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INFLUENCE OF THE DRYING AIR TEMPERATURE ON THE ESSENTIAL OIL CONTENT OF *Melaleuca alternifolia* Cheel

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ABSTRACT

The purpose of the present study is to evaluate the influence of drying air temperature on the essential oil content of sliced *Melaleuca alternifólia* Cheel. Three samples were taken randomly from each treatment and analyzed when still fresh in order to determine the moisture and essential oil contents. The samples were then cooled in the B.O.D at 2 °C till completion of the drying process. For the application of drying tests, an updraft fixed-bed dryer was used equipped with a liquefied petroleum gas (LPG) burner to heat up the drying air. The air velocity was 0.5 ± 0.03 ms^{-1} and the relative humidity at the dryer entrance was 65%. The drying air temperatures were 40, 50, 60, 70 and 80°C. Three replications of the drying tests were done; where 500 g of the sliced plant cut into 5 cm thick layers were used. The essential oil was extracted in three hours by means of a hydro-distillation method. No statistical differences were detected between the drying treatments; however, when compared to the fresh plant, a reduction of 18.19% in oil content was observed as compared to the dried samples under different temperatures.

Keywords: medicinal plant, drying, hydro-distillation

INFLUÊNCIA DA TEMPERATURA DO AR DE SECAGEM NO TEOR DE ÓLEO ESSENCIAL DE *Melaleuca alternifolia* Cheel

RESUMO

No presente trabalho foi avaliada a influência da temperatura do ar de secagem sobre a quantidade do óleo essencial de *Melaleuca alternifólia* Cheel picada e tomadas, aleatoriamente, três amostras de cada tratamento as quais foram analisadas ainda frescas, avaliando-se o teor de água e o teor de óleo. Depois de retiradas as amostras o material foi resfriado em câmara climatizada a 2°C. Para a realização dos testes de secagem utilizou-se um secador de leito fixo, com fluxo de ar ascendente, equipado com um queimador de gás liquefeito de petróleo (GLP) para aquecimento do ar de secagem; a velocidade média do ar era de $0,5 \pm 0,03$ m s^{-1} e sua umidade relativa média de entrada era de 65%. As temperaturas do ar de secagem foram 40, 50, 60, 70 e 80°C. Para cada teste de secagem foram utilizados aproximadamente 500 g de folhas trituradas, perfazendo uma camada de 5 cm de espessura, além de realizados três testes por tratamento. O óleo foi extraído por hidrodestilação, por três horas. Não houve diferença estatística entre os tratamentos de secagem; entretanto, quando comparados com a planta fresca verificaram-se redução da quantidade de óleo de 18,19% em relação ao material secado nas diferentes temperaturas.

Palavras-chave: planta medicinal, secagem, hidro-destilação

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INTRODUCTION

The World Health Organization estimates that 80% of the world's population uses medicinal plants medicines in some way. The growing demand for medicinal species indicates the emergence of a market with high potential for consumption, requiring raw material of high quality, with regular supply and easy availability. To meet this demand, growth in the size and number of cultivation areas is occurring in the various regions of the country. For this reason, adequate dryers are needed, using temperature values for drying air that provides a rapid reduction in the water content without affecting the quality of medicinal plants active principles. Drying may also contribute to regular supply and facilitate the marketing of plants, because it facilitates the transport and storage (Castro & Ferreira, 2001).

The post-harvesting process of medicinal plants has great importance in the production chain, because of its direct influence on the quality and quantity of the active principles in the product sold (Silva & Casali, 2000).

Radünz et al. (2002) used 5 temperatures (ambient air and heated air at 40, 50, 60 and 70 ºC) for the drying of *Lippia sidoides* Cham, compared with the fresh plant, to evaluate the essential oil content. For the sample dried with natural air (ambient air) a significant reduction of 8% in the essential oil content was observed, while drying at 40, 50, 60 and 70°C showed no significant differences between it and the fresh plant.

