Ekoloji 28(108): 189-193 (2019)

LETTER TO THE EDITOR

Chemical Composition Analysis of Kadsura coccinea Extractives

Xu Zhang[#1], Lin Zhu[#1], Feifei Song[#1] , YangYang[1], Jijuan Zhang[1], Chao Shi[2], Zhongfeng Zhang[1,3*]
[1] The Green Dwelling Engineering Technology Research Center of Hunan Province, Central South University of Forestry and Technology, Changsha 410004, China
[2]China Forestry Exchange, Beijing 100120, China
[3]Laboratory of Biomaterials Science, Kyoto Prefectural University, Kyoto 〒606-8522, Japan
[#]First coauthors: Xu Zhang, Lin Zhu and Feifei Song
[*]Email: csfuzzf@163.com (Zhongfeng Zhang)

*K*adsura coccinea are widely distributed in many parts of China. Its fruit can be eaten and the roots can be used as medicine. However, K. coccinea still lack extensive use. In this paper, nano-catalysis and high-efficiency extraction methods were used to reveal the resource utilization of K. coccinea. This study reviews the chemical constituents and pharmacological effects of Kadsura coccinea by Fourier transform-infrared spectroscopy (FT-IR) and gas chromatography-mass spectrometry (GC-MS) was used to analyze the organic solvent extracts of K. coccinea. FT-IR fingerprints and GC-MS chemistry were established by statistical methods. A component analysis table was used to analyze the functionality of the components. The results provide an experimental basis for pharmacological research and for the development and utilization of K. coccinea.

I Introduction

Kadsura coccinea is a wild dicotyledonous evergreen woody vine plant of the genus Schisandra. The K. coccinea was first recorded with the “Lingnan Collection”. It is also known as the Cold Rice Ball, the Dragon Flower Vine, the Blood Rattan Bubble, the Foreign Red Flower and the “Bufona”. It is widely distributed in South China, Southwest China and other provinces, and is commonly used in its areas. K. coccinea is a perennial evergreen climbing vine with hard leaves. Plants are light, anti-yin, warm, cold-resistant, dioecious. The taste of the fruit is spicy, slightly bitter and warm. *K. coccinea* is commonly used in the treatment of stomach, chronic gastritis, bruises and swelling, dysmenorrhea, postpartum blood stasis and abdominal pain. The pharmacological activities of these drugs are mainly related to the lignans and triterpenoids contained therein. This paper reviews the chemical constituents and pharmacological effects of K. coccinea. A systematic chemical composition analysis was performed on the extract of *K. coccinea*.

II Experimental materials and methods

1 Materials

K. coccinea is widely distributed in South China, Southwest China and other provinces. They are comprised of climbing evergreen vines, born in sparse mountain forests, and are often entangled in large trees.

2 Experimental methods

(1) Baking the powder: First, the prepared black tiger wood was dried and pulverized, and the grain size and thickness of the material were crushed into 200 mu.

(2) Extraction: Three kinds of extracting agents were prepared, the first one is Ag, the second is Fe_3O_4, the third is Ag + Fe_3O_4, which were heated to 80°C for 5 h in a bottle with 250 ml of three solvents and 15 g of wood powder.

(3) Steam condensation: first add the heated material to the measuring cup, and the slag was added to a triangular conical flask. Next the filtered material was placed in a steamer and rotated for 3-5 min. At last, the remaining solution was poured into a sample bag for the next experiment.

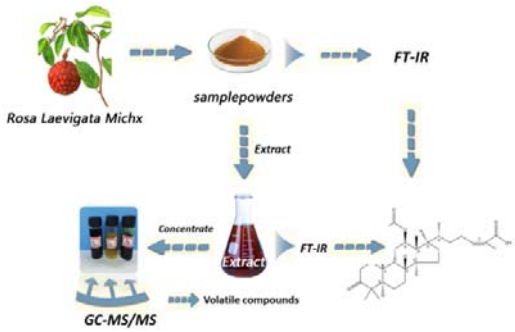

Fig. 1: Process route for analysis of chemical constituents of the Kadsura coccinea

2.1 FT–IR analysis

2.1.1 Experimental conditions

The structure of an unknown can be inferred based to the position and shape of the absorption peak in the spectrum, and the content of each component in the mixture is determined according to the intensity of the characteristic absorption peak. In this experiment, the pyrolysis infrared spectrum heating rate was 55 ℃/min, the temperature rise was 850℃ at room temperature, and the temperature was kept at 850℃ for 2 h. (Fig. 1.)

