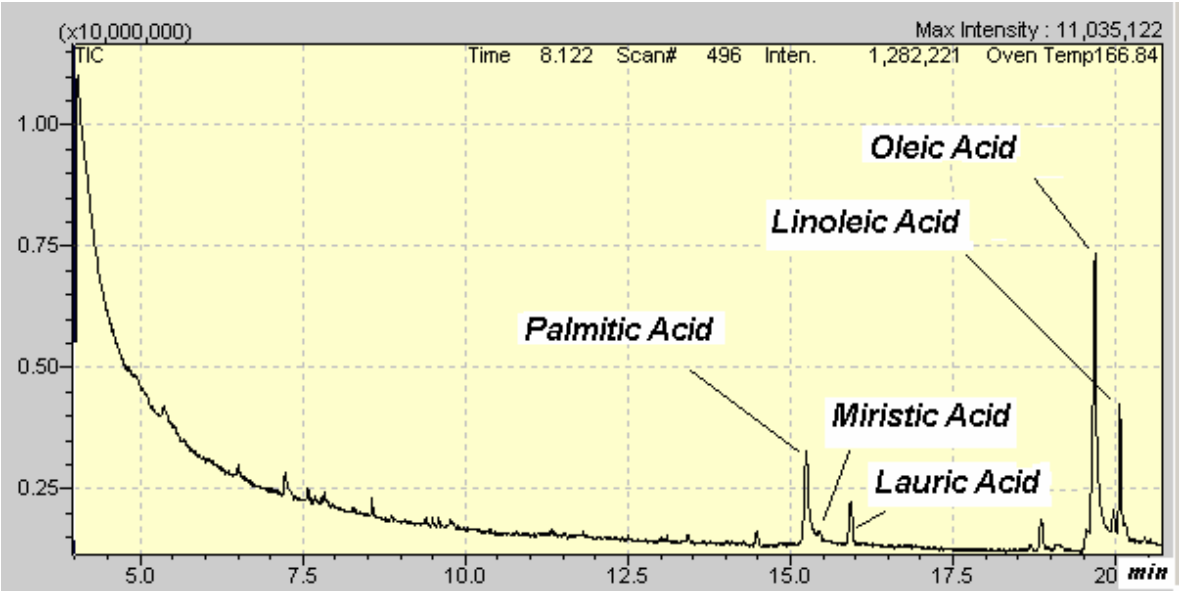

Figure 1. GC-MS chromatogram of non-irradiated Acai Oil

The GC-MS chromatogram of the irradiated Acai oil was shown in Figure 2. Basically, it was verified the presence of the same compounds. However, the irradiated sample showed the presence of dibutyl phthalate, but this was related to the fact that irradiation was carried out in PVC bottle, as a result of dibutyl phthalate leaching from the bottle to the oil due to the radiation effect.

The mass spectrum of the oleic acid was shown in Figure 3 only for illustrative purpose.

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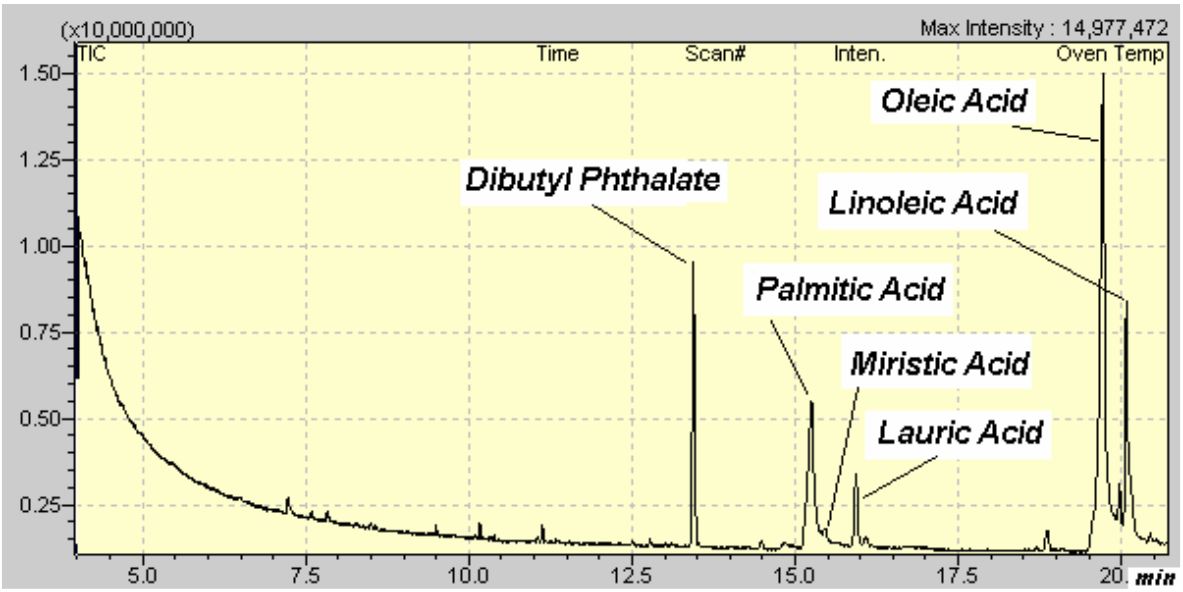

