



**VOLATILE OIL CONSTITUENTS OF *ROSMARINUS OFFICINALIS* L. OBTAINED  
IN OPEN-AIR MARKET FROM RIO DE JANEIRO**

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**ABSTRACT**

The chemical composition of volatile oil samples of *Rosmarinus officinalis* L. obtained in open-air market from Rio de Janeiro city have been characterized by GC/FID and GC/MS. The plant material was extracted by simultaneous distillation-extraction in the first day of its acquisition and two day after. The major components identified in the oil of *R. officinalis* were  $\alpha$ -pinene (9.4–11.8%),  $\beta$ -pinene (5.5–8.5%), myrcene (8.6–11.3%), 1,8 cineole (12.6–13.2%), camphor (23.2–34.5%) and verbenone (7.7–20.9%). The oil isolated from the same sample, but in different days presented similar composition quantitative and qualitative, except by significant changes in 1, 8 cineole and verbenone contents. The high amount of camphor found in volatile oils, in comparison to other alecrim oils, suggested to classify this sample of *R. officinalis* as a camphor chemotype.

**Keywords: Alecrim, Camphor, Essential Oil, Medicinal Plant, Verbenone**

**INTRODUCTION**

The sale of *Rosmarinus officinalis* L. common. In Brazil, the open-air market is (Lamiaceae) at informal market is very one of the main available sources of

medicinal herbs in urban areas, and many times these places are sources of dissemination of information through the popular uses of medicinal plants for different diseases, including guidance from preparation to be used.

Report published by WHO (World Health Organization) confirms that the plants used by traditional communities without academic knowledge or pharmaceutical manuals are effective in the treatment of diseases, being justified by special metabolites verified, after finding by phytochemical research. The WHO noted that it is very necessary incorporate the traditional medicine to modern medicine, to implement the better health systems [1].

Due to Brazilian biological diversity, especially among plants, the search for new drugs and its effects require a rigorous and continuing research in each phytogeographic region [1-2]. Much of the potential use of medicinal plants comes from efforts to meet the pharmacology of local flora [3]. Brazil covers a wide area with different geographical environments, in which the flora is abundant and diverse, providing a potential resource in early bioactive [4].

The open-air market has two purposes, to offer an opportunity for the small family farmer acquire socio-economic independence, and search that available

access to quality food from family production and consequent recovery of this product. Brazilian open-air markets are characterized according to its periodicity and right places.

Rio de Janeiro Municipality has about 210 licensed open-air market located in the Northern and Southern zones. The main medicinal plants sold in open-air market around Rio de Janeiro are member of the Asteraceae and Lamiaceae families [5]. Medicinal plants sold in open-air market have not yet validated and its chemical components have not been tested. In view of this, approximate the herb sellers and research institutions is an interesting strategies to provide better exchange of scientific and empirical information and to safe plant material and quality of products that are sold to consumers.

*R. officinalis*, popularly known as rosemary, and alecrim in Brazil, is used for flavoring food and as a beverage drink, also immersed in olive oil as food spice. In folk medicine, it is used to treat hepatic, intestinal, renal and respiratory affections. It is also known for its colagogue, antispasmodic activities and at stimulating the hair growth [6-8]. Rosemary is rich in monoterpenoids that are responsible for its aroma and taste, and that has shown wide antimicrobial and antifungic activities [9-12]. Regarding the analysis of essential oils of *R. officinalis* L.

from different geographic origins, studies have been demonstrated some chemical variability. The main constituents described for rosemary oils were  $\alpha$ -pinene, 1,8 cineole, myrcene and camphor [13-16]. The aim of this study was to investigate the chemical composition of *R. officinalis* volatile oil freely sold in fairs and its terpenoid changes until three days after purchasing.

## MATERIALS AND METHODS

### Plant Material

*Rosmarinus officinalis* samples were obtained in October 2008 from the same open-air market, in Rio de Janeiro city (Brazil) located between 22° 54' 24" S and 43° 10' 21" W geographic coordinates. The open-air market happens weekly on Monday and Thursday, in the morning. YLA 1, YLA 2 and YLA 3 were purchased in the same day – Monday; while YLA 4 was obtained in the Thursday of the same week. A voucher specimen was authenticated by Erika von Sohsten Medeiros from Rio de Janeiro Botanical Garden (RB), Brazil, and is deposited at the Herbarium of Rio de Janeiro Botanical Garden, under accession number RB 471608.

