Chemical Constituents and Comprehensive Application of the Essential Oil from Artemisia Argyi

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Abstract: Objective: To research the chemical constituents of antibacterial active ingredient of the essential oil from the artemisia argyi. Methods: High performance liquid chromatography and gas chromatography-mass spectrometry were applied for the identification of chemical constituents in different extraction methods from Artemisia argyi. Results: Fifty chemical components were detected and twenty compounds were identified in the essential oil. The chemical constituents were mainly including artemisol (55.49%), 3,3,6-Trimethyl-1, 4-heptadien-6-ol (15.37%), Eucalyptol (11.87%) and 4-methyl-1-(1-methylethyl)- 3-Cyclohexen-1-ol (3.50%), mostly composed of terpenoids. Conclusion: The main components in the essential oil and water exraction from artemisia argyi were elucidated.

1 INTRODUCTION

The essential oils of traditional chinese medicine are present in various aromatic plants such as artemisiae argyi, amomi fructus, cinnamomi cortex, zanthoxyli pericarpium et al. Several techniques have been used to obtain essential oils from the plant, including steam distillation, supercritical fluid extraction, solvent extraction. Yuan Haibin analyzed the volatile oil extraction rate in solvent extraction and supercritical-CO_2 fluid extraction, and compared the main components. The extraction rate was 2.7 times higer than solvent extraction through supercritical-CO_2 fluid extraction, and thirty-one compositions were defined by solvent extraction and its main compositions were 2,5,5-trimethyl-1,3,6-Heptatriene, β-Pinene and et al. Twenty-two compositions were defined by supercritical-CO_2 fluid extraction. Therefore, we selected the asolvent extraction for further research. The main compositions of essential oils are low molecular weight aroma chemicals such as aromatic and aliphatic compounds. Now, essential oils and some of their extract components from traditional Chinese medicine have been widely used in air fresheners, food additives, cosmetics, as well as in medicinal uses (Aparicio-Soto 2016).

Artemisia argyi is traditional Chinese herbal medicinewidely which is scattered throughout China, and frequently used for diseases treatment including inflammation, eczema and tuberculosis (Gao 2017). Recently study on Artemisia argyi found that both its volatile oil and water extracts exhibited good antibacterial, immune regulation effects, anti-inflammatory (Chen 2017). In-depth studies on the chemical constituents of artemisia argyi have shown that many constituents are identified from artemisia argyi extract and dried leaves, such as 1,8-cineole, borneol oil, chlorogenic acid, neochlorogenic acid, cryptochlorogenic acid, Isochlorogenic acid b, isochlorogenic acid c and pigenin (Dai 2015). The main purpose of this paper was to comparative study on volatile oil components and water extract components of argyi leaves and further identify antimicrobial components on the basis of the Preparation of the Essential Oil from Artemisia Argyi Grown in Qichun, China and its application in Antibacterial effection.

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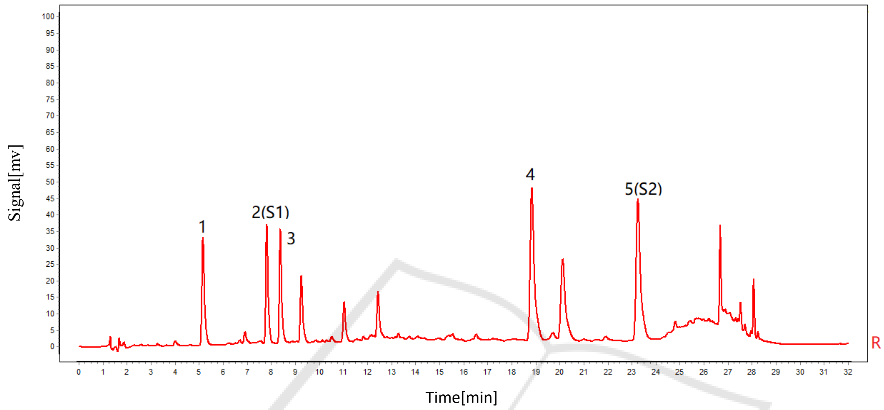
2 MATERIALS AND METHODS

2.1 Material and Essential Oil Extraction

Artemisia argyi were collected during May in China. Five samples of the leaves (5kg for each samples) from artemisia argyi were hydrodistilled for 5 h in extraction equipment. The essential oil and water extraction were collected for further analysis (Li 2021).

2.2 High Performance Liquid Chromatography

Fingerprints of water extraction of artemisia argyi were determined by HPLC-PDA. All samples were analyzed by HSS T3 C18 (150mm×2.1mm, 1.8μm) maintained at 30°C, and eluted with acetonitrile-0.1% formic acid at the flow rate of 0.3mL/min, and the detection wavelength was 235nm respectively (Shin 2017).



Peak 1: Neochlorogenic acid; Peak 2: Chlorogenic acid; Peak 3: Cryptochlorogenic acid; Peak 4: Isochlorogenic Acid B; Peak 5: Isochlorogenic acid C

Figure 1: Fingerprint of artemisia argyi.

