MEDICAL MOLECULES OF WASTE *CHINESE BUCKEYE* SEED FROM PHARMACY

by

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Original scientific paper
https://doi.org/10.2298/TSCI190528039L

Fourier transform infrared (FT-IR) spectroscopy and gas chromatography-mass spectrometer (GC-MS) were used to analyze organic solvent extracts of Populus tomentosa Carriere, the results show that the Chinese Buckeye Seed is mainly healthy and rich in Chinese Buckeye Seed extracts,The main representative of the active ingredient are Furfural, Isosorbide Dinitrate, Catechol, 1,2-Benzenediol, 4-methyl-, 3-Amino-s-triazole, 2,3-Quinoxalinedione, 1,4-dihydro-, Docosanoic acid, Medetomidine. Chinese Buckeye Seed extract contains a large amount of biologically active ingredients, including acids, phenols, alcohols, ketones and ethers, not only in the fields of bioenergy, biomedicine, cosmetics, skin care and fragrance, but also potential application prospects, Chinese Buckeye Seed's chemical composition research provides a scientific basis for the development and utilization of this plant.

Key words: *Chinese Buckeye Seed, FT-IR, GC-MS*

Introduction

At present, the focus of available energy is a renewable natural resource – biomass energy, which is an indispensable part of many other sources of renewable energy [1, 2], especially wood [3, 4], plant or plant source material [5, 6], many processes can be used to produce bioenergy [7, 8]. Biomass is highlighted as one of the promising RES that solve environmental problems and can replace the energy consumption of fossil fuels [9-11]. At present, biomass energy can be generated by many methods, such as useful heat, electricity and fuel [12]. Industrial wood has also recently begun to be used in energy [13], concerns about sustainable development have led to an increasing focus on the production of alternative biomass for woody biomass [14, 15], biomass energy will play an important role in replacing fossil fuels with renewable energy [16-18].

Chinese Buckeye Seed is a dry and mature seed of Aesculus chinensis Bunge. It has the effect of soothing the liver and stomach and relieving pain, mainly contains saponins and flavonoid glycosides [19], flavonoid glycosides have significant anti-influenza and anti-respiratory syncytial effects, in addition, it also has significant anti-tumor and anti-virus effects for the treatment of chronic venous insufficiency [20]. Products such as sodium aescinate freeze-dried

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powder, sodium aescinate, compound aescinate and sodium aescin have been opened, aescin is also found to prevent skin aging, inhibit inflammation of the capillary, and avoid vascular damage caused by acute inflammation [21]. It is also an anti-tumor drug candidate with development potential. Since few studies focus on the composition of *Chinese Buckeye* Seed, this paper uses FT-IR and GC-MS, techniques to study the potential of *Chinese Buckeye* Seed's biomass energy and food flavors.

Material and methods

Experimental materials

The samples were collected from the Xixia forest area of Henan Province. The sample was processed into a powder from fresh material, and four extracts were extracted from ethanol, methanol, benzene/ethanol (1:1) and ethanol/methanol (1:1), respectively.They were named F1, F3, F4, and F5 samples, respectively, in which sodium bicarbonate was added to the sample and extracted with ethanol as F2.

Experimental methods

The FT-IR Analysis: The FT-IR spectrum of the sample was obtained on FT-IR spectrophotometer (IR100) using a KBr disk containing 1.00% finely ground samples [22].

The GC-MS Analysis: 7890B-5977A GC-MS. Column HP-5MS (30 m × 250 μm × 0.25 μm). Elastic quartz capillary column, the carrier gas used for high purity helium, flow rate of 1 mL/min. The split ratio is 2:1. The temperature program of the GC starts at 50 °C, rises to 250 °C at a rate of 8 °C/min, and then rises to 300 °C at a rate of 5 °C/min. The MS program scan mass range of 30 amu-600 amu, ionization voltage of 70 eV, ionization current of 150 μA electron ionization (EI). The ion source and the quadrupole temperature were set at 230 °C and 150 °C, respectively [23-25].