Figure 2. GC-MS Chromatogram of irradiated Acai Oil

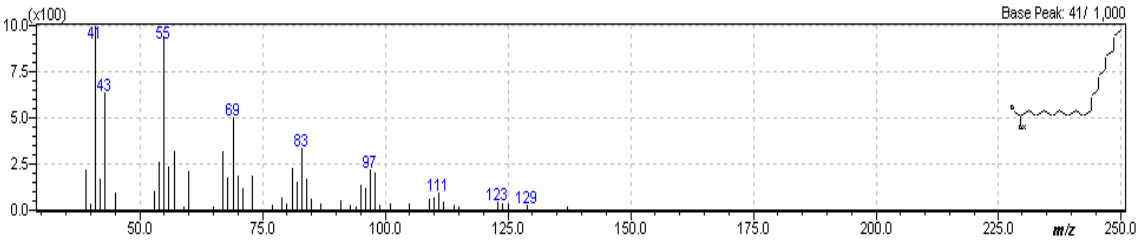

Figure 3. Masses spectra of oleic acid.

Table 2. GC/MS Analysis of non-irradiated Acai Oil.

T.R. (min)	COMPOSITION	FORMULA	Molar mass	AREA (TIC)	IR(%)	CAS
15.2	Palmitic Acid	$C_{16}H_{32}O_2$	256	10037612	32.2	57-10-3
15.4	Myristic Acid	$C_{14}H_{28}O_2$	228	1204918	3.9	544-63-8
15.9	Ethyl Ester Palmitic Acid	$C_{10}H_{16}$	284	4063860	13.1	628-97-7
18.8	Methyl Ester Oleic	$C_{19}H_{36}O_2$	296	2482392	8.0	112-62-9
19.7	Oleic Acid	$C_{18}H_{38}O_2$	282	31131622	100.0	112-80-1
19.9	Linoneic Acid Chloride	$C_{18}H_{31}ClO$	298	3070993	9.9	7459-33-8
20.0	Ethyl Oleic	$C_{18}H_{38}O_2$	310	8445239	27.1	111-62-6

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A semi-quantitative determination of some compounds was presented in Tables 2 and 3, referring to the results of non-irradiated and irradiated Acai oil respectively. The most abundant compound was oleic acid and it was established as internal standard, i.e., its area was considered as 100%. It was observed reduction of monoesters concentration probably due to the transformation of ester group in carboxylic acid.

Table 3. GC/MS Analysis of irradiated Acai Oil

T.R. (min)	COMPOSITION	FORMULA	molar mass	AREA (TIC)	IR (%)	CAS
15.2	Palmitic Acid	$C_{16}H_{32}O_2$	256	31284651	37.3	57-10-3
15.4	Miristic Acid	$C_{14}H_{28}O_2$	228	4381154	5.2	544-63-8
15.9	Ethyl Ester Palmitic Acid	$C_{10}H_{16}$	284	9179540	11.0	628-97-7
18.8	Methyl Ester Oleic	$C_{19}H_{36}O_2$	296	2775850	3.3	112-62-9
19.7	Oleic Acid	$C_{18}H_{38}O_2$	282	83760841	100.0	112-80-1
19.9	Linoneic Acid Chloride	$C_{18}H_{31}ClO$	298	7293915	8.7	7459-33-8
20.0	Ethyl Oleic	$C_{18}H_{38}O_2$	310	32207517	38.5	111-62-6

Table 4 shows the relative intensities area of each compound in irradiated and non-irradiated Acai Oil samples. It can be seen elevation of intensity area of ethyl oleic, palmitic acid and myristic acid and reduction of methyl ester oleic, ethyl ester palmitic acid and linoleic acid chloride

Table 4: Comparison of the relative areas of the irradiated and non-irradiated samples

COMPOSITION	IRRADIATED	NON-IRRADIATED	VARIATION
Palmitic Acid	37.3	32.2	5.1
Miristic Acid	5.2	3.9	1.4
Ethyl Ester Palmitic Acid	11.0	13.1	-2.1
Methyl Ester Oleic	3.3	8.0	-4.7
Oleic Acid	100.0	100.0	0.0
Linoleic Acid Chloride	8.7	9.9	-1.2
Ethyl Oleic	38.5	27.1	11.3

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4. CONCLUSION

The main Acai oil constituent are fatty acids, saturated and unsaturated and other compounds like ethyl oleic, methyl ester oleic and linoleic acid chloride. After irradiation at 25kGy, sterilization and crosslinking dose, it was observed no appearance or disappearance of any molecule but only some ester consumption and eventual conversion in carboxylic acids. It can be concluded that in the absence of humidity the Acai Oil showed good resistance to radiation. The study has to be continued by Acai Oil irradiation in presence of water and to verify the viability of oil immobilization in hydrogel membranes which will be submitted to ionizing radiation.

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