Braga et al. (2005) evaluated the effects of different drying air temperatures (35, 40, 45, 50, 55 and 60ºC) on the yield and composition of essential oil from long pepper (*Piper hispidinervium* c. dc) leaves in a fixed-bed dryer. They observed that the essential oil yield increased after the drying process compared with the fresh plant. However, safrole content decreased about 20 percent when temperature was above 50ºC.

This study aimed to evaluate the influence of the drying air temperature on the essential oil content of the Melaleuca alternifólia.

MATERIAL AND METHODS

Melaleuca (*Melaleuca alternifólia*) plants from plantations located in the city of San Miguel do Anta, Minas Gerais were used.

The plant harvest was at 9:00 am, because active principle concentration is at its highest at this time (Silva, 2001). Three samples of 0.20 kg were taken randomly from each treatment which was analyzed fresh, evaluating the moisture and essential oil contents.

The moisture content of the samples was determined using the gravimetric method recommended by ASAE Standards (2000) for forage and similar plants. This was done by placing 25 g of the product in an oven with forced air circulation at 103 ± 2°C for 24 h, each done in triplicate.

The drying treatments were arranged in a randomized blocks with three repetitions. Five drying temperatures were evaluated: air heated at 40, 50, 60, 70 and 80 °C. For each temperature, 500 g from sliced plants (leaves and stems) were used, making a layer of 5 cm thick in the drying chamber.

An updraft fixed-bed dryer, equipped with a liquefied petroleum gas burner to heat the drying air was used as described by Radünz (2004). The air velocity was 0.5 ± 0.03 m s^{-1} and the relative humidity at the dryer entrance was 65%.

Drying was completed when the product reached a water content of 0.11 d.b. (10% w.b.). This value was set as an average between the values established for medicinal plants in different pharmacopoeias in many countries, ranging from 8 to 14% w.b. (Farias, 2003).

The essential oil was extracted by hydrodistillation utilizing Clevenger equipment, adapted to a round-bottomed two liter flask as described by Skrubis (1982) and Ming et al. (1996), with heating maintained at the minimum temperature required to the water boil. The flask was loaded with samples of 20 and 90 g of dried and fresh leaves of lemon grass, respectively. One litter of distilled water was added, which was volume sufficient to cover the material, beginning the hydrodistillation process. The extraction time was 90 min which was determined by preliminary tests, and three repetitions were performed for each treatment. After the beginning of process, hydrolat samples (mixture of water and oil) were taken each 30 min.

The oil was separated with pentane (3x30 mL) in a 500 mL separation funnel and the procedure was repeated 3 times. The organic fraction (pentane and essential oil) obtained

was transferred to a 125 mL Erlenmeyer flask and treated anhydrous magnesium sulfate (5 g). The mixture was filtered directly to a flask of 125 mL and concentrated in a rotary evaporator at 38°C and the oil obtained was transferred into a 5 mL bottle to be weighed. Quantification of essential oil was performed by weighing the samples on an analytical scale with an accuracy of 0.0001 grams. The essential oil contents, obtained from drying treatments, were compared to the fresh plant (control), and calculated according to Venskutonis (1997), based on dry matter.

RESULTS AND DISCUSSION

The variations of the plant moisture content as a function of the drying time, submitted to five drying air temperature 40, 50, 60, 70 and 80 °C are shown in Figure 1.