2.3 Gas Chromatography-Mass Spectrometry (GC-MS)

GC-MS analyses were performed on an Agilent Technologies 6890 Plus equipped with an Agilent Technologies MSD 5973 mass-selective detector and the same columns (Seo 2003). Helium was the carrier gas at a flow rate of 1.5 mL/min. Column temperature was initially at 60°C for 5 min and then gradually increased to 200°C at a 5°C/min rate and held for 20 min. Injector temperature was set at 250°C (Silva 2003). For mass spectrometry detection. The injector, ion source and quadrupole rod temperatures were set at 250°C, 230°C and 150°C, respectively. The injection volume was 10 μL with split ratio 1:20. Mass spectrum recorded under electron impact ionization mode (EI) with ionization energy 70 eV and mass scan range of 55–550 amu (Tsibranska 2003).

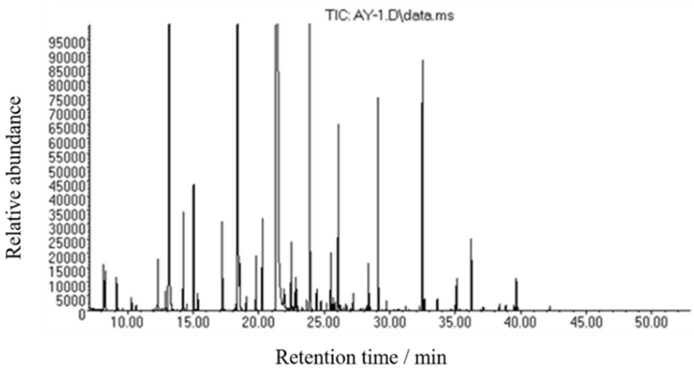


Figure 2: Total ion chromatogram the volatile oil of artemisia argyi.

Table 1: Composition of the essential oil from artemisia argyi grown in Qichun.

No.	Retention time / min	Chemical formula	Molecular weight	Compounds	Relative content /%
1	8.166	$C_{10}H_{16}$	136	α-Pinene	0.31%
2	9.149	$C_{10}H_{16}$	136	2,5,5-trimethyl-1,3,6-Heptatriene	0.22%
3	10.281	$C_{10}H_{16}$	136	β-Pinene (Tautenhahn 2012)	0.08%
4	12.301	$C_{10}H_{16}$	136	1-methyl-4-(1-methylethyl)- 1,3-Cyclohexadiene	0.38%
5	12.861	$C_{10}H_{16}$	136	Limonene	0.14%
6	13.171	$C_{10}H_{18}O$	154	Eucalyptol	11.87%
7	14.241	$C_{10}H_{16}$	136	1-methyl-4-(1-methylethyl)- 1,4-Cyclohexadiene	0.70%
8	15.028	$C_{10}H_{14}$	134	1-methyl-2-(1-methylethyl)-Benzene	0.88%
9	17.209	$C_3H_5N_3$	83	3-aminopyrazole	0.63%
10	18.408	$C_{10}H_{18}O$	154	3,3,6-Trimethyl-1,4-heptadien-6-ol	15.37%
11	19.787	$C_8H_{16}O$	128	1-octen-3-ol (Xiao 2018)	0.34%
12	20.266	$C_{10}H_{18}O$	154	terpineol	0.59%
13	21.442	$C_{10}H_{18}O$	154	3,3,6-Trimethyl-1,5-heptadien-4-ol	55.49%
14	23.89	$C_{10}H_{18}O$	154	4-methyl-1-(1-methylethyl)- 3-Cyclohexen-1-ol	3.50%
15	26.06	$C_{10}H_{16}$	136	4-carene (Zhang 2013)	1.23%
16	27.209	$C_{10}H_{16}O$	152	2-methyl-5-(1-methylethyl)- 2-Cyclohexen-1-one	0.10%
17	28.379	$C_{10}H_{16}O$	152	4-(1-methylethyl)- 1-Cyclohexen-1-carboxaldehyde	0.30%
18	29.104	$C_{10}H_{16}O$	152	Carveol	1.43%
19	32.491	$C_{15}H_{24}O$	220	Caryophyllene oxide	1.80%
20	36.218	$C_{10}H_{12}O_2$	164	Eugenol (Zhang 2010)	0.59%

3 CONCLUSION

In this study the antibacterial activity and chemical composition of the essential oil from artemisia argyi grown in Qichun (China) was analyzed. Among the twenty compounds identified, terpenoids were the most represented classes of volatiles which possessed 93.51%. Monoterpenes, which include monoterpene hydrocarbons and oxygenated monoterpenes, were the predominant chemical class of essential oil constituents. Most of the high content compositions such as artemisol (55.49%), 3,3,6-Trimethyl-1,4-heptadien-6-ol (15.37%), Eucalyptol (11.87%), 4-methyl-1-(1-methylethyl)-3-Cyclohexen-1-ol (3.50%), Caryophyllene oxide (1.80%) and Carveol (1.43%) identified in this study were belonged to oxygenated monoterpenes. Overall, artemisol (55.49%) had the highest concentration compared with other constituents in the essential oil from the artemisia argyi grown in Qichun (China). Presently, the highest content of artemisol identified in the volatile oil component was 67.83%, which is from seriphidium mongolorum. However, in the past report the volatile oil from artemisia argyi had a low content of artemisol or even no detected. Therefore, this study was the first time to obtain highest content of artemisol from artemisia argyi. This result might be attributed to the special geographical environment in Qichun (China). The literature on the pharmacological effects of artemisol is rarely reported, and its application value needs further research.

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