### Volatile Analysis

Fresh plants (5 g) were homogenized with 100 mL of distilled water and submitted to simultaneous distillation extraction (SDE) for 2 h using 2 mL of dichloromethane as an

organic collecting solvent. Part of the same plant material obtained in Monday was collected in the same day, and others maintained at room temperature ( $\pm 26^{\circ}\text{C}$ ) for further extraction. Essential oil of YLA 1, YLA 2 and YLA 3 samples were extracted in Monday, Tuesday and Wednesday, respectively. The sample YLA 4 was submitted to distilling process in the same day it was purchased, on Thursday.

Analytical GC/FID was carried out on a Varian Star 3400 gas chromatograph fitted with a DB-5/MS column (30 m  $\times$  0.25 mm, film thickness 0.25  $\mu\text{m}$ ) and equipped with flame ionization detection (FID). Temperature was programmed from 60° – 240°C at 3°C min<sup>-1</sup>. Sample injection of 1  $\mu\text{L}$  was performed at 270°C, splitless mode. Hydrogen was used as carrier gas, at linear velocity of 1 mL min<sup>-1</sup>.

GC/MS analyses were performed using a Shimadzu Model GC MS-QP 2010 Plus apparatus under the following conditions: column, ZB-5MS fused silica capillary column (30 m  $\times$  0.25 mm, film thickness 0.25  $\mu\text{m}$ ); carrier gas, helium at 1 mL/min; injection of 1  $\mu\text{L}$ ; split ratio 1:40; injector temperature, 270°C; interface 230°C; column temperature, 60° – 240°C at 3°C min<sup>-1</sup>; mass spectra, 70 eV

### Identification of Components

The identification of the constituents was achieved by comparison of Retention

Indices (RI) calculated for all volatile contents using a homologous series of n-alkanes (C<sub>8</sub>-C<sub>28</sub>) recorded under same operating conditions, comparison of MS data and their GC with those of standard samples held in the computer library search National Institute of Standards and Technology (NIST) and literature [17].

## RESULT AND DISCUSSION

The compounds identified for *R. officinalis* are listed in **Table 1**. It was identified 26 constituents in the leaf oil of *R. officinalis*. The main constituents in the plant oil of *R. officinalis* obtained in open-air market were  $\alpha$ -pinene,  $\beta$ -pinene, myrcene, 1,8 cineole, camphor and verbenone. Different chemotypes have been classified to *R. officinalis* according to the major compounds in the volatile oil. It has been reported four chemotypes:  $\alpha$ -pinene, 1,8 cineole, myrcene and camphor [15]. Camphor was the most abundant component in the essential oil of samples from Rio de Janeiro. Camphor is used to clear the lungs, dispel apathy and calm nervous depression. It is widely employed as analgesic, antiseptic, antiinflammatory, arthritis, muscular aches and pains, rheumatism, bronchitis, coughs, colds, fever, flu and in respiratory infections [18]. Celiktaş *et al.* [19], suggest that changes in chemical composition of *R. officinalis* oils depend on climate variations, and cool climate may be

responsible for abundant amount of camphor. In the present study, the conditions that contribute to oil variation were not associated to low temperature, considering that Rio de Janeiro is a typical tropical area where the average of temperature recorded was 23°C, in October (Instituto Nacional de Meteorologia - INMET, Brazil). These data suggest that the percentage amount of verbenone in rosemary purchased on Monday and isolated in the same day was higher (20.91%) than the same plant material isolated in two following day. The oil of the YLA 1 sample was characterized by higher amount of verbenone, low percentage of 1,8 cineole (1.58%) and absence of the first monoterpenes when compared to other samples, resulting in reduced percentage of monoterpenes (74.2%). One of the reasons to these discrepant data in comparison to YLA 2 and YLA 3, could be the oxidation of the pinenes with air to produce verbenone [19]. Verbenone is a natural organic compound used for insect control, playing an important role in the control of the Southern pine bark beetle threat to pine trees. Linalool, camphor and verbenone monoterpenes decreased their levels in late isolations (YLA 2 and YLA 3) agreement with the easy volatilization of this chemical class. Cedrene decreased in more than 50% in the second and third samples isolation of

volatile oil (YLA 2 and YLA 3). The results obtained for YLA 2 and YLA 3 (first acquisition) compared to YLA 4 (second acquisition) were quantitative and qualitative very similar, indicating the same origin of plant material sold in the open-air market. Monoterpenes were the major components, accounting for about 74.2-93.7% of the total oil composition.