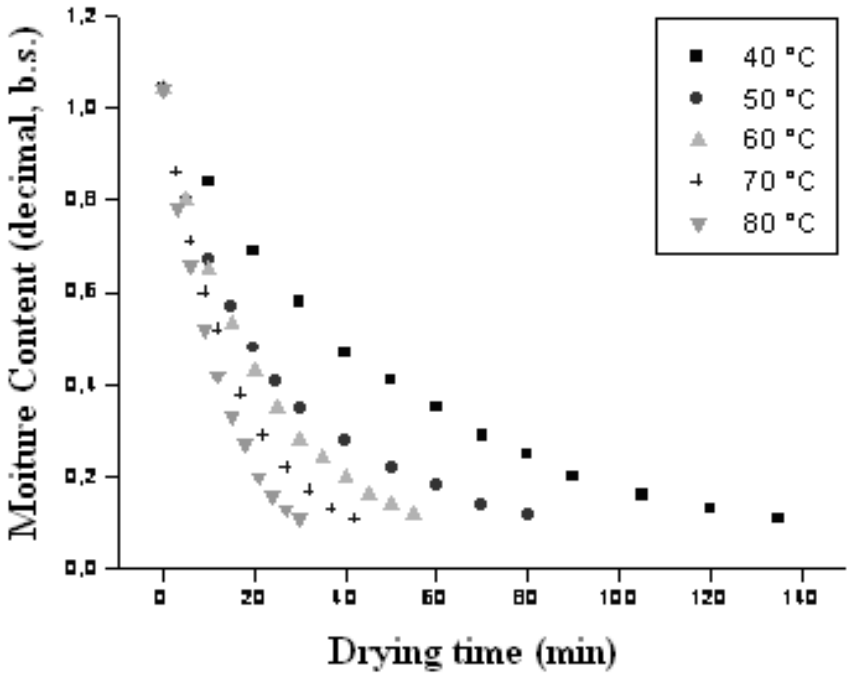

Figure 1. Average values observed for the moisture content as a function of the drying time, submitting melaleuca to five drying air temperature.

Figure 2 presents the results obtained in the analysis of the essential oil extraction from the sliced fresh plant (control) and in the samples submitted to the drying process with different temperatures.

It was found that there was no significant association between essential oil content and drying temperature (P> 0.05). However, from the results shown in Figure 2, it can be seen that the drying of the melaleuca slices in different temperatures provided a reduction in the essential oil content of approximately 18.19% compared to fresh plant sliced (P <0.05). These reductions can be attributed to volatilization of the essential oil during the drying process.

In works carried out with different medicinal species, it was also observed that the increase of air temperature can cause considerable reductions in the essential oil content compared to the fresh plant (Venskutonis, 1997; Silva, 2001; Borsato et al., 2005; Barbosa et al., 2006).

Other authors working with other medicinal plants also cited the influence of the drying air temperature on in the essential oil content, however, they have reported that the increase of the air temperature can increase the essential oil production (Martins, 2000; Radünz, 2004; Martinazzo, 2006).

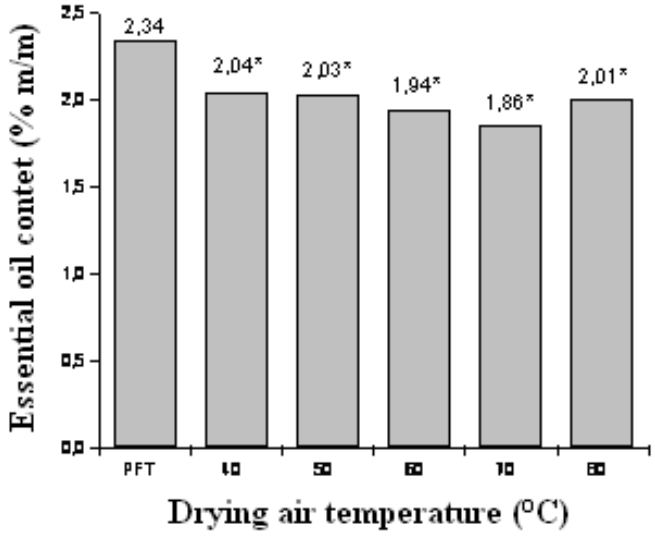

Figure 2. Essential oil Content extracted from leaves of melaleuca submitted to drying in the fixed-bed dryer with different air temperatures compared to the sliced fresh plant (control). *Significant difference in relation to control by the Dunnett test to 5% significance. Coefficient of variation: 5.34%.

