EXTRACTS OF *QUERCUS DENTATA* LEAF

by

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Along with the development of our economic society and the growing demand for wood, the value of the use of Quercus dentata Thunb has also increased year by year. However, the traditional trees used are resources that are cut down, and development primarily uses only the branches, while ignoring the value in using the rest of the trees. Thiscauses a waste of resources. In response, this study uses benzene, an alcohol found in Quercus dentata Thunb leaf extract. Fourier transform infrared spectroscopy (FT-IR) and gas chromatography-mass spectrometry (GC-MS) were used for catalytic cracking products, and the efficient extraction of pyrolysis products were studied. Analysis shows that Quercus dentata Thunb leaf extract species contain a variety of biological active ingredients; and the ingredients in pharmaceutical and chemical production have very high value. For example, the Quercus dentata Thunb leaf of benzyl alcohol extract, Lupeol, has significant anti-cancer, anti-oxidation, and anti-inflammatory effects. The analysis of the chemical composition of the Quercus dentata Thunb leaf provides a new theoretical basis.

Key words: *Quercus dentata Thunb, FT-IR, GC-MS*

Introduction

Quercus dentata Thunb is a deciduous tree of the family crustaceae [1]. The wood ring Kong Cai is a material that is qualitatively hard, wear-resistant, and easily becomes warped or cracked [2]. It is used for timber and floor materials; and the leaf contains a variety of medicinal ingredients [3]. The protein content of 14.9% means that it can be used as feed for silkworms. The seed starch is 58.7%, which is inclusive of 5.0% tannin [4], also contributing to its use in wine, or as feed. The bark and seeds can be used as an astringent medicine. From the tree bark, cupula extract can be obtained.

Quercus dentata Thunb has a long history of development. During the Qing Dynasty in China, the Mulberry people used *Quercus dentata Thunb* leaves to raise silkworms. However, the trunk wood is the primary resource utilized from *Quercus dentata Thunb* [5], while the use of other parts of the tree are ignored.

In order to explore the ingredients of the *Quercus dentata Thunb* leaves, this study used benzene and ethanol from *Quercus dentata Thunb* leaf extract, along with FT-IR [6] and GC-MS [7] to study the *Quercus dentata Thunb* leaf extract functional changes and the types

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of pyrolysis products. Through the use of different extract conditions of the *Quercus dentata Thunb* leaf extract and the analysis of its component function (use) [8], the utilization value of the *Quercus dentata Thunb* leaf was further studied and explored.

Material and methods

Experimental materials

Samples of *Quercus dentata Thunb* were collected from Luanchuan, Henan. The leaves were taken off and crushed with a pulverizer. Ethanol, benzoic alcohol, and methanol were used as raw materials to extract the crushed *Quercus dentata Thunb*.

Different extraction

The 10-g-samples were taken and added into three prepared extraction bottles. The 300 ml ethanol, 150 ml benzene, and 150 ml ethanol solutions were each added to 300 ml methanol, and these solutions were then placed into three extraction bottles. A mixed solvent extraction system was used for extraction [9]. The extraction conditions were: leaves were soaked for 12 hours after adding the reagent, and heated in water bath for 5 hours. Then, the extract filtrate of *Quercus dentata Thunb* leaves was extracted and concentrated to about 10 ml by vacuum evaporation at 75 °C and 0.01 MPa [10].

The FT-IR analysis

The KBR was ground into a powder, and then mixed with *Quercus dentata Thunb* leaf extract to a proportion of 100:1, respectively. After grinding on a tablet [11]. (Au query: please rewrite the mention of the tablet into the sentence or place within the paragraph where it belongs. Unfortunately, I am unable to discern the meaning from the way this paragraph is structured.) The infrared spectrum data recorder records the infrared spectrum of molecular absorption, and by collecting this data, the general infrared absorption spectra transverse for wavelength shows the position of the absorption peak. The y-axis represents the light transmittance and displays the absorption intensity [12-20].

The GC-MS analysis

The GC-MS analysis was as follows:

– GC: The column was hp-5 ms (30 m × 250 ms × 0.25 ms). Elastic quartz capillary column, carrier gas for high purity helium, flow rate 1 ml/min, separation ratio 50:1. The gas chromatographic temperature program started at 50 °C, rose to 250 °C at 10 °C/min, then rose to 280 °C at 5 °C/min [21].
– MS: The program scanning mass ranged from 30 amu to 600 amu; the ionization voltage was 70 ev, and the ionization current was 150 mua electron ionization (ei). The ion source and quadrupole temperatures were set at 230 °C and 150 °C, respectively [22-28].

