MOLECULES AND INDOOR ATMOSPHERIC EFFECT OF ROSEWOOD: *DALBERGIA GRANADILLO*

by

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Original scientific paper
https://doi.org/10.2298/TSCI190524040N

Dalbergia granadillo's human health components were studied using PY-GC-MS, TDS-GC-MS, and GC-MS. The composition of known human health functions was studied by reviewing available literature. The 7-Methyl-Z-tetradecen-1-olacetate has the effect of removing heat and relieving cough in the human body and effectively treat both dry cough and sore throat caused by fire; 1,2-Benzene dicar boxy licacid, bis (2-methyl propyl) ester hasacertainanti-cancer activity, pharmaceutical applications can be used for the synthesis of cancer drugs.

Key words: *Dalbergia granadillo, PY-GC-MS, GC-MS, TDS-GC-MS, health care in gradients*

Introduction

Dalbergia granadillo Pittier's mainorigin is Mexico, and the plant belongs to Leguminosae Dalbergia. The *Dalbergia granadillo* is a diffuse porous material, with obvious growth wheel, the heart wood section is dark red and dark red with whites trips. The *Dalbergia granadillo* wood structure is delicate, the texture is straight or staggered. The *Dalbergia granadillo* has high strength, hardness, air-dry density of 0.98-1.22 g/cm^3, and it is commonly used to make high-end furniture and hand crafts. Traditionally, *Dalbergia granadillo* is considered to be useful timber with human health functions [1, 2]. Therefore, the *Dalbergia granadillo* powder was analyzed via PY-GC-MS, TDS-GC-MS, TG, and FT-IR; the extractives of ethanol, ethanol/benzene and ethanol/methanol in *Dalbergia granadillo* were analyzed via GC-MS and FT-IR; this was done to determine the active molecules of *Dalbergia granadillo*, and the figurative effect of human care function [3].

Material and methods

Materials

The *Dalbergia granadillo* used in the experiment was produced in Mexico. The *Dalbergia granadillo* used in the experiment are first pulverized and then tested with the obtained wood powder. The ethanol, benzene and methanol were used in the experiments were

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purely chroma to graphed. Quantitative filter paper should be extracted with ethanol for 12 hours. The three extractives used in the experiment were ethanol, ethanol/benzene (volume ratio of 1:2), and ethanol/methanol (volume ratio of 1:1).

Experimental methods

Extraction method

The crushed and processed *Dalbergia granadillo's* powder was weighed three parts and the mass was 16 g (accuracy was 1.0 mg). A well-weighed powder and 300 ml of ethanol, ethanol/benzene (1:2 by volume), and ethanol/methanol (1:1 by volume) were added in the three round bottom flasks, respectively. Then, the mixture was refluxed at 85 °C, 82 °C, and 80 °C for 4.5 hours. The obtained extractives were subjected to suction filtration on a circulating water type vacuum pump (YUHUASHZ-D(III)), using a quantitative filter paper subjected to ethanol extraction treatment for 12 hours. Finally, the obtained extract was steamed and concentrated via rotary evaporator (YUHUARE-2000A).

The FT-IR analysis

The *Dalbergia granadillo's* powder and the concentrated extractives refluxed by three types of extractants were subjected to FT-IR detection (Thermo Fisher Nicolet, 670 FT-IR). The scanning of each powder was collected at a spectral resolution of 4 cm^{-1} and the spectral range was 400-4000 cm^{-1} [4-10].

The TG analysis

The powder of *Dalbergia granadillo* was analyzed via TG analyzer (TGAQ50V20.8-Build34). The carrier gas used in the experiment was high purity nitrogen and the nitrogen release rate was 60 ml/min. The temperature program of TG starts at 30 °C and increased to 250 °C at a rate of 5 °C/min [11-14].

The GC-MS analysis

The three extracts were analyzed via GC-MS (AgilentGC-MS7890B5977A). 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 20:1. The temperature program of the GC starts at 50 °C, increased to 250 °C at a rate of 8 °C/min, and then increased to 300 °C at a rate of 5 °C/min. The MS programs can mass range of 30-600 amu, ionization voltage of 70 eV, and ionization current of 150 μA electron ionization (EI). The ion source and the quadrupole temperature were set to 230 °C and 150 °C, respectively [15-18].

The TDS-GC-MS analysis

The *Dalbergia granadillo* powder was analyzed via thermal desorption GC-MS. The TDS starting temperature of 30 °C, for 1 minute, at 10 °C/min rate rose to 100 °C, keep 5 min, then 10 °C/min rate increased to 200 °C, the transmission line temperature of 230 °C. The CIS starting temperature of –50 °C, hold for 0.1 min, and then 10 °C/s rate rose to 230 °C, keep for 1 minute. Measurements were conducted via GC-MS (AgilentGC-MS7890B5977A). The temperature program of the GC starts at 50 °C, increased to 250 °C at a rate of 8 °C/min, and then increased to 300 °C at a rate of 5 °C/min. The MS program scan mass range of 30-600 amu, ionization voltage of 70 eV, ionization current of 150 μA electron ionization (ei). The ion source and the quadrupole temperature were set to 230 °C and 150 °C, respectively. The analytical standard library was analyzed via NIST14.L [19-21].

