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INFLUENCE PHYSIOLOGICAL STATE OF SEEDS OF *CARAPA PROCERA* ON THE CHEMICAL CHARACTERISTICS OF EXTRACTED OIL

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ABSTRACT

The influences physiological parameters of (maturity dismantles of) seeds of *Carapa will procera* in relation to physical parameters extraction one the quality of oil was studied. The out puts of extraction to the soxhlet obtained by recent hexane one old but seeds of *Carapa will procera* of Senegal are nearly identical and one average reveal content important year of oil off 58,5%. However the maturity of seeds is accompanied by reinforcement has of the color which master keys from the blade yellow to the dark yellow, year increase in the acidity and index of saponification, of has reduction in the peroxide index. Moreover, the results could forward has sensitive additional biosynthesis of the palmitic acids, palmitoleic and myristic to the detriment of the acids oleic, linoleic and behenic. On the other hand, the evolution of the iodine index according to the maturity of seeds remains mitigated. Within the framework of this study, complementary chemical constant were given compared to the preceding work announced one the oil of *C. will procera* in particular the index iodine (41-70%) and the peroxide index (0.87-3.11%).

Key words: *Carapa will procera*, Maturity, Fatty-acids, Characters chemical.

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INTRODUCTION

With an renewed interest of phytochemistry, the plants are very studied because of their strong industrial use in the sectors agro-alimentary[1-3], cosmetologic and especially pharmaceutical[4,5]. Thus the oil extracted from Graine *Carapa will procera* was the subject of interesting studies by several research teams[6-13]. *Carapa will procera* is a plant belonging to the family of Méliacées, Ordre of Térébinthales pushing in the tropical areas of Africa and America[6]. In Senegal, we note a push of this plant in the south in the Casamançaise area where we note a strong knowledge and consideration of his utilities. Thus ethno-pharmacological investigations reveal that this plant has many therapeutic properties: analgesics, antibactériennes, anti-inflammatory drugs, anti-malaria, pesticides, healing, febrifuge, antitumor, vermifuges[8,9,11,12,14]. In spite of genetic variability that this species[10] presents, these properties are announced in all its zones of distribution.

This study aims to contribute to a better control of the conditions of determination of the chemical characteristics of the oil of *C. will procera* of Senegal. It precedes insulation and the characterization of the active ingredients responsible for the various properties allotted to *C. will procera* in order to open ways of valorization of this vegetable gasoline.

EXPERIMENTAL

Materials and methods

Seeds of *C. will procera* collected in June 2004 considered as old and others collected in June 2005 considered recent seeds in Casamance (area of the south Senegal) were the subject of oil extraction at the laboratory with the current of the month of July 2005. The almonds are insulated and crushed with a granulometry 100% lower than 500 µm in order to obtain a powder. According to the period of harvest, we carried out an extraction the soxhlet and an extraction the liquid solid method of old seeds and seeds recent. The moisture contents of seeds are determined by stoving with 105°C according to method NF V 03-903. The various physico-chemical constants of oil are given according to standardized methods AFNOR[15]. It is about:

- Determination of the content of oil of the powder of seeds (AFNOR NF V03-924)
- Determination of the index of refraction (AFNOR NF T 60-200)
- Determination of the Iodine index (AFNOR NF T 60-200)
- Determination of the peroxide index (AFNOR NF T60- 220)

- Determination of the acid value (AFNOR NF T60- 204)
- Determination of the index of saponification (AFNOR NF T 60 - 206).

The determination of the profile in fatty-acid of the various samples was carried out on a chromatograph with gas phase HP 6890.

RESULTS AND DISCUSSION

Determination of the water content and oil of the powder of seeds

The results obtained on the two batches of seeds are confined in Table 1. the results represent an average obtained on three tests of handling.

Table 1: Water content and oil of seeds of *C. will procera*

	Recent seeds	Old seeds
Water content (%)	46.49	4.49
Content of oil (% MS) extracted by soxhlet	58.15	59.38

Within sight of these results, the water content is much weaker in old seeds than in recent seeds. On the other hand the outputs obtained are appreciably equal with a light superiority in old seeds.

Visual aspect of the various oil extracts

In the absence of a measurement of the color of the samples used within the framework of this work, of the criteria of differentiation allowed to draw up Table 2.

Table 2: Aspect of the various extracted oil samples

Designation	Oil extracted in Soxhlet		Oil extracted by the liquid solid method	
Aspects	Old seed	Recent seed	Old seed	Recent seed
Consistency	Liquid	Liquid	viscous	Liquid
Color	Yellow	Pale yellow	yellow	Pale yellow

Except for the oil extracted old seeds by the solid method/liquid, all the samples are liquid. The coloring of the oils extracted at the laboratory is yellow pale or yellow following the shelf life of seeds. All the samples have a characteristic and identical odor and are of bitter savor.

