

Isolation and identification of chemical components of petroleum ether extracts from roots of *Semiaquilegia adoxoides* (DC) Makino

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ABSTRACT: Roots of *Semiaquilegia adoxoides* (DC.) Makino have been used as medicinal herb for years in China, but there have been very little information about their chemical components. In this paper, chemical components from roots of *S. adoxoides* in Guizhou province, extracted by petroleum ether, were isolated and identified by using gas chromatography-mass spectrometry (GC-MS) technique. There were peak-line maps of 31 substances. The chemical structures of 12 substances were identified. Content of each component in the volatile oil was confirmed by peak area normalization method. Content of components detected was 90.55% of total extracts from root of *S. adoxoides*. Content of β -sitosterol, linoleic acid, oleic acid, and palmitic acid was 38.26%, 18.73%, 15.68%, and 13.51%, respectively. (**Keywords:** *Semiaquilegia adoxoides*, Root extract, Chemical component, Isolation, Identification)

Introduction

Semiaquilegia adoxoides (DC.) Makino is called Zhibai Tiankui or millennium mouse feces in China. It is one of the perennial plants in the buttercup (Ranunculaceae) family. It is widely distributed in provinces of the middle and lower reaches of the Yangtze River in China (Chinese Unrefined Pesticide Editorial Board (CUPEB), 1959). The plant has slim stem of about 40 centimeters high with short and sparse hairs on the stem surface. Its basal leaves have a long-petiole. Other small leaves are wide-wedge shaped with deep crevices. There are sparse and coarse dentations on exterior rim of slivers of the leaf. Underside of the leaf is purple in colour. The succulent roots of *S. adoxoides* are spindle or oval shaped. The root surface and interior are gray-black and white, respectively (**Figure 1**). There have been no records of this plant species in Thailand. Roots of *S. adoxoides*

have functions of detumescence, detoxifying and diuretic effects on human. Thus, its roots often are used to treat scrofula, tonsillitis, bruises, snakebite, pain, turgescence and furuncle Jiangsu New Medical College (JNMC), 1975; Nanjing College of Pharmacy “Traditional Chinese and Herbal Drugs” Editorial Board (NCPTCHDEB). 1976). The roots contain volatile components, but there have been very little information about their chemical contents. In order to effectively use and develop *S. adoxoides* resource, chemical components and content in volatile oil from roots of *S. adoxoides* in Guizhou province were studied.

Materials and Methods

Plant Source

Semiaquilegia adoxoides used in this study were manually collected from a hill of agricultural fields at South Campus, Guizhou University. The plants were

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Figure 1 *Semiaquilegia adoxoides* (DC.) Makino1. 1. Stems and leaves. 2. Flowers. 3. Storage roots. 4. Cross section of the root. 5. Longitudinal section of the root.

mainly about 2-3 years of age. Identification of the species was based on the method as described by CUPEB (1959) and JNMC (1975). The roots were rinsed with water, air-dried and oven-dried at 45 °C. Subsequently they were powdered and stored at 20 °C in the dark before use.

Extraction of chemical component from roots of *S. adoxoides*

One hundred grams of the root powder were weighed into a flask of the Soxhlet apparatus. All solvents such as n-hexane, petroleum ether (30-60%), and ether used in this study were of analytical reagent grade. The extraction with petroleum ether was done

for 12 h. After dehydration with anhydrous sodium sulphate, the extracts were collected in a 250-ml round-bottom flask, concentrated in a rotary evaporator to near dryness (Beijing Medical College (BMC), 1981). The resulting residues were then dissolved with n-hexane. After n-hexane was evaporated, a yellow oily substance was obtained.

Determination of the chemical components

HP6890/HP5973 gas chromatography-mass spectrometry (GC-MS) (Hewlett-Packard Company, USA) with HP-5 silica capillary column (30 m x 0.32 mm x 0.25 μm) (Hewlett-Packard Company, USA) was used.

Gas chromatographic conditions

Helium (99.999% in purity) of 1 ml/min was used as a carrier gas. Split (40:1) injection of 1 μ L was carried out at 250. The oven temperature was programmed as follows: initial temperature 60, held for 1 min, then increased at rate of 10/min to 170, held for 1 min, and finally followed by 5/min to 230, and held for 18 min. Initial pressure in the column was 51.98 kPa.

Mass spectrometry conditions

The mass spectrometer was operated in an electron impact ionization mode. The operating conditions were as follows: ionization energy 70 eV; ion source temperature 230; filament emission current 34.6 μ A; electron multiplier voltage 1859V; quality range 10 550u; and solvent was delayed for 4 min.

Results

Isolation and identification of chemical components

The results from analysis of the GC-MS total flow diagram indicated that there were 31 isolated substances of the volatile oil from roots of *S. adoxoides*. The chemical structures of 12 substances were confirmed by the method of searching NIST98 MS Gallery, using G1701BA chemical workstation and consulting the relative literatures (Pu-zhu, 1987; Yan-fang et al., 2006; Jian-hua and Jun-han, 2004). Total ion flow diagram was shown in **Figure 2**.

Content of different chemical components of the volatile oil

Content of each component of the volatile oil from roots of *S. adoxoides* was confirmed by the method of peak area normalization method. The results of the analysis were shown in **Table 1**. It can be seen that

content of the components detected accounted for 90.55% of the volatile oil in roots of *S. adoxoides*. They were mainly fatty acid compounds, including β -sitosterol (38.26%), linoleic acid (18.73%), oleic acid (15.68%), and palmitic acid (13.51%) (Chemistry and Chemical Industry Dictionary Editorial Board (CCIDEB), 2003).

