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CHEMICAL PROFILE OF NUTMACADAMIA WASTE

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Abstract: Macadamia (Macadamia integrifolia Maiden & Betche), is a non-timber forest crop introduced in Brazil, considered the queen of Nuts. Commercial interest in the species increased in the 1990s. The macadamia fruit has a cream-colored almond (walnut). A crop with an average return rate of 25%. The aim of this work was to evaluate the chemical profile of nutmeg residue (peel), in order to know the chemical composition and possible classes of metabolites. The analyzes were carried out from the peels. For the chemical composition, the contents of total extractives, holocellulose and Klason lignin were determined. Phytochemical analysis was performed to identify secondary metabolites in the hydroalcoholic extract. The quantitative results found were 1.25% of total extractives, 57.65% of holocellulose and 29.86% of Klason lignin. Phytochemical prospection revealed the presence of phenols and tannins, alkaloids, flavones, flavonols, xanthones, leucoanthocyanidins, catechins and flovonones. Thus, it was possible to characterize the chemical profile of the Nutmacadamia residue.
Keywords: *Macadamia integrifolia Maiden & Betche*; Chemical profile; Phytochemical prospecting.

INTRODUCTION

Macadamia integrifolia Maiden & Betche, a member of the Proteaceae botanical family, is a tree native to the coastal rainforests of southern Queensland and northern New South Wales, Australia.

The emergence of commercial interest in Brazil only took place in the 1990s, which encouraged farmers to invest more in cultivation. In addition, local climatic conditions also facilitate the development of the crop [2]. Still, its cultivation was gradually being considered a form of income diversification on the property (mainly due to the long time for return on investment), leveraged by the growing demand for the product in the foreign market [3].

In Brazil, macadamia produced in 2018, about 6,000 tons in shell. For this year, the expected production is 7,200 tons. It corresponds to an increase of 20% compared to the previous year. Still showing little expressive values in relation to the potential.

The nut is surrounded by a shell, making it necessary to process the macadamia nut. Walnut processing generates 75% of agro-industrial by-products, which contribute to environmental pollution.

Residues of forest origin consist mainly of cellulose, polyoses (hemicellulose) and lignin, in smaller quantities extractives (secondary metabolites) and mineral substances.

The main objective of waste evaluation is to guide the most appropriate use of these by identifying their extractives and their ability to use, resulting in the definition of the best way to use them, defining recommended laboratory practices for their improvement.

Extractives are often responsible for certain characteristics such as color, smell, natural resistance to decay, taste and abrasive properties. The content and composition of extractives vary between species.

Thus, the classification can be considered a guide to obtain the maximum benefit, rather an orientation of how these residues must be used, both in terms of their components, and in natura as substrates and biomass.

Phytochemical studies comprise stages of isolation and identification of the most important major constituents of plants, mainly substances originating from secondary metabolism [4].

Research on extractives has been motivated by the discovery and characterization of new chemical structures, obtaining new products and by-products of commercial value and determining the problems related to some

uses of wood [5].

MATERIALS AND METHODS

For this study, the endocarps (peels of Macadamia fruits) were obtained at the TRIBECA nut processing plant, at Santa Marta Farm, located in the Municipality of Piraí, State of Rio de Janeiro. The endocarps (shells) of the macadamia nut as represented in Figure 1.

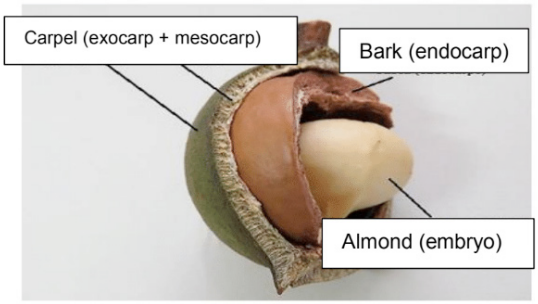

Figure 1. Macadamia fruit composition.

CHEMICAL CHARACTERIZATION OF THE ENDOCARP

For the chemical analyses, the endocarps were separated and then crushed in a mill to determine the extractive, holocellulose and lignin contents. Chemical analyzes were performed according to methods adapted from ASTM D 1105 [6]. Three repetitions of the endocarps were performed for each chemical analysis.

EXTRACTIVES CONTENT

The samples were dried in an oven to determine the moisture content. The extraction cycle occurred with cyclohexane, ethyl acetate and methanol solvents in a soxhlet type extractor. Then, each of the samples was separated by the distillation process through a rotavapor system (Rotary evaporator) in a water bath at a temperature of 80°C. Afterwards, the extracts obtained were determined using the equation:

$$\mathbf{TE\ (\%) = P2/P1x100}$$

Where, TE = extractive content (%); P2 = weight of concentrated extract (g); and P1 = Dry sample weight (g).

The methodology used to detect groups of extractives was proposed in the literature [7]. Their analyzes were carried out from the hydrophilic extract and the lipophilic extract of the endocarps.

RESULTS AND DISCUSSION

At Table 1 presents the results of the chemical analysis of the endocarp samples.

Extracts		
Lignina de Klason	**Holocelulose**	**Hydrophilic extractives**
33,98%	57,65%	7,41%

Table 1. Lignin, holocellulose and extractive contents:

It can be verified that the content of total extractives is smaller in relation to the literature data. It was found for macadamia bark residues, 14.7% of extractives [8]. It must be noted that the authors analyzed the entire bark (carpel and endocarp), not just the endocarp, the object of this study. The lignin contents found in the literature differ from those found in the tests carried out, there are no detailed records of the residues in their entirety (carpel and endocarp) or only the endocarps. According to [8] the lignin mentioned in macadamia bark assumes values of 40.1%. However, the values found in the endocarp samples of the *Macadamia integrifolia Maiden & Betche*, it was quantified in 33.98%. Table 2 presents the classes found.

Constituents	Hydrophilic Extract
Alkaloids	+
Tanins	+
Phenols	+
Flavones, Flavonols, Xanthones	+
Leucoanthocyanidins	+
Catechins	+
Flavanones	+
Flavonols, Flavanones, Flavanonols and Xanthones	+
Steroids	+
Triterpenoids	+

Table 2. Metabolic classes present, with hydrophilic extract and lipophilic extract of *Macadamia integrifolia Maiden & Betche endocarps.*

For the FT-IR spectroscopy analysis (Figure 2) the extracts obtained in the extraction cycle were used. The spectra were recorded on the Instrument: BRUKER model VERTEX 70, software: Opus version 6.5. FTIR analysis was performed using Attenuated Total Reflectance (ATR) mode - Analyzed range: 4000 to 400cm-^{1} Resolution:4 cm-^{1}. Spectra were obtained in triplicate for each extract.

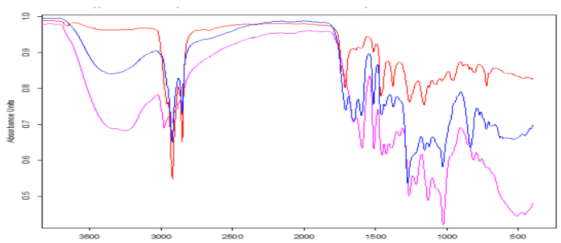

Figure 2. FT-IR spectroscopy analysis.

CONCLUSIONS

With the work it was possible to establish the chemical characterization of Macadamia Nut residues. Phytochemical prospecting elucidated several secondary metabolites with potential for study and use in different industrial and economic sectors.

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