2.1.2 FT–IR test results and discussion

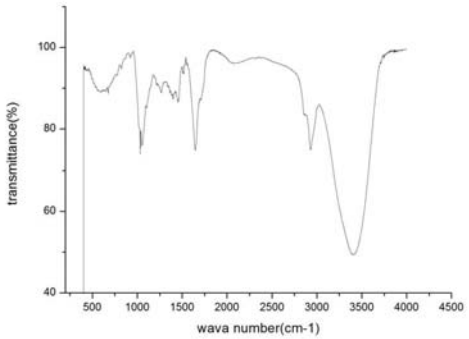

Fig. 2. Fourier-transform infrared spectroscopy fingerprint of *Kadsura coccinea*

The infrared fingerprint of the *Kadsura coccinea* was analyzed according to the relationship between the infrared spectrum range of organic compounds and the functional groups, and the results are shown in Table 1.

Table 1. Analytical results of Fourier-transform infrared spectroscopy fingerprint of *Kadsura coccinea*

Band/cm^{-1}	Absorption peak/cm^{-1}	The group of belonging	Corresponding chemical composition
3700-3000	3415	O—H Stretching Vibration	Phenol, Alcohol compounds
3000-2800	2928	C—H Stretching Vibration	Aliphatic acid, alkane
1690-1590	1648	C=O Aromatic ring vibration stretching vibration	Aromatic
1500-1390	1455	C—H Bending Vibration	Ether chemical
1200-970	1033	C—O Stretching Vibration and O—H In-plane bending vibration	Phenol compound
900-600	673	C-H out-of-plane bending vibration	Hydrocarbon compound

The spectral analysis in the region below the wave number of 1,800/cm^{-1} was complicated (Fig. 2). Almost all absorption bands in this area were complex absorption bands created by superposition of various modes of vibration.

The absorption peaks of the K. coccinea extracts shown in Table 1 were mainly concentrated in the ranges of 900-600, 1,700-1,970, and 3,700-3,000 cm^{-1}. The main chemical components were phenols, alcohols, fatty acids, alkanes, aromatics, ethers, and hydrocarbons. Many types of hydrocarbon compounds were detected, which are the main chemical components that affect the smell of wood.

2.2 GC-MS analysis

2.2.1 Experimental conditions

GC conditions: the column was an HP-5MS (30 m × 250 μm × 0.25 μm) elastic quartz capillary column; carrier gas was nitrogen; flow rate was 1 ml/min; inlet temperature was 50°C, column conditions: increase to 250°C at 8 °C/min, then increase to 300°C at 5 °C/min; splitless injection. MS conditions: MS mode was El; ion source temperature was 230°C; quadrupole temperature was 150°C; scanning start point was 30-600; solvents: methanol/benzene (85°C).

2.2.2 GC–MS test results and discussion

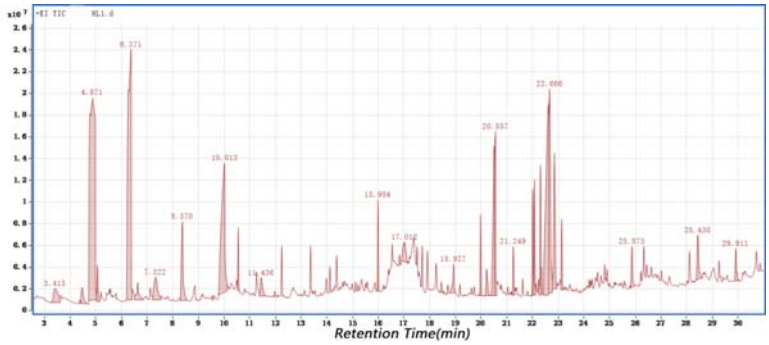

Fig. 3. Total ion chromatograms of the Kadsura coccinea by GC-MS (85℃).

The GC/MS analysis showed that the main components of the K. coccinea extract were: N, N-diethylformamide, 2-ethylhexanol, 5-hydroxymethylfurfural (HMF), palmitic acid, linoleic acid, and petroselinic acid. (Fig. 3)The following chemical components were analyzed.

Ethylhexanol (isooctanol) is a branched, eight-carbon chiral alcohol. It is a colorless liquid that is poorly soluble in water but soluble in most organic solvents.It is produced on a massive scale (>2,000,000,000 kg/y) for use in numerous applications, such as solvents, flavors, and fragrances and particularly as a precursor to produce other chemicals, such as emollients and plasticizers. Isooctanol occurs in natural plant fragrances, and the odor has been reported as “heavy, earthy, and slightly floral” for the R enantiomer and a “light sweet floral fragrance” for the S enantiomer.

