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LETTER TO THE EDITOR

The Chemical Constituents of Vitex Negundo Wood

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By means of the thermogravimetric analyzerr, the Vitex negundo wood flour with different extraction materials was heated under the control temperature. And finally the relationship between temperature change and material mass and moisture content is analyzed by TG curve. By gas chromatography/mass spectrometry (GC-MS) analysis of the chemical components of the vitex negundo wood, explore its contain more sugar, oleamide, oleic acid, phenol and small amounts of formaldehyde, explain vitex negundo wood in food, medicine, industry, etc.. The fast Fourier transform infrared (FTIR) spectroscopy was used to detect the characteristics of Vitex negundo wood flour and the organic solvent of Vitex negundo wood which was added into the extract. And the main components of extraction are aromatic, acids, ketones, aldehydes, alcohols, alkanes, phenols and ethers. Using thermal desorption gas chromatography/mass spectrometry (TD-GC-MS) analysis to analyze the volatile compounds of vitex negundo wood, it can contains a lot of intermediates for formation of organic compounds, and has certain phenol and aldehyde components can be used for medicine.

1 Introduction

Vitex negundo L is a kind of fast-growing shrub of verbena, 1-3 years old, and 2-4mm in diameter and 2-5 meters in height. Its sexual temperature, taste, bitterness, and which can be classified as the lung, stomach, liver meridian. Vitex negundo wood was widely used in folk medicine, and it is used in the treatment of rheumatism and asthma, and which has the effect of removing wind, dehumidification, an algesia and so on, particularly in South and Southeast Asia. Vitex negundo wood is compact and has excellent performance, which can be used as raw material for processing Musical Instruments. Meanwhile, it can also be used as a high quality raw material for processing chopsticks. However, for a long time, people for the development and utilization of vitex negundo neglected, after the cut down basic for firewood, make its long-term in a state of low efficiency utilization, result in serious waste of resources. At present, there are more studies on its non-volatile components and less on the volatile components.

2 Experimental Materlals And Methods

2.1 Material

Vitex negundo wood: This has grown in Shaoyang, Hunan, 0.95 g/cm3 air dry density and 12% to 15% moisture content.

2.2 Experimental methods

(1) Baking powder: First, the prepared Vitex negundo wood is dried and pulverized, and the grain size or thickness of the material was crushed into 200 mu powder; (2) Extracting: prepare three extracting agents of ethanol, ethanol/methanol (volume ratio of 1:1) and ethanol/ethyl acetate (volume ratio of 1:1) respectively, and then three kinds of solvents with 250 ml and 15 g wood powder together into a circular heating in a bottle, and it needs to be under 80°C high temperature heating 5h; (3) Spin steaming enrichment: add heated material into the measuring cup and filter residue in the triangle cone bottle. Then put the filtered material spin in the steamer, and it need to distillation about 3 to 5 minutes. Finally, pour the remaining solution into the sample bag for the next four experiments.

2.3 TG test results and discussion

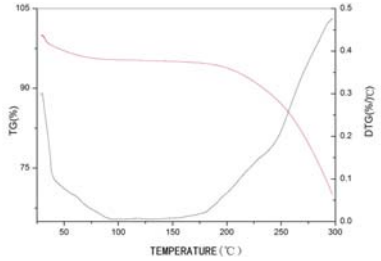

Figure 1. Analysis of the chemical composition of Vitex negundo wood by GC-MS

Shown in Figure 1, from the TG curve can be concluded that the pyrolysis of the Vitex negundo wood powder is three processes. First of all, the temperature is between 0-100°C, Vitex negundo wood water vapor evaporation, the moisture content decreased rapidly, its weight has also been reduced. However, the quality of wood flour decreased rapidly at the beginning, indicating that the wood flour contained some moisture in itself, and at high temperatures, the water was evaporated and the quality was rapidly reduced. When the temperature reaches 100°C to 150°C, the water content of the Vitex negundo wood flour powder changes too much because the wood itself contains a certain amount of free water and bound water, and the wood is absolutely dry at this time. At temperature of 160°C, at this stage mainly cellulose and small amounts of lignin pyrolysis, associated with a drop in weight. In the temperature of 180°C, the pyrolysis of hemicellulose in the wood powder, wood powder quality will reduce rapidly. At temperature of 220°C, the thermal degradation rate increased, this is mainly due to the vitex negundo wood of hemicellulose and cellulose degradation, leading to low molecular carbohydrates pyrolysis easier, so which makes samples easier to pyrolysis and wood powder quality will continue to reduce.