CONCLUSIONS

The essential oil content extracted from the dried plant was not affected by different drying temperatures, however, the drying caused reduction in the essential oil content compared to the fresh plant.

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BIBLIOGRAPHY REFERENCE

ADAMS, R. P. **Identification of essential oil components by gas Chromatography mass spectroscopy**. Carol Stream, Illinois: Allured Publ. Corp., 1995. 469p.

Barbosa, F. F.; Barbosa, L. C. A.; Melo, E. C.; Botelho, F. M.; Santos, R. H. S. Influência da temperatura do ar de secagem sobre o teor e a composição química do óleo essencial de Lippia alba (Mill) N. E. Brown. **Química Nova**, v.29, n.6, p.1221-1225, 2006.

Borsato, A.V.; Doni-Filho, L.; Ahrens, D.C. Secagem da camomila [*Chamomilla recutita* (L.) Raeuchert] com cinco temperaturas do ar. **Revista Brasileira de Plantas Medicinais**, v.7, n.2, p.77-85, 2005.

Braga, N. P., Cremasco, M. A.; Valle, R. C. C. R. The effects of fixed-bed drying on the yield and composition of essential oil from long pepper (*Piper hispidinervium* c. dc) leaves. **Brazilian Journal of Chemical Engineer,** v. 22, n.2, p.257-262, 2005.

Castro, H. G. de; Ferreira, F. A. **Contribuição ao estudo das Plantas Medicinais: carqueja (*Baccharis genistelloides*).** Viçosa-MG. 2001. 102p.

Farias, M. R. Avaliação da qualidade de matérias-primas vegetais. In: SIMÕES C.M.O. et al. **Farmacognosia: da planta ao medicamento**. 5 ed. Porto Alegre/Florianópolis: Editora da UFRGS/Editora de UFSC, 2003.

Martinazzo, A. P. **Secagem, armazenamento e qualidade de folhas de *Cymbopogon citratus* (D.C.) Stapf.** Viçosa: UFV, 2006, 159p. (Tese de Doutorado)

Martins, P.M. **Influência da temperatura e da velocidade do ar de secagem no teor e na composição química do óleo essencial de capim-limão (*Cymbopogon citratus* (D.C.) Stapf).** Viçosa: UFV, 2000. 77p. (Tese de Mestrado)

Ming, L.C., Figueiredo, R.O., Machado, S.R., Andrade, R.M.C. Yield of essential oil of

and citral content in different parts of lemongrass leaves (*Cymbopogon citratus* (D.C.) Stapf.) Poaceae. **Acta Horticulturae**, v.1, n.426, p. 555–559, 1996.

Radünz, L. L. **Secagem de alecrim pimenta, guaco e hortelã comum sobre diferentes temperaturas e sua influência na quantidade e qualidade dos princípios ativos.** Viçosa: UFV, 2004, 90p. (Tese de Doutorado)

Radünz, L. L.; Melo, E. C.; Martins, P. M.;S, R. H. S.; Santos, R. R.; Machado, M. C. Secagem de alecrim-pimenta (*Lippia sidoides* Cham.) em secador de leito fixo. **Revista Brasileira de Plantas Medicinais,** v.5, n.1, p.79-82, 2002.

Silva, F. da; Casali, V. W. D. **Plantas Medicinais e aromáticas: Pós-Colheita e Óleos Essenciais.** Viçosa-MG: UFV, DFT, 2000. 135p.

Silva, S. R. S. **Composição química, avaliação da atividade antimicrobiana do óleo essencial e deficiência de *Melaleuca alternifolia* Cheel crescida no Brasil.** Viçosa-MG: UFV, 2001, 60p. (Tese de Mestrado)

Skrubis, B. G. The drying of laurel leaves. **Perfumer & Flavorist**, v.7, n.5, p.37-40, 1982.

Venskutonis, P. R. Effect of drying on the volatile constituents of thyme (*Thymus vulgaris*) and sage (Salvia officinalis L.). **Food Chemistry**, v. 59, p.219-227, 1997.

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