HMF, also called 5-(hydroxymethyl) furfural, is an organic compound formed by dehydration of certain sugars. It is a white low-melting point solid (although commercial samples are often yellow) that is highly soluble in both water and organic solvents. The molecule consists of a furan ring, containing both aldehyde and alcohol functional groups.

HMF forms in sugar-containing food, particularly as a result of heating or cooking and this production has been the topic of studies, as HMF is potentially carcinogenic to humans. However, in vivo genotoxicity testing is negative. HMF is classified as a food improving agent and is primarily

being used in the food industry as a food additive, biomarker, and a food flavoring agent. It is also produced industrially on a modest scale as a carbon-neutral feedstock for the production of fuels and other chemicals.

Palmitic acid was discovered in saponified palm oil by Edmond Frémy in 1840. Palmitic acid is naturally produced by a wide range of plants and organisms, typically at low levels. According to the World Health Organization, evidence is “convincing” that consuming palmitic acid increases the risk of developing cardiovascular disease, based on studies indicating that it may increase low density lipoprotein levels in the blood. Retinyl palmitate is an antioxidant and a source of vitamin A added to low fat milk to replace the vitamin content lost through the removal of milk fat.

Acknowledgements

This work was financially supported by the National Natural Science Fundation of China (31872697). The Hunan Science Fund for Distinguished Young Scholars (16JJ1028).

References

Chen ZX, Zhang ZF (2016) Mechanical characteristics of antibacterial ep/wood biocomposites against skin disease. Saudi Journal of Biological Sciences 23(1):126-136.

Chen ZX, Zhang ZF (2016) Review on antibacterial biocomposites of structural laminated veneer lumber .Saudi Journal of Biological Sciences 23(1):142-147.

Gharibreza M, Ashraf MA (2016) Bera lake water quality, past and present situation. Journal of Environmental Biology 37(5SI):1097-1104.

Khan SA, Imam SM, Ahmad A, Basha SH, Husain A (2018) Synthesis, molecular docking with cox 1& ii enzyme, admet screening and in vivo anti-inflammatory activity of oxadiazole, thiadiazole and triazole analogs of felbinac. Journal of Saudi Chemical Society 22(4):469-484.

Meng FG, Zhang JY, Zhang ZF, Seo HJ, Zhang XM (2015) Luminescence and decay behavior of divalent europium activated barium borophosphate polycrystalline ceramics in the temperature regime 10–525 K. Ceramics International 41(9):11726-11732.

Peng WX, Zhang ZF, Lin Z, Makoto O, Chang JB, Gu FL, Zhu XW (2013) Molecular characteristics of biomedical and bacteriostasis extractives of illicium verum fruit. Journal of Pure and Applied Microbiology 7(3):2017-2024.

Peng WX, Zhang ZF, Lin Z, Makoto O, Chang JB, Gu FL, Zhu XW (2013) Molecular characteristics of biomedical and bacteriostasis extractives of illicium verum fruit. Journal of Pure and Applied Microbiology 7(3):2017-2024

Wang K, Li L, Xue W, Zhou S, Lan Y, Zhang H, Sui Z (2017) Electrodeposition synthesis of pani/mno2/graphene composite materials and its electrochemical performance. International Journal of Electrochemical Science 12(9):8306-8314.

Zhang JJ, Song FF, Tao J, Zhang ZF, Sheldon QS (2008) Research progress on formaldehyde emission of Wood-Based Panel. Journal of Polymer Science.

Zhang ZF, Bai XF, Zha JW, Li WK, Dang ZM (2014) Preparation and dielectric properties of BaTiO3/epoxy nanocom osites for embedded capacitor application. Composites Science and Technology 97:100-105.

Zhang ZF, Huang K, Ye YJ, Shi JY, Zhang X (2014) Analysis of fracture mechanics of glued laminated lumber composed of china's plantation wood. Asian Journal of Chemistry 26(17):5649-5656.

Zhang ZF, Huang K, Ye YJ, Shi JY, Zhang X (2014) Molecular characteristics analysis of wood extractives from pinus massoniana trees. Polymers & Polymer Composites 22(8):683-685.

Zhang ZF, Huang K, Ye YJ, Shi JY, Zhang X (2015) Pyrolysis characteristics and kinetics analysis of moso bamboo. Materiale Plastice 52(1):122-124.

Zhang ZF, Huang K, Ye YJ, Zhang X (2014) Chemical components and pharmacological action of ethanol/benzene extractives from chinese plantation pinus massoniana biomass. Asian Journal of Chemistry 26(11):3388-3390.

Zhao Q.Q, Chen M.Y, He R.L, Zhang Z.F, 2016.Review on antibacterial characteristics of bridge engineering biomaterials. Saudi Journal of Biological Sciences 23(1):137-141.