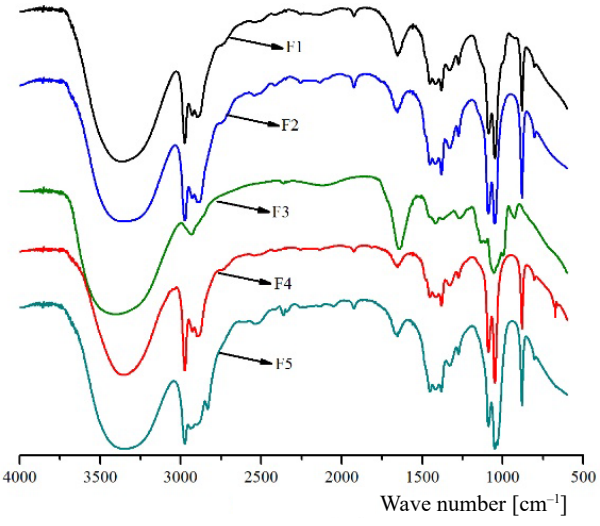

Figure 1. The FT-IR spectra of F1, F2, F3, F4 and F5 samples

Results and discussion

Analysis of FT-IR

The FT-IR spectroscopy was used to study the structural groups of the sample. As can be seen in fig. 1, the spectra of the five samples are listed for comparison. The absorption peaks of the five extract samples were mainly concentrated at 3700-2974 cm^{-1}, 2974-2885 cm^{-1} and 1658-881 cm^{-1}, the main organic chemical components are alcohols, fatty acids, phenols, ethers, hydrocarbons and aromatic compounds [26]. The characteristic absorption peak is reduced, indicating that the chemical components alcohol, ether, phenol, hydrocarbon and aromatic compound are partially extracted [27]. According to the analysis of the graph, the main structure of these lignin is very similar to the characteristic band of the functional group, and all the spectra show a typical lignin mode. The lignin characteristic absorption peaks did not change significantly at

1658 cm^{-1}, 1456 cm^{-1}, 1413 cm^{-1}, 1380 cm^{-1}, 1329 cm^{-1}, 1277 cm^{-1}, 1089 cm^{-1}, 1049 cm^{-1} and 881 cm^{-1} [28]. It is mainly OH stretch at the peak 3358 cm^{-1}, -CH stretch at the peak 2974 cm^{-1}, C=C stretch at 1658 cm^{-1}, C-H stretch at the peak 1456 cm^{-1}, and C-C stretching vibration at 1277 cm^{-1}, 1049 cm^{-1} is C-O stretching.

However, the absorption intensity of the F3 sample at 1658 cm^{-1} increased and weakened at other peaks, F3 and F5 also weakened at 2974 cm^{-1} of cellulose, indicating partial hydrolysis of cellulose lignin after extraction [29]. It can be seen from fig. 1 that compared with F2, and the ethanol extract added with sodium bicarbonate is very similar to the main structure and functional group distribution range [30]. In F3, except for the peaks 3358 cm^{-1} and 1658 cm^{-1}, and the transmission intensity of all peaks is smaller than other values. As the carbon species changes, the transmission intensity of all peaks gradually decreases, indicating that these groups contain less carbon [31].

Experiental methods

The total ion chromatograms of the three extracts analyzed by GC-MS are shown in figs. 2-5.

According to the results of GC-MS analysis, 38 peaks were detected in F1, and 32 chemical components were detected. The contents are as follows: Furfural (6.74%), Melibiose (0.55%), D-Alanine, N-propargyloxycarbonyl-, isohexyl ester (6.55%), 5-Hydroxymethylfurfural (37.77%), Melezitosev (8.40%) and so on.

