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Microwave Oven Extraction of an Essential Oil

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The essential oil, extracted by a current of air from the leaves of *Lippia sidoides* Cham. heated in a microwave oven for 5 minutes, was qualitatively identical with that obtained by conventional steam distillation for 60–90 minutes.

KEY WORDS Essential oil *Lippia sidoides* Cham. Microwave oven Steam distillation

INTRODUCTION

A new technique for essential oil extraction in semi-micro scale, using a modified commercial microwave oven, was developed for routine experiments in the natural products laboratory. This new extraction system, illustrated in detail in Figure 1, can replace with advantage the standard steam distillation method for qualitative purposes. The method is feasible for amounts of plant material in the 30–40 g range and the time necessary for complete extraction (5 min) is significantly shorter than the steam distillation technique (60–90 min). The oil chemical composition appears not to be modified by the process, since no qualitative differences were detected in the chemical composition of the oils obtained using the two methods.

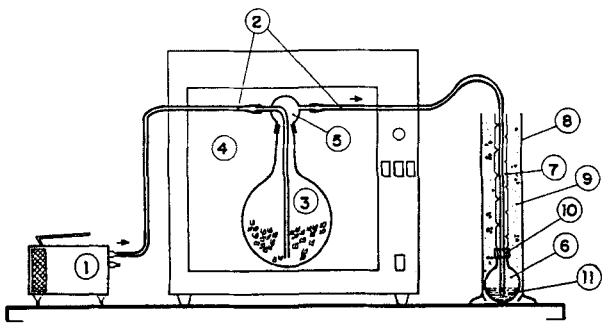

Fig. 1. System for essential oil extraction by microwave oven. (1) Air pump. (2) Teflon ducts. (3) One-litre round-bottom flask 24/40 with fresh leaves. (4) Microwave oven. (5) Washing flask head. (6) 50-ml round-bottom flask. (7) Vigreux column 24/40. (8) One-litre graduated cyclinder. (9) Ice/salt mixture. (10) Teflon seal. (11) Distilled water and oil (20–30 ml)

EXPERIMENTAL

Microwave Oven Modification

A Westinghouse domestic microwave oven was used after a small modification that consisted in drilling two holes with 15 mm diameter in the back to allow the connection of teflon tubing (see Figure 1).

Plant Material

Freshly harvested leaves from *Lippia sidoides* Cham.[1] growing in the Medicinal Plant Garden of the Laboratory of Natural Products of UFC, at Fortaleza, was used in this experiment. Eleven samples of this material were separated. One weighing 300 g was submitted to conventional steam distillation and ten others weighing 30–40 g. were used in the microwave extraction procedure.

Conventional Steam Distillation

The system developed before[2] was used, the vessel was charged with the plant material and the extraction time was 1.5 hours. The oil obtained was separated from residual water extracted with dichloromethane and analysed by CG–MS.

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Microwave Oven Distillation

Plant material (30–40 g) was charged in the apparatus shown in Figure 1. The oven was set to high cooking level and heated for 5 minutes. The mixture of oil and water obtained in the flask was extracted with dichloromethane and submitted to GC–MS analysis. A comparison between yield data of plant material distilled by both procedures is not presented because the main objective of microwave extraction is to have a more adequate extraction method for a very rapid and qualitative semi-micro analysis.

Essential Oil Analysis

GC–MS was performed on an HP–5995 Hewlett-Packard instrument equipped with a fused silica capillary column coated with SP-2100 column (30 m × 0.25 mm i.d.). Nitrogen was used as carrier gas at a rate of 1 ml/min and the programmed temperature was 50–250° C at 4° C/min.

RESULTS AND DISCUSSION

GC–MS analyses of eleven samples extracted from the same species (*Lippia sidoides*[1]) gave similar results, and data from two oil samples obtained by microwave oven and steam distillations were used for comparison. The overall composition in both oils appears to be the same as shown in Table 1, where no qualitative differences were detected, although the percentage composition for each components in the two analyses varies significantly.

The major advantage of the microwave oven extraction is that a relatively small amount of plant material is required, the time for complete extraction is shortened and no water is added to the extraction vessel. This method is designed to appreciate variations in the chemical composition of small samples extracted from the same plant at different times of the day.

The process can be used in other comparisons but, owing to the amounts of plant involved and the final set-up for oil collection, no quantitative measurements can be accurately made or yields quantified.

Table 1. Essential oils from *Lippia sidoides* Cham. obtained by two processes

MICROWAVE OVEN Compund	%	STEAM DISTILLATION Compund	%
α-Thujene	0·73	α-Thujene	2·79
α-Pinene	0·10	α-Pinene	0·90
Myrcene	3·45	Myrcene	3·19
α-Terpinene	1·66	α-Terpinene	1·80
p-Cymene	16·41	*p*-Cymene	14·72
1,8-Cineole	0·10	1,8-Cineole	1·73
trans-Ocimene	0·74	*trans*-Ocimene	0·10
γ-Terpinene	7·58	γ-Terpinene	5·61
Methylthymol	2·18	Methylthymol	2·42
Thymol	58·43	Thymol	49·79
Thymyl acetate	1·07	Thymyl acetate	1.21
β-Caryophyllene	5·67	β-Caryophyllene	13·94
β-Maaliene	0·10	β-Maaliene	1·03
Total	98·22	Total	99·23

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