Considering the use of medicinal herbs by folk people, it is relevant the run time of use of plant material after acquisition that can be applied to prepare food in the same day or in the followings. volatile oil isolated from plant material maintained under ambient temperature until second and third day decreased camphor, verbenone and cedrene constituents, resulting slight impairment in aroma and taste quality of condiment. Compared to other *R. officinalis* Brazilian samples, oils from Rio de Janeiro have presented different major compounds. Oils from South Brazil, Rio Grande do Sul (RS), revealed pronounced percentage of  $\alpha$ -pinene (40.5%/44.5%) and 1, 8 cineole (17.4%/17.5%) [16, 21].

## CONCLUSION

In conclusion, *R. officinalis* volatile oil from Rio de Janeiro possessed higher camphor content (27.1%). These results show the importance of knowing phytochemical characteristics of the medicinal plants we are using and the plant material origin. This

study also verified a slight quantitative variation in the volatile oils components between second and third day of the extraction from same plant material acquisition.

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Table 1: Constituents (%) of the Oils of *Rosmarinus officinalis* L. From Open-Air Market, Rio De Janeiro

Constituents <sup>a</sup>	RI <sup>b</sup>	Relative Area			
		Acquisition 1 (Monday)			Acquisition 2 (Thursday)
		YLA 1	YLA 2 <sup>c</sup>	YLA 3 <sup>d</sup>	YLA 4
<i>α</i> -pinene	935	*	11.2	11.8	9.4
<i>α</i> -camphene	951	*	3.82	4,20	4.09
verbenene	953	*	0.15	0.15	0.1
<i>β</i> -pinene	978	*	5.5	7.0	8.5
myrcene	988	0.5	11.3	11.2	8.6
<i>α</i> -phellandrene	1003	*	0.22	0.22	0.2
<i>α</i> -terpinene	1015	*	0.57	0.62	0.63
<i>p</i> -cymene	1024	*	3.02	3.12	2.76
limonene	1029	0.29	*	*	*
1.8 cineol	1033	1.58	13.2	13.4	12.6
<i>γ</i> -terpinene	1059	0.52	1.71	1.94	2.27
<i>p</i> -mentha-2.4(8)-diene	1084	0.46	0.85	0.88	0.82
linalool	1098	2.86	0.89	0.84	0.94
chrysanthenone	1122	0.44	0.55	0.48	0.25
camphor	1153	34.5	26.4	24.4	23.2
pinocarvone	1163	0.1	0.43	0.46	0.65
menthol	1171	0.8	1.18	1.0	1.09
borneol	1173	2.06	*	*	*
n.i.	1174	*	0.39	0.4	0.5
terpinen-4-ol	1180	*	0.93	0.98	1.15
n.i.	1194	5,95	2.15	2.0	2.2
verbenone	1207	20.9	8.2	7.7	8.85
n.i.	1219	0.25	*	*	*
n.i.	1266	*	0.26	0.22	0.15
bornyl acetate	1282	2.96	0.51	0.86	1.54
jasmone	1387	*	0.16	*	*
cedrene	1413	9.2	2.79	2.9	4.9
santalene	1450	1.7	0.52	0.53	1.0
<i>β</i> -gurjunene	1470	0.4	*	*	*
n.i.	1635	0.4	*	*	*
epi- <i>α</i> -bisabolol	1681	0.83	0.24	0.21	0.34
Monoterpenes		74.2	93.7	87.4	90.6
Sesquiterpenes		12.5	3.5	3.6	6.2
Total identified		86.7	97.2	91.0	98.8

NOTE: <sup>a</sup>Arranged According to Retention Time in DB-5 Column. <sup>b</sup>Retention Indices Calculated. <sup>c</sup>Plant Material Obtained on Monday and Extracted in Tuesday, <sup>d</sup>Plant Material Obtained in Monday and Extracted in Wednesday. \*Not Detected. n.i., Not Identified