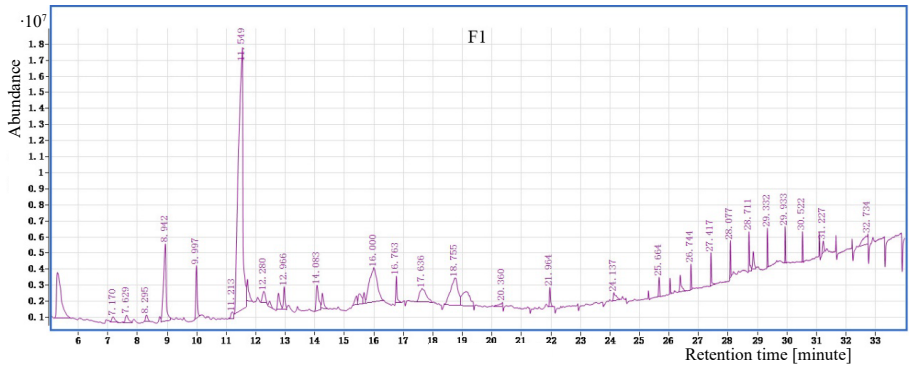

Figure 2. Total ion chromatogram of F1 sample

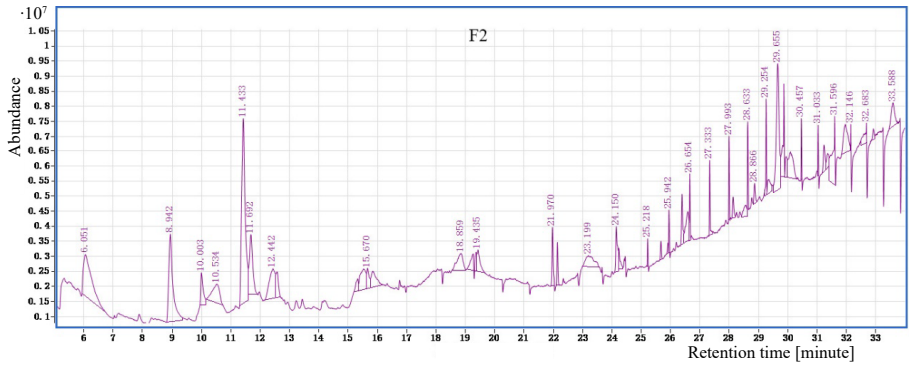

Figure 3. Total ion chromatogram of F2 sample

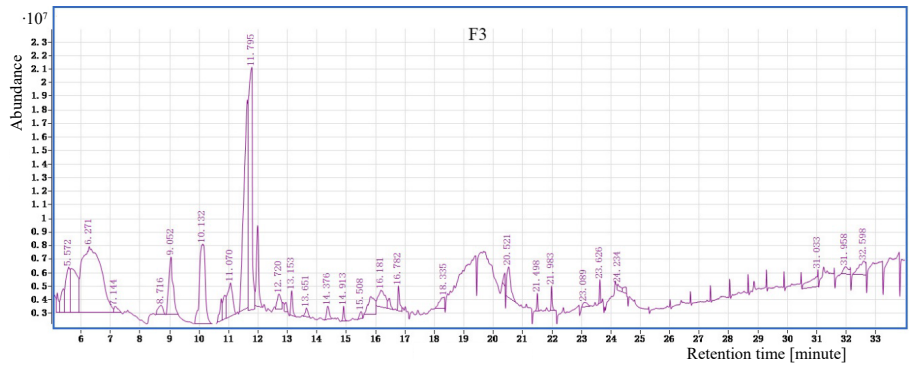

Figure 4. Total ion chromatogram of F3 sample

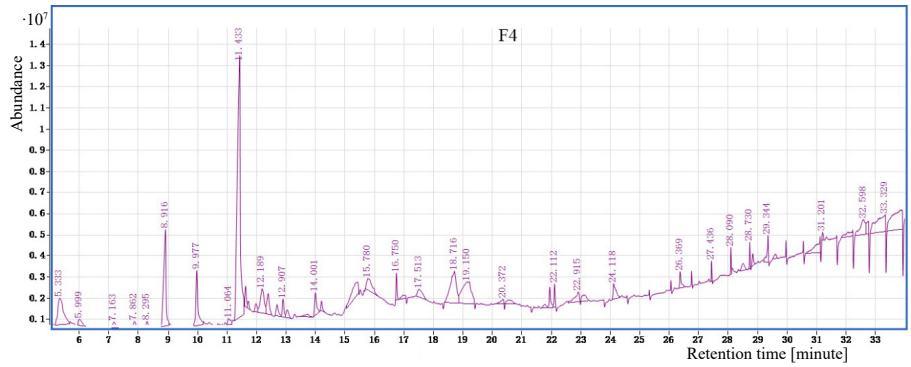

Figure 5. Total ion chromatogram of F4 sample

According to the results of GC-MS analysis, 50 peaks were detected in F2, and 37 chemical components were detected. The contents are as follows: Dihydroxyacetone (7.38%), Maltol (7.78%), 4H-Pyran-4-one, DL-Arabinose (2.89%), 5-Hydroxymethylfurfural (14.14%),Vitamin E (7.75%) and so on.