The Py-GC-MS analysis

The powder of *Dalbergia granadillo* was analyzed via thermal cracking-gas chromatography-mass spectrometry (CDS5200-trace 1310ISQ). The carrier gas used was high purity helium, the pyrolysis temperature was 500 ℃, the heating rate was 20 °C/ms, and the pyrolysis time was 15 seconds. The pyrolysis product transfer line and the injection valve temperature were set to 300 °C; Column TR-5MS; Capillary column (30 m × 0.25 mm × 0.25 μm); Shunt mode, split ratio of 1:60, shunt rate of 50 mL/min. The temperature of the GC program starts at 40 °C for 2 minute, increased to 120 °Catarate of 5 °C/min, and then increased to 200 °C at a rate of 10 °C/min for 15 minute. Ion source (EI) temperature of 280 °C, scanning grange of 28-500 amu [22-24].

Results

The FT-IR analysis

Figure 1 shows the comparasion of the infrared spectra of the *Dalbergia granadillo* powder and the three extracts. The infrared spectrum of 3360 cm^{-1} is the O-H stretching vibration in the cellulose, phenol, alcohol, and carboxylic acid compounds [25, 26]. The infrared spectrum of 2900 cm^{-1} is C-H stretching vibration and C-H bending vibration in cellulose and hemicellulose [27]. The infrared spectrum of 1738 cm^{-1} is the C=O stretching vibration in hemicellulose, lipids, ketones [28]. At 1600 cm^{-1} the lignin aromatic carbon skelet is in the state of vibration. The 1425 cm^{-1} of the infrared spectrum is the CH_2 bending vibration and the CH_2 shear vibration in the lignin and the cellulose. The infrared spectra of 1126 cm^{-1} and 1033 cm^{-1} are C-H aromaticin-plane bending vibrations. The infrared spectrum 817 cm^{-1} is the G-ring C-H outside the bending vibration [29].

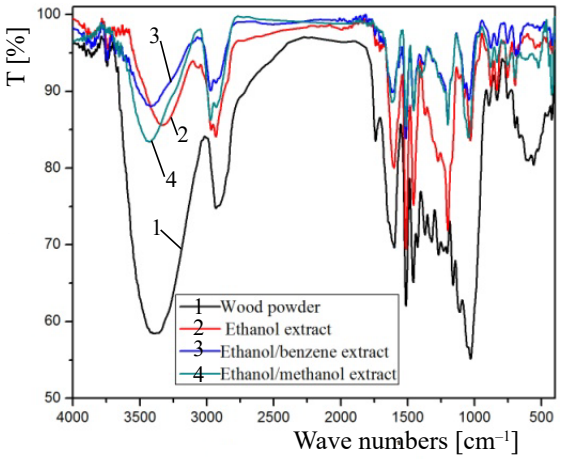

Figure 1. The FT-IR spectra of *Dalbergia granadillo* powders and three extracts

The TG analysis

Figure 2 show that the TG curve of the *Dalbergia granadillo*. In temperature section 30-75 °C in fig. 2, the quality of *Dalbergia granadillo* changes faster, mainly due to water evaporation and a small amount of oilev aporation. In temperature section 75-150 °C is present continuous micro prcess of wood flour. More violet pyrolysis reaction of the *Dalbergia granadillo* is present in the 150-250 °C temperature range, leading to a faster decrease of the quality of wood powder.

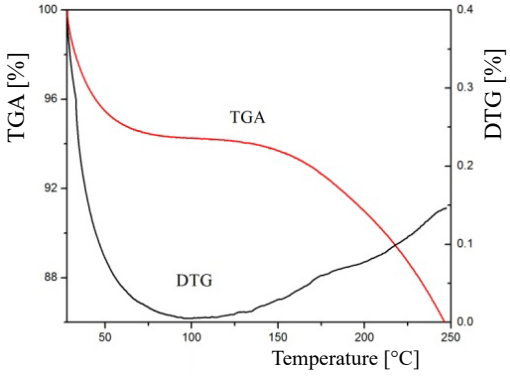

Figure 2. The *Dalbergia granadillo's* TG curve

The GC-MS analysis

Figures 3-5 show the total ion chromate grams of the extractives of ethanol, ethanol/benzene, and ethanol/methanol, respectively.

