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Short Communication

Volatile constituents of essential oil from *Citrus sinensis* grown in Tien Giang Province, Vietnam

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Abstract

Hydrodistilled essential oil from the peel of *Citrus sinensis* grown in the suburbs of HoChiMinh City was analysed by GC and MS. Numerous compounds were identified, of which limonene, β – myrcene and α – pinene were major components. Small amounts of decanal, sabinene, linalool, α – Terpineol and nerol were also detected.

Keywords: *Citrus sinensis,* essential oil, limonene, GC – MS

Introduction

The genus *Citrus*, a member of the Rutaceae, is widely grown in warm climate regions. *Citrus sinensis* is native to Southeast Asia. Orange essential oil is used in soap, food, perfumes, chemicals and many other products. D-limonene (90%), the main ingredient in orange peel oil, provides a natural odour. There have been many studies conducted to determine the chemical composition in essential oil of orange peel. For example, the essential oils of orange peel from Iran which have been identified include limonene (92.42%) and β-myrcene (3.89%)[4]. Oranges grown in Italy had the main components of limonene (93.67%) and β-myrcene (2:09%) in essential oil[1]. Extensive studies on the chemical composition of various *C. sinensis* species have also been conducted.

Vietnam has a tropical climate, which is favourable for growing citrus. Despite having great potential, it has not been fully exploited and utilized. This research on chemical composition of the essential oil of *C. sinesis* grown in Vietnam was aimed at commercialising and optimizing the process for essential oil laboratory scale distillation.

Materials and Methods

Peel of oranges grown in Cai Be, Tien Giang province, in a green and fresh form was obtained.

Fifty grams of orange peel were subjected to hydrodistillation using a Clevenger-type apparatus to survey and optimize factors affecting yield of essential oil in the laboratory such as: concentration of salt solution, soaking time, time of distillation. Solubility in alcohol and freezing point of essential oil were also studied. The oil obtained was dried over anhydrous sodium sulphate and kept in sealed vials while awaiting GC – MS analysis.

GC-MS analysis was carried out with a Hewlett-Packard HP 5890 GC/5972 MS. Samples were subjected to the GC column (Rt×5MS - 29m×250micron,0.25micro film), at flow rate of 1ml/min at 250^{o}C. Detector temperature was set at 280^{o}C. MS scan mode: full (35-450 amu) Atune. The oven temperature was held at 40^{o}C for 5 min, programmed at 3^{o}C/min to 200^{o}C and second programmed at 10^{o}C/min to 300^{o}C then held at this temperature for 5 min.

Results and Discussion

From the study, we obtained the following specifications:

- The concentration of salt solution: 2%
- Soaking time: 1 hour
- Time of distillation: 50 minutes

Solubility of essential oil in alcoholic solutions:

- 90^{o} alcohol: essential oil = 9 : 1
- 85^{o} alcohol: essential oil = 12 : 1
- 80^{o} alcohol: essential oil = 23 : 1

The temperature under which essential oil was crystallized, was under -22^{o}C. The 13 compounds identified in the oil are listed in Table 1. Limonene (96.46%) was the major component followed by β-Myrcene (2.15%). From Table 1 it is clear that the essential oil of *C.sinensis* grown in Vietnam is dominated by monoterpen, limonene was more than the minimum requirement of 90%.

Table 1. Chemical composition of the volatile oil of Vietnamese orange peel.

Compound	Area (%)
Limonene	96.46
Beta – Myrcene	2.13
Alpha – Pinene	0.51
Decanal	0.12
Sabinene	0.09
Linalool	0.07
Alpha – Terpineol	0.07
Geranyl acetate	0.06
Alpha – Phellandrene	0.04
Citronellyl n – propionate	0.04
Copaene	0.02
Delta – Cadinene	0.02
Neryl acetate	0.01

This Limonene rate was high when compared with other rates for essential oils from many other countries (Table 2).

Table 2. Comparison of the chemical composition of the essential oil from various countries.

Compound	Italian [1]	Valencia [3]	North Iranian [4]	Cai Be Vietnam
Limonene	93.67	97.0	92.42	**96.46**
α-Pinene	0.65	-	0.94	0.51
Sabinene and β-pinen	1.00	-	-	0.09
Myrcene	2.09	0.03	3.89	2.13
Octanal	0.41	-	-	-
Linalool	0.31	0.03	0.63	0.07
δ-3-Carene	0.31	-	-	-
Decanal	0.27	-	0.38	0.12

This rate for Limonene was also high when compared with rate for essential oil which was obtained from another location in Tien Giang Province (Table 3).

Table 3. Comparison of the chemical composition of the essential oil from two different locations in Tien Giang Province, Vietnam.

Compound	Cho Gao District[2]	Cai Be District
Limonene	84,86	**96.46**
β – Myrcene	-	2.13
α – Pinene	2,67	0.51
Decanal	0,52	0.12
Sabinene	0,08	0.09
Linalool	0,54	0.07
α – Terpineol	0,36	0.07
Geranyl acetate	-	0.06

The cultivar of *C. sinensis*, farming conditions, maturity of oranges, etc. affected the components of essential oil, especially the concentration of limonene in oil. Therefore, these factors should be further studied for their influence, which will help increase the concentration of limonene in orange oil.

Conclusion

Essential oil obtained by distillation with a Clevenger-type apparatus, had 1.167 ml/50g yield. Limonen content (96.46%) in Cai Be (Tien Giang, Vietnam) essential oil, which had higher limonene content than essential oil from other countries, should be suitable for commercialization and application in food technology.

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