The results of GC-MS analysis showed that 38 peaks were detected in F3 and 32 chemical compounds were detected. The contents of more substances are as follows: Levoglucosenone (3.22%), Levoglucosenone (5.21%), DL-Arabinose (21.23%), 5-Hydroxymethylfurfural (13.18%), 5-Hydroxymethylfurfural (15.94%) and so on.

From the results of GC-MS analysis, it was found that 50 peaks were detected in F4 and 38 chemical components were detected as follows: 3,5-Dimethylpyrazole (4.59%), D-Alanine, N-propargyloxycarbonyl-, isohexyl ester (6.87%), 4H-Pyran-4-one 2,3-dihydro-3,5-dihydroxy-6-methyl-(3.47%), 5-Hydroxymethylfurfural (24.21%), M.beta.-D-Glucopyranose, 4-O-.beta.-D-galactopyranosyl-(6.10%) and so on.

Analysis of function

Chinese Buckeye Seed products have certain human health functions, furfural is mainly used as an industrial solvent for the preparation of decyl alcohol, citric acid, tetrahydrofuran, etc. It is a raw material for the preparation of many pharmaceuticals and industrial products, and is used in the pharmaceutical, pesticide, veterinary medicine and food industries [32]. The 5-Hydroxymethylfurfural protects the heart by inhibiting L-type Ca2+ currents, 5-HMF in I/R [33], 5-Hydroxymethylfurfural (HMF) synthesizes a BAMF, which uses BAMF to modify cy-

tochrome c faster than aspirin [34], 5-HMF has a good effect on cardiovascular. By introducing a furfural moiety into the fluorescein molecular skeleton, a fluorescent probe (Fluo-HMF) was developed as a bioimaging fluorescent probe for some related allergic mechanism studies [35]. Phorbol: Up-regulation of PKC plays a physiological role in regulating uterine contracture after delivery, and a shift from staged to strong tonic contraction may contribute to postpartum hemostasis [36], phorbol-ester inhibits metastatic spread and occurrence of melanoma [37], phorbol-ester also controls protease expression [38], KLF5 promotes phorbol ester-induced apoptosis and exerts tumor suppressor function in prostate cancer cells [39]. As a pharmaceutical intermediate, chemical raw material and food additive, Dihydroxyacetone can synthesize some medicines for treating cardiovascular diseases. It can be used in cosmetics to prevent excessive evaporation of water from the skin, moisturizing and sunscreening the skin, and preventing ultraviolet radiation [40]. Vitamin E is a fat-soluble vitamin that is one of the most important antioxidants, vitamin E TPGS is a synthetic derivative of natural alpha-tocopherol and also shows promising anticancer effects as a single agent [41], vitamin E treatment may provide protection against deposition of calcium oxalate stones in human kidneys [42]. It is very effective to provide joint therapy through contact lenses [43], mechanisms that induce insulin sensitivity improvement [44]. The VE-DC platform has high potential as a vector for delivering siRNA to the liver for gene therapy targeting hepatitis C [45]. Glycidol is used as a stabilizer for natural oils and vinyl polymers, demulsifiers and dyeing delaminators for surface coatings, chemical synthesis, fungicides, etc. Derivatives of glycidol are resins, plastics, pharmaceuticals, pesticides and auxiliaries. Industrial raw materials [46].

Conclusion

It can be seen from the above studies that the *Chinese Buckeye* Seed active ingredient has antibacterial, pharmaceutical and insecticidal activities, and the main components of the bio-oil obtained by biomass pyrolysis are almost all oxygen-containing organic substances, which are mainly classified into acids, ketones and alcohols. The FT-IR and GC-MS tests showed that the *Chinese Buckeye* Seed catalytic mechanism was originally interpreted as a compound containing unsaturated bonds C=C and C=O. In wood extracts, many organic substances are the same as homologues, and the residue after the active ingredient can be used as part of a biomass liquid fuel for future use. This study provides a scientific basis for the comprehensive utilization of *Chinese Buckeye* Seed extracts in high-end resources such as bioenergy, biomedical pesticides, cosmetics and spices.

Acknowledgment

The authors acknowledge financial support by the new century excellent talent support program (NCET-12-0725), and the Major scientific and technological achievements transformation projects of strategic emerging industries in Hunan Province (2016GK4045), and the Academician reserve personnel training plan of lift engineering technical personnel of Hunan Science and Technology Association (2017TJ-Y10).

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Paper submitted: May 28, 2019
Paper revised: August 20, 2019
Paper accepted: September 6, 2019