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DEVELOPMENT OF YERBA MATÉ PRODUCTS WITH MICROWAVE HYDRODIFFUSION AND GRAVITY: PARTIALLY DECAFFEINATED YERBA MATÉ AND EXTRACT RICH IN CAFFEINE AND PHENOLIC COMPOUNDS

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1. Introduction

Yerba Mate (*Ilex paraguariensis*) is a species native to countries located in South America, such as Paraguay, Uruguay, Argentina and Brazil. The leaves and branches of yerba maté are industrialized to be used in the preparation of traditional beverages, such as chimarrão (with hot water) and tererê (with cold water) [1]. The beverages from this plant are known for their bitter taste, and for their functional properties, presenting stimulating and antioxidant effects associated with the presence of caffeine and phenolic compounds [2]. Besides yerba maté for the preparation of traditional beverages, extracts are also produced to diversify its use and apply the beneficial compounds of yerba maté in other products [3].

Even being a compound that is ingested with the purpose of improving physical and mental performance, increasing athletes' performance and concentration [4], caffeine can also present adverse effects if consumed in excess. Altered heart rate, increased blood pressure, nervousness, nausea, reduced fertility, and insomnia are some of the symptoms of excessive caffeine intake [5]. Since yerba maté is consumed in large quantities in traditionalist regions, some individuals may experience these symptoms. Therefore, depending on the consumer's daily caffeine intake, it is possible to develop different products, whether high-caffeine or low-caffeine.

Microwave hydrodiffusion and gravity (MHG) is a sustainable technology that combines microwave extraction with the Earth's gravity [6]. The extraction can be carried out free of solvent by means of fresh raw material or with the addition of water to humidify the dry material. This technique is used both for the extraction of polar compounds and for drying [7]. Therefore, the objective of this study is to determine if MHG allows for the processing of yerba mate with reduced caffeine content and an extract rich in phenolic compounds and caffeine in the same process.

2. Experiment

To partially remove the caffeine and obtain the extract, the yerba maté was previously moistened with 300 ml of distilled water, remaining at rest until all the water was absorbed by the sample (approximately 1 hour) and was subjected to extraction in the MHG using 400 Watts for 15 minutes [8]. To obtain the conventional yerba maté extract, 3 grams of sample were macerated in falcon tubes mixed with 30 mL of water [8]. The samples were shaken for 4 hours on an orbital shaking table (250 rpm) at room temperature.

The HPLC-UV/Vis (ProStar 210, Varian) equipment was used for the identification and quantification of caffeine. Hypersil Gold C18 column (5 µm particle, 4.6 mm, 250 mm) was used for chromatographic separation with isocratic elution with acetonitrile/water (30:70, v/v) at a flow rate of 1 mL/min and 5 minutes running time. The analysis was performed at room temperature [9]. Caffeine was identified by comparing the retention time and analysis of the peak spectrum of the sample with that of the caffeine standard. A calibration curve with the caffeine standard was used for the quantification, with readings performed at 270 nm wavelength.

The total phenolic compound content of yerba maté was evaluated using the Folin-Ciocalteau method, where the gallic acid standard was used to provide a calibration curve [10]. Readings were taken at a wavelength of 760 nm.

To evaluate the difference between the developed products and the control samples, the Student t-test with a 5% significance level was used.

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3. Results and Discussions

The results (Fig.1) show that with MHG it is possible to reduce by 38% of the caffeine content of yerba mate when we consider that 100% of the caffeine was removed by maceration for 4 hours. Therefore, it is a product that has been partially decaffeinated, being its reduction of more than 25%, the minimum percentage required to claim that a product has a reduction of some of its constituents [11].

When comparing the extract obtained by MHG with the extract obtained by maceration, MHG is a more advantageous process, because with this method it was possible to obtain an extract with a higher concentration of caffeine and phenolic compounds when compared to the conventional method (Fig. 2). In the extract of MHG was find 32.41% more caffeine and 41.89% more phenolic compounds when compared with the conventional extract. Besides providing a product with advantageous characteristics, the processing by MHG is also faster than the conventional method, taking 16 times less time than maceration to obtain the extract.

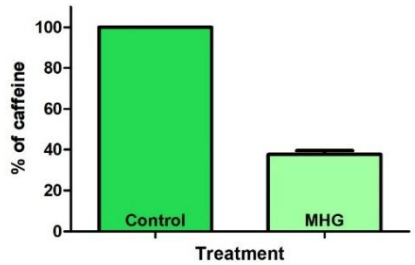

Fig. 1. *Percent (%) of caffeine extracted with MHG. The data are expressed as percent of control. The samples differ from each other using the Student's t-test at a significance level of 5%.*

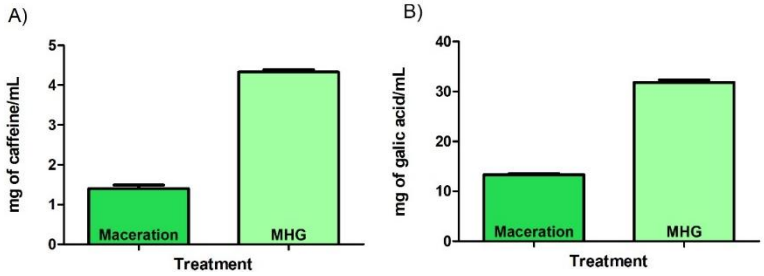

Fig. 2. *Caffeine and phenolic compounds from yerba maté extracts obtained by maceration and by MHG .The samples differ from each other using the Student's t-test at a significance level of 5%.*

MHG's technology shows itself as an efficient technique for obtaining yerba maté extract rich in phenolic compounds and caffeine, besides allowing the partial removal of caffeine from yerba maté. Through this work is seen the development of innovative products simultaneously with a fast and sustainable methodology, where these products can supply the different demands of the consumer market.

4. References

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