2.4 GC-MS analysis

Under these experimental conditions, the wood flour samples of ethanol, ethanol/methanol and ethanol/ethyl acetate extracts were named Y-1, Y-2 and Y-3, respectively, and then determined by GC-MS.

Table 1. Result of Y-1 samples by GC-MS

No.	RT (min)	Peak area %	Chemical component
1	5.565	0.33	Tetraethyl silicate
2	8.417	2.76	2,3-Dihydro-3,5-dihydroxy-6-methyl-4(H)-pyran-4-one
3	9.976	2.37	5-Hydroxymethylfurfural
4	11.988	0.62	Melezitose
5	12.202	0.18	Melezitose
6	14	19.27	Melezitose
7	15.417	3.77	Vanillic acid
8	16.316	1.45	Melezitose
9	17.635	0.16	d-Mannose
10	18.457	0.24	Melezitose
11	19.253	0.13	d-Mannose
12	20.52	3.15	n-Hexadecanoic acid
13	20.579	2.15	Phthalic acid, butyl dodecyl ester
14	20.999	0.71	1-Propyl-3,6-diazahomoadamantan-9-ol
15	22.235	0.54	7-Methyl-Z-tetradecen-1-ol acetate
16	22.293	0.44	7-Methyl-Z-tetradecen-1-ol acetate
17	22.552	1.42	Linoleic acid
18	22.603	0.95	Oleic Acid
19	22.843	0.21	Oleic Acid
20	23.069	2.28	Hexadecanamide
21	25.016	8.11	Oleamide
22	25.262	1.52	Oleamide
23	25.825	2.76	gamma.-Sitosterol
24	26.375	0.25	Ethyl iso-allocholate
25	26.543	1.09	Ethyl iso-allocholate
26	29.13	5.02	Lupeol
27	29.538	7.89	Erucic amide

Table 2. Result of Y-2 samples by GC-MS

No.	RT (min)	Peak area %	Chemical component
1	8.411	5.68	2,3-Dihydro-3,5-dihydroxy-6-methyl-4(H)-pyran-4-one
2	9.963	2.16	5-Hydroxymethylfurfural
3	11.548	0.40	Maltose
4	11.982	0.66	Melezitose
5	12.221	0.13	Melezitose
6	12.396	0.07	Melezitose
7	13.929	10.82	Melezitose
8	14.278	0.09	Melezitose
9	14.608	0.11	Melezitose
10	14.692	6.61	6-Aminonicotinic acid
11	15.41	5.19	Vanillic acid
12	16.057	0.10	Melezitose
13	16.27	3.45	Melezitose
14	16.542	0.25	Melezitose
15	16.872	0.83	Melezitose
16	17.629	0.40	d-Mannose
17	17.939	0.06	Melezitose
18	18.457	0.22	Melezitose
19	19.24	0.09	d-Mannose
20	20.514	3.88	n-Hexadecanoic acid
21	20.993	0.80	1-Propyl-3,6-diazahomoadamantan-9-ol
22	21.943	0.06	2-Myristynoyl pantetheine
23	22.228	0.37	7-Methyl-Z-tetradecen-1-ol acetate
24	22.286	0.28	7-Methyl-Z-tetradecen-1-ol acetate
25	22.539	2.11	Linoleic acid
26	22.597	1.50	Oleic Acid
27	22.836	0.30	Oleic Acid
28	23.063	1.91	Hexadecanamide
29	25.01	6.41	Oleamide
30	25.792	3.39	gamma.-Sitosterol

Table 3. Result of Y-3 samples by GC-MS

No.	RT (min)	Peak area %	Chemical component
1	5.558	0.20	Tetraethyl silicate
2	8.437	1.94	2,3-Dihydro-3,5-dihydroxy-6-methyl-4(H)-pyran-4-one
3	10.028	1.37	5-Hydroxymethylfurfural
4	11.496	0.42	Maltose
5	11.956	0.62	Melezitose
6	12.202	0.15	Melezitose
7	12.363	0.13	Melezitose
8	13.942	16.95	Melezitose
9	14.259	1.41	Melezitose
10	14.705	7.73	6-Aminonicotinic acid
11	15.423	5.34	Vanillic acid
12	16.251	1.17	Melezitose
13	16.536	0.22	Melezitose
14	17.325	0.87	d-Mannose
15	19.246	0.09	d-Mannose
16	19.401	0.09	d-Mannose
17	20.52	3.71	n-Hexadecanoic acid
18	20.572	1.69	Butyl 8-methylnonyl phthalate
19	20.999	0.64	1-Propyl-3,6-diazahomoadamantan-9-ol
20	22.228	0.34	7-Methyl-Z-tetradecen-1-ol acetate
21	22.286	0.36	7-Methyl-Z-tetradecen-1-ol acetate
22	22.545	1.62	Linoleic acid
23	22.597	0.84	Oleic Acid
24	22.836	0.33	Oleic Acid