Discussion

The high-grade fatty acids contained in volatile oil from roots of *S. adoxoides* are important industrial raw materials. β -sitosterol has functions of antiinflammatory, antibacterial growth, antiulcer, lowering cholesterol, cooling, and antitumor (Information Center Station of Traditional Chinese and Herbal Drugs of State Pharmaceutical Administration (ICSTCHDSPA), 1986). Apart from being used as herbal medicine, roots of *S. adoxoides* have been used to make cosmetics such as pilatory perfume, shampoo, nutrition cream and growth and productivity promoters for animals (Xin-hua and Chuang-xin, 2000). Such usage probably resulted from their containment of other fatty acid components such as linoleic acid, oleic acid, palmitic acid, and others. The experimental results in the present study were supposed to have certain guiding significance for development and use of *S. adoxoides* resources.

According to previous reports, roots extract of *S. adoxoides* also have insecticidal and fungicidal functions (Ming et al., 1997; Shi-Qiong et al., 2004; Xue-ping and Ming, 2005; Xue-ping and Ming, 2006). Currently, roots of *S. adoxoides* are one of the traditional Chinese medicines used to treat mumps, which is caused by Rubulavirus. (CUPEB, 1959; JNMC, 1975). Whether or not it could be used to control virus diseases in plants are yet to be determined. The chemical components found in this study will be further tested for bioactivity on tobacco mosaic virus (TMV). Research in that direction is underway in our laboratory.

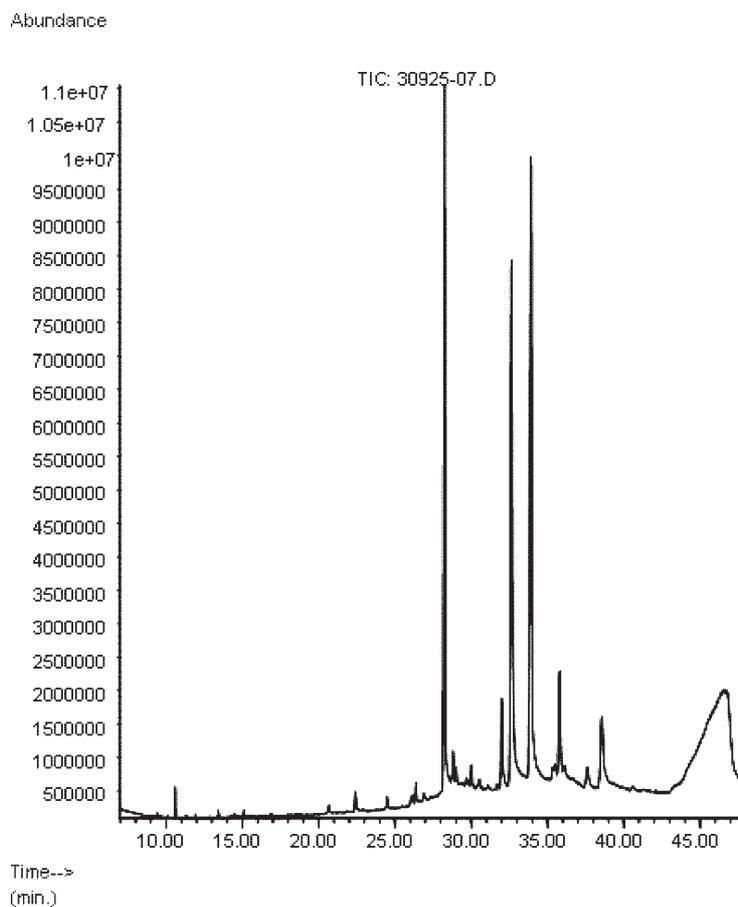


Figure 2 GC-MS total ion flow diagram of volatile oils in root of *Semiaquilegia adoxoides*.

Table 1 Chemical component of volatile oil from roots of *Semiaquilegia adoxoides*.

No	RT/min	Compound	Molecular formula	Relative molecular mass	Relative content (%)
1	10.06	Hexanoic acid	C ₆ H ₁₂ O ₂	116	0.22
2	13.43	Ocfanoic acid	C ₈ H ₁₆ O ₂	144	0.04
3	15.10	Nonanoic acid	C ₉ H ₁₈ O ₂	158	0.08
4	24.49	Myrsific acid	C ₁₄ H ₂₈ O ₂	228	0.16
5	26.37	Pentadecylic acid	C ₁₅ H ₃₀ O ₂	242	0.30
6	28.25	Palmitic acid	C ₁₆ H ₃₂ O ₂	256	13.51
7	30.01	Margaric acid	C ₁₇ H ₃₄ O ₂	270	0.41
8	32.01	Stearic acid	C ₁₈ H ₃₆ O ₂	284	2.44
9	32.64	Oleic acid	C ₁₈ H ₃₄ O ₂	282	15.68
10	33.92	Linoleic acid	C ₁₈ H ₃₂ O ₂	280	18.73
11	37.61	Arachidic acid	C ₂₀ H ₄₀ O ₂	312	0.72
12	46.56	β-sitosterol	C ₂₉ H ₅₀ O	414	38.26

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