Results and analysis

Infrared spectroscopic analysis

The infrared spectrum observation and comparison of ethanol, phenyl alcohol, and methanol extracts from *Quercus dentata Thunb* leaves are shown in fig. 1. The data in the figure shows that the extracts of the three different solutions are similar in composition. The absorption peaks of different extracts from *Quercus dentata Thunb* leaves in the infrared spectrum appear between 3500-3200 cm^{-1}, 3030-2800 cm^{-1}, 1800-1700 cm^{-1}, 1700-1550 cm^{-1}, 1500-1400 cm^{-1}

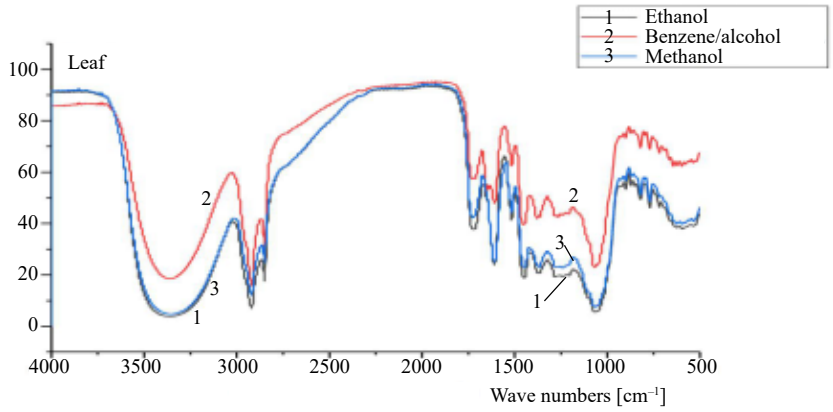

Figure 1. Infrared spectra of the three reagents

and 1200-1000 cm^{-1}, respectively. These absorption peaks are related to the stretching vibration of hydroxyl, the stretching vibration of methyl, the stretching vibration of N-O, the C congruent vibration of C, and the bending vibration inside the C-H plane [29]. These substances may be alcohol, phenol, alkane, aryl, aryl peroxide, nitrocompound, or aromatic hydrocarbon [30].

The GC-MS analysis

Forty-three substances were found from the 81 peaks of the ethanol extract from the *Quercus dentata Thunb* leaf, fig. 2. External applications can address tonsillitis, wheezing, bronchitis, the common cold, tuberculosis, rhinitis, gastric ulcers, duodenal ulcers, gallbladder and bladder stones, rheumatism, neuralgia, and so forth [31]. The 9-Octadecenamide (4.30%) was used as lubricant and a film removing agent for various kinds of concentrated master-works, such as polyethylene, polypropylene, synthetic fibers, and cable (insulation) materials. 9,12,15-Octadecatrienoic acid, (Z, Z, Z)-(1.56%) enhances intelligence, improves memory, protects eyesight, improves sleep, lowers blood lipids, and lowers blood pressure. Melezitose (2.30%) used as precipitation agent, chemical reagent and water-proofing agent [32]. The D-galactose (2.16%) is used for organic synthesis, medically for the determination of liver function, and is also a nutritional drug [33]. Lactose (3.25%) is a nutritive sweetener widely used in baby foods, confectionaries, margarines, and so forth. It is also used as a culture medium, as an absorbent, and as an ode [34]. Additionally, it is used in biochemical studies and in the synthesis

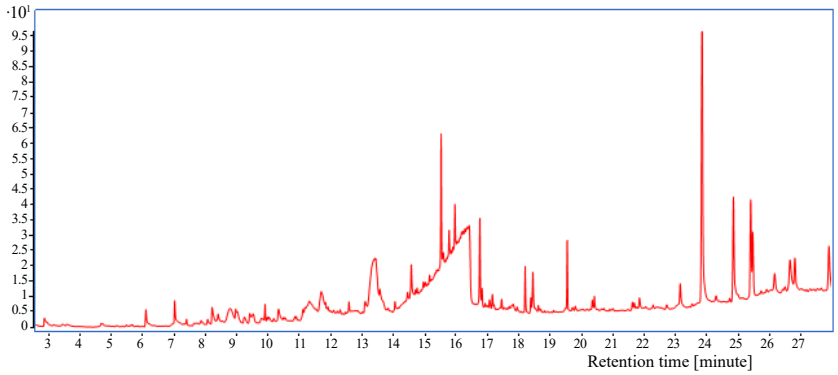

Figure 2. Total ion chromatographic analysis of the ethanol extracts

of vitamin E and vitamin K1 in Phytol (1.10%) [35]. It also contains Phloroglucinol, delta. -tocopherol, Palmitoleic acid, Levodopa, Stigmast-5-en-3-ol, (3b,24S)-,et al. The contents of n-tetracosanol–1 (12.15%), Melezitose (15.31%), and 1-deoxyinositol (25.69%) were all high, but their USES were not clear and needed to be further studied.It can be seen that the ethanol extract of quercetum leaves contains a large number of organic components and a relatively high content. It has a wide range of USES and has great utilization value, indicating that ethanol may be the most suitable extract for the extraction of quercetum leaves' organic components.