25	23.063	1.97	Hexadecanamide
26	25.01	6.99	Oleamide
27	25.255	1.32	Oleamide
28	25.792	3.59	gamma.-Sitosterol

According to the Tables 1-3, 22 compounds can be summarized according to the literature. The main chemical components are Melezitose, D-Mannose, Oleamide, Oleic acid, n-Hexadecanoic acid and Hexadecanamide, respectively, the following analysis of these chemical compositions, in order to reflect the valuable properties of real Vitex negundo wood in real life.

Melezitose, also spelled melicitose, is a nonreducing trisaccharide sugar that is produced by the juice of several trees, such as larch or Douglas fir. This substance can be used in microbiological research in conjunction with other biochemical tests to identify two different genera of Klebsiella and Raoultella by using melezitose. Melezitose can also be made into a pharmaceutical peptide powder. Substances containing this chemical composition easily with the air of water and carbon dioxide chemical effects, and therefore need to be placed in a sealed cool and dry preservation.

2.5 FT–IR analysis

With vitex negundo wood flour and organic solvent extract as the research object to collect the infrared spectrum, and very little because the content of extract, therefore, extract timber to absorption of the summit are three element (cellulose, hemicellulose, and lignin) to a large degree of interference. It is impossible to extract all the extracts without destroying the three elements, so there is some error in the experimental results. Figure 2 and Figure 3 show the FTIR fingerprint of Vitex negundo wood extractives and FTIR fingerprint of Vitex negundo wood organic solvent extractives respectively.

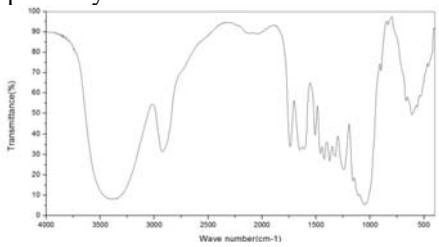

Figure 2. FTIR fingerprint

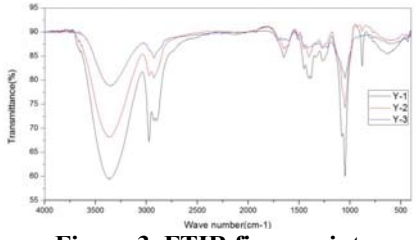

Figure 3. FTIR fingerprint

According to the relationship between the infrared spectrum range of organic compounds and the functional groups, the infrared fingerprint of the Vitex negundo wood was analyzed. It can be seen that it is very difficult to analyze the spectrum in the region below the wave number of 1600 cm^{-1}. Almost all of the absorption bands in these regions are complex absorption bands generated by superposition of various vibration modes.

It can be seen from the literature that there is no significant peak change at the characteristic absorption peak of cellulose at 2900 cm^{-1} and 1055 cm^{-1}, but the absorption intensity is reduced, indicating that the cellulose is slightly hydrolyzed; the absorption intensity of hemicellulose was significantly reduced at 1242 cm^{-1}, indicating that hemicellulose was hydrolyzed. The absorption peaks of lignin characteristics were not significantly altered at 1611 cm^{-1}, 1508 cm^{-1}, 1242 cm^{-1} and 1055 cm^{-1}, indicating that lignin was hydrolyzed after the extraction experiment. The characteristic absorption peak of phenolic compounds appeared at 3362 cm^{-1}, and the absorbance was significantly reduced, indicating that the phenolic compounds were extracted with a large amount of organic solvents. Phenolic compounds are the main components that affect the color of wood.

2.6 TD-GC-MS analysis

According to the experimental results, from the Vitex negundo wood mainly extracted 62 kinds of chemical composition.

2-Propanone, 1-hydroxy- is a colorless liquid, soluble in water, ethanol, and ether. It exists in beer, tobacco and honeycomb. The product is unstable and can be added with methanol to stabilize the base. Its main function is organic synthesis intermediate. Acetic acid, methyl ester can be dissolved with most organic solvents; It mainly used as resin, paint, ink, paint, adhesives, leather production process required organic solvents, polyurethane foam foaming agent, water and so on.

3 Conclusion

Vitex negundo wood plays a very important role in people's daily life. Through the above four experiments, full of vitex negundo wood chemical properties and chemical composition analysis, extract a lot of valuable constituents, late carries on the thorough research. The compounds extracted

from them not only benefit people's diet, but also play a decisive role in pharmaceutical and healthcare.

Acknowledgements
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