Indices characteristic of the oil of *Carapa will procera*

Table 3 shows the various variations of the physicochemical constants according to whether oil is obtained by the method with the soxhlet or by the liquid solid method.

Table 3: Some chemical characteristics of the oil of *C. will procera*

Designation	Oils extracted at the laboratory by the liquid solid method		Oils extracted at the laboratory by the method with the soxhlet	
	Recent seed	**Old seed**	**Recent seed**	**Old seed**
Index of refraction	68.50	68.00	67.50	69.00
Acid value (%)	0.56	1.56	0.10	5.58
Iodine index (%)	66.31	68.70	56.83	41.72
Peroxide index (%)	3.11	1.50	2.33	0.87
Index of saponification (%)	91.10	186.77	48.79	166.30

The oil samples give appreciably equal values in index of refraction whatever the method of extraction and the shelf life. On the other hand, the values of saponification and acid value present great variations. The oil extracted recent seeds has values increasingly lower than that coming from old seeds. For the iodine index, we note values located in the same order of magnitude for the oils extracted by the solid method/liquid contrary to the method in Soxhlet. The values of peroxide index are higher in recent oils than in old oils.

Profiles in fatty-acids

The results of the chromatographic analysis consigned in Table 4 give the proportions of fatty-acids. The essential fatty-acids by order of abundance are the acids oleic, palmitic, linoleic and stearic.

Table 4: Summary of the various fatty-acids with percentages by weight. Ha (old oil); HN (recent oil)

Fatty-acids	Ha	HN
	%	%
14 : 0 (myristic acid)	0.14	0.10
16 : 0 (palmitic acid)	26.71	19.50
16 : 1 (n-7) (palmitoleic acid)	0.37	0.21
17 : 0 (acid heptadécanoïde)	0.12	0.10
17 : 1 (heptadéca oïque ene)	0.05	0.03
18 : 0 (stearic acid)	8.95	9.10
18 : 1 (n-9) (acid oleic)	49.25	54.12
18 : 1 (n-7) acid 11-octadécénoïque	0.02	0.01
18 : 2 (n-6) (linoleic acid)	12.44	14.64
18 : 3 (linolenic acid)	0.14	0.20
20 : 0 (acid arachidonic)	1.50	1.44
20 : 1 (arachido oïque ene)	0.22	0.19
22 : 0 (acid behenic)	0.10	0.37

Oil known as recent comes from seeds having been preserved during five days after harvest and that known as old for at least seven months. The results of extract to hexane enable us to note that, whatever the state of seeds or the shelf life the content of oil remains appreciably the same one. A light superiority of oil resulting from old seeds is explained by phenomena of maturation. Indeed, according to Heller[16] generally in recent seeds, the synthesis of reserves, which proceeds during maturation is still unfinished, even if the seed is detached from the vegetative apparatus. The duration of the time of maturation is variable according to the species and can extend from a few weeks in four months. For this period the water content decreases thus explaining the light variation obtained on seeds of *C. will procera* collected. These contents of oil confirm those of Diémé[8], which obtained 57.30% while using in the place of hexane, the diéthyl ether, showing thus that the type of solvent used also remains without effect on the output of extraction. The fat contents rate in seeds of *C. will procera* met in Senegal is lower than that obtained on species of Congo is 62.50%[13]. It is higher than the result of seeds coming from Sierra Léone[7], that is to say 50.36%. Work under development with Benign announces a rate of 53.00%. All these results testify to a variation of content of oil related either to the geographical area (Table 5), or with the granulometry of powder Luthria et al.[17]

Table 5: Content of oil of seeds of *C. will procera* of various origins

	Senegal[8]	Congo[13]	Sierra-Léone[7]	Benign[9]
Content of oil (%) ms	57.30	62.50	50.36	53.00

The examination of Table 2 makes it possible to note that oils resulting from recent seeds are always yellow pale by the presence of carotenoids, contrary with those coming from old seeds (darker yellow). Two lesson emerges from this result: a stability of coloring due to a high percentage of acid oleic (Perez-Galvez et al.[18]; and a more marked coloring in the old seeds which is explained by the degree of maturity Heller[16].

Concerning the physicochemical criteria, the index of refraction and the iodine index are important criteria of classification of oils. According to Wolf[19], there exists a close connection between the iodine index and the index of refraction. These two parameters make it possible to classify oils out of nonsiccative oils (II < 100), out of semi-siccative oils (100 < II < 130) and out of siccative oils II130 >. The oil of *C. will procera* is thus a nonsiccative oil. The low values of iodine index obtained by the method in Soxhlet testify to the loss in unsaturated fatty-acids. Indeed the method in Soxhlet brings the temperature of solvent and oil to 60° even 80°C. Thus, under these conditions the couple of values temperature/time (lasted of 4 hours extraction) facilitates the disintegration of the double connections. The influence of the strong temperatures on the physical characteristics of oil also appears by a reduction in the rate of linoleic acid, an appearance of the trans shapes of Gancedo et al.[20], a development of color and an appearance by Kim et al.[21] In addition work of Derbesy and Busson[7] in Sierra Leone then of Old and Kabele-Ngiefu[13] in Congo (Table 6), respectively gave values of very different iodine index (70 and 36.5). Nevertheless the iodine index of *C. will procera* samples ofla Sierra Leonepresent the same sizes of values as those of Senegal. The light difference observed can be allotted to a difference in chemical composition in relation to the geographical area.