In this study, 45 compounds were found in 78 peaks of the *Quercus dentata Thunb* leaf benzenol extract, fig. 3. Dibutyl phthalate (1.10%), which is mainly used as plasticizer for nitrates, acetate fibers and polyvinyl chloride [36]. The D-mannose (3.21%) was used as a biochemical reagent in the cell culture and molecular biology [37]. Lactose (2.60%) is widely used in the production of baby foods, sweets, margarines [34], and so forth. It is also used as culture media, absorbents, exciphers, and so forth. The N-hexadecanoic acid (1.15%) was used as a precipitant, chemical reagent, and waterproof agent. Sucrose (6.76%) is widely used in food, cosmetics, and medicine, and is also used as the standard for analysis and testing [38]. Triethylamine (3.97%) is widely used in manufacturing medicines, pesticides, polymerization inhibitors, high-energy fuels, vulcanizing agents of rubber, and so forth [39]. It should be noted that the content of Lupeol (5.20%) in the phenyl alcohol extract of quercetin leaves reaches 5.20%, which has significant effects on anti-tumor, anti-inflammatory, and antioxidant effects [40-42].

The 32 substances were found in 52 peaks of methanol extract from Quercus dentata leaves, fig. 4. The main substances were D-mannose (1.04%), which was used as a biochem-

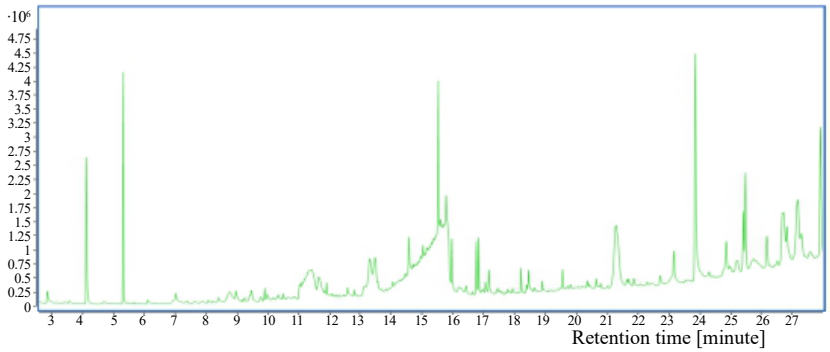

Figure 3. Total ion chromatographic analysis of Benzyl alcohol extracts

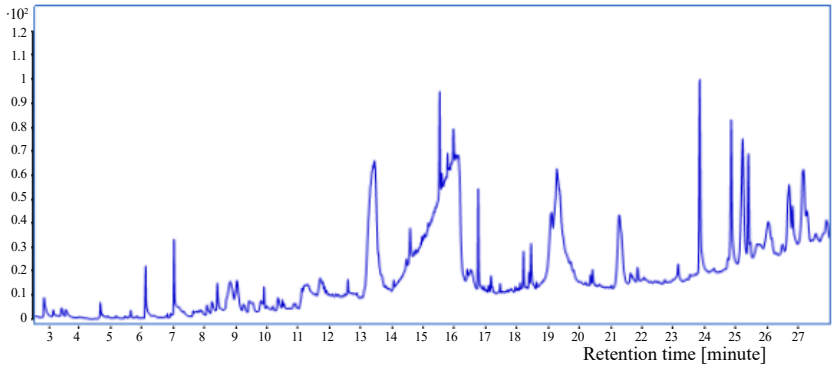

Figure 4. Total ion chromatographic analysis of methanol extract

ical reagent, cell culture, and molecular biology; the n-hexadecanoic acid (1.53%) as used as a precipitant, chemical reagent, and water-proofing agent defoamer to manufacture other food additives [43].

Conclusions and discussion

It can be seen from the above analysis that the changes of infrared light transmittance of ethanol, benzenol, and methanol extracts from *Quercus dentata Thunb* leaves are not obvious, and the absorption peaks are mainly between 3250-3500 cm^{-1}, 2750-3030 cm^{-1}, 1350-1800 cm^{-1}, and 1000-1200 cm^{-1}, indicating that the extracts from *Quercus dentata Thunb* leaves may contain alcohol, phenol, alkane, aryl, aryl peroxide, nitrocompound, and aromatic hydrocarbon [44].

The results of GC-MS showed that the extract of quercetin leaves contains many substances, some of which play important roles in medicine, chemistry, and the food industry, such as the internal administration of Squalene for hypertension and hypotension, external application for tonsillitis and asthma, and so forth. Lactose (2.60%) is widely used for producing baby food, sweets, and so forth. In particular, the content of Lupeol in the phenyl alcohol extract of quercetin leaves was 5.20%, which had significant effects in anti-cancer, anti-oxidation, anti-inflammation and other properties [45]. Other substances are also high in these contents, but their role is unclear under current conditions and remains to be studied.

Above all, the *Quercus dentata Thunb* leaf contains a variety of useful substances in the pharmaceutical chemical industry, and so forth. They are also involved is a high-quality forest biomass resources. This study, utilizing FT-IR spectroscopy and GC-MS, GC-MS technology for the analysis of *Quercus dentata Thunb* leaf extract, is of significant reference to the scientific use and value of this resource.

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