Within the framework of this study, complementary chemical constants were given compared to preceding work of Diémé[8]; in particular the index of refraction, the iodine index and the peroxide index.

As for the index of refraction, the method of extraction, nor the age of seeds do not seem to influence it: the values remain in a fork reduced by 67.5 to 69.

The peroxide index makes it possible to appreciate oxidation the step of oil and the acid value measures the quantity of free fatty-acids resulting from the hydrolytic reactions of triglycerides. These two types of index are thus quality standards making it possible to give an account of the state of conservation of an oil. In other words, when an oil is not subjected to good conditions of conservation, its quality can worsen in various ways, but generally by hydrolysis or oxidation. From this point of view, an oil of good quality must present an acidity and a low or zero index of peroxide. In comparison with the values of reference of the *codex alimentarius* FAO[22] concerning raw consumable oils (4 for the acid value and 15 for the peroxide index), the values obtained on the oil of *C. will procera* are low. However, the oils extracted old seeds more acid and are oxidized than the oils extracted recent seeds. Wan and Dowd[23] having already shown that the technique of extraction does not influence the acid value, the only argument which would explain these variations of values for this parameter would be the degree of maturity of seeds. The presence of tannins responsible for the bitterness of oil contribute to limit oxidation by their antioxydant capacity Amarowicz et al.[24] For the high values of peroxide index announced by Djenontin[9], Apfelbaum[25] stipulates that other substances present in oils such as carotenoids, the vitamins has and E, the squalene can undergo similar reactions of oxidation with peroxide formation which can induce a high peroxide index.

The values of index of saponification vary between 48,79 to 186.77 with the low values recorded in recent oils. Derbesy and Busson[7], Old and Kabele-Ngiefu[13] for samples originating inla Sierra Léone and Congo (Table 6) found values similar and respectively of 199 and 197.

Table 6: Some chemical constants of oil exits of different geographical areas

Designation	Senegal present work	Congo[13]	Sierra-Léone[7]	Benign[9]
Iodine index	68	36.5	70	
Acid value	1.58		14	18.1
Peroxide index	1.18			13
Index of saponification	176.53	197	199	

The standards of fatty-acids used during this work are thirteen (13)

Myristic acid, palmitic acid, 9-hexadécénoïque acid, heptadécanoïque acid, 17 : 1, stearic acid, oleic acid, octadécénoïque acid 12, linoleic acid, linolenic acid, acid arachidic, ricosaéne-9oïque acid and acid behenic.

One notes on Table 4, the prevalence of the oleic acid, then palmitic acid, then of the linoleic acid and finally of the stearic acid. This is observed in the two samples with a certain difference in values. This one finds the same explanations as previously, in particular the effect of the degree of maturity of seeds. This maturity is accompanied by an increase to a significant degree in oleic, linoleic, and behenic acid with the detriment of the palmitic acid. Mirallès[26] and Diémé[8] having worked on the oil extracted from seeds coming from the same geographical area obtained the same prevalences. It is: oleic acid, palmitic acid, stearic acid, linoleic acid, ricosaéne-9 oïque acid; with a clear difference in values for the palmitic acid and the linoleic acid. In addition; Derbesy and Busson and Djenontin[7,9] had a composition in fatty-acid having a prevalence comparable with our results, nevertheless we note a significant variation for certain fatty-acids like the oleic acid and the linoleic acid. This is due to the difference in geographical area. The dispersion of the values is especially noted with the results obtained in Congo by Vieux[13] thus proving the action of the temperature on the chemical composition of oil; because working on samples preserved at the refrigerator during four (4) to six (6) months, it finds values different with a disturbance from the prevalence observed. The remarkable example is the increase in the stearic acid with a value of 59.5. Thus we can say that the profile of the fatty-acids depends on the state of seeds, the conditions of conservation and the geographical area.

CONCLUSION

The outputs of extraction to the soxhlet obtained by hexane on old or recent seeds of *Carapa will procera* of Senegal are nearly identical and reveal an important content of oil (58.5% on average).

The properties of the oil of *C. will procera* depend primarily on its chemical composition but also on the techniques of extraction and the degree of maturity of seeds used. Indeed, the method of extraction to the soxhlet decreases the index of iodine and saponification while it increases the acid value. The maturity of seeds is accompanied by an increase by acidity and index by saponification. Taking into account the therapeutic importance of the oil of *C. will procera*, an impact study of the genetic variability announced by Doligez[10] on the chemical composition of oil, and a research deepened on the composition in active elements are necessary.

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