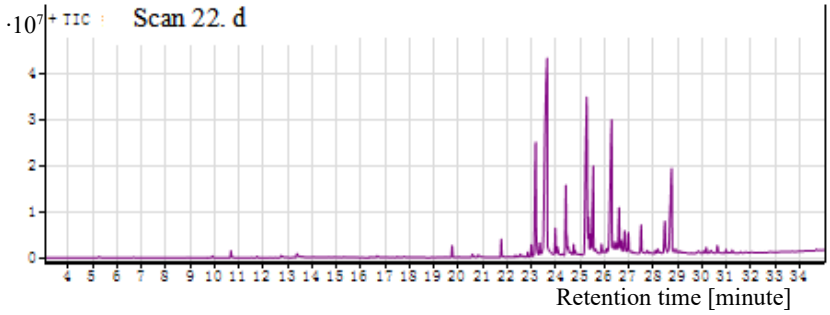

Figure 3. Total ion chromate grams of ethanol extractives of *Dalbergia granadillo*

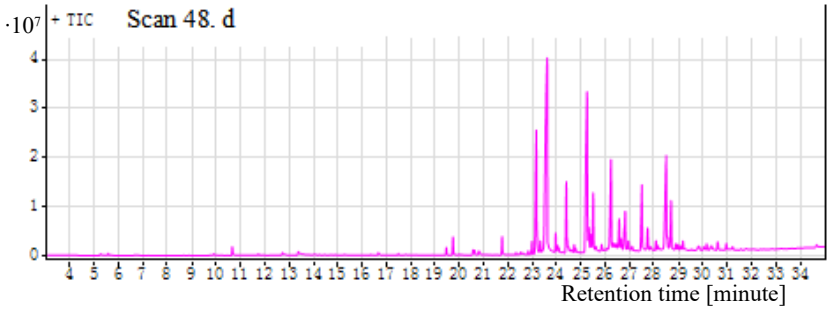

Figure 4. Total ion chromate grams of ethanol/benzene extractives of *Dalbergia granadillo*.

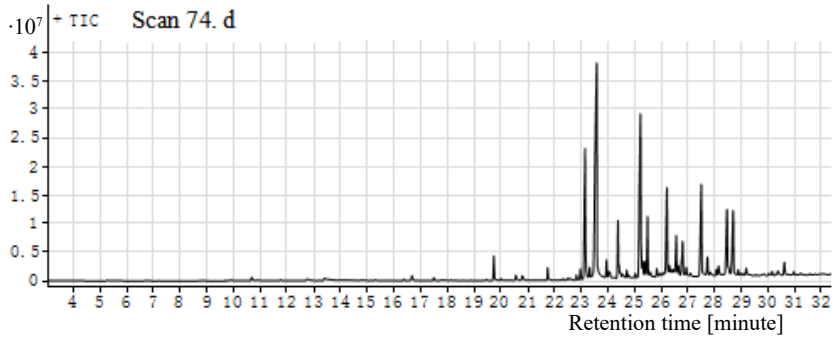

Figure 5. Total ion chromate grams of ethanol/methanol extractives of *Dalbergia granadillo*

The chemical constituents of three extracts of *Dalbergia granadillo* were determined via GC-MS qualitative analysis technique [30]. A total of 51 peaks were located via GC-MS gas chromatographic analysis of the ethanol extract of *Dalbergia granadillo*, and nine compounds were identified [31]. The results show that the components are: 2H-1-benzopyran-2-one, 7-hydroxy-3- (4-methoxyphenyl)-(7.71%), 3, 3', 4, 4'-Tetramethoxystilbene (5.01%), 10, 11-Dihydro-10-hydroxy-2, 3, 6-trimethoxydibenz (b,f) oxepin (2.12%), Phenol, p-1-indanyl-(0.75%), cis-Trismethoxyresveratrol (0.56%), and 1,4-Benzenediol,2-methoxy-(0.24%).

A total of 70 peaks were found via GC-MS gas chromate graphic analysis of the ethanol/benzene extract, and 14 compounds were identified. The results show that the components mainly are: 10, 11-Dihydro-10-hydroxy-2, 3, 6-trimethoxydibenz(b,f)oxepin (7.7%), 3, 3', 4, 4'-Tetramethoxystilbene (3.09%), S-Indacene-1, 7-dione, 2, 3, 5, 6-tetrahydro-3, 3, 4, 5, 5, 8-hexamethyl- (1.37%), Phenol, p-1-indanyl-(0.9%), and 4-Methoxybenzene-1, 2-diol(0.44%).

A total of 61 peaks were located via GC-MS gas chromate graphic analysis of the ethanol/methanol extract, and 10 compounds were identified. The results show that the components mainly are: 3, 3', 4, 4'-Tetramethoxystilbene(2.85%), Tricyclo [4.4.0.0(2,7)] dec-8-ene-3-methanol,. alpha.,. alpha., 6, 8-tetramethyl-, stereoisomer (1.33%), S-Indacene-1, 7-dione, 2, 3, 5, 6-tetrahydro-3, 3, 4, 5, 5, 8-hexamethyl-(1.12%), Phenol, p-1-indanyl-(0.68%), cis-Trismethoxyresveratrol (0.62%), and 2-Naphthalenemethanol, decahydro-. alpha.,. alpha., 4a-trimethyl-8-methylene-, [2R-(2.alpha.,4a.alpha.,8a.beta.)]-(0.35%).

The TDS-GC-MS analysis

Figure 6 shows the total ion chromate grams of the *Dalbergia granadillo* powder. The chemical constituents of *Dalbergia granadillo* powder were determined by TDS-GC-MS qualitative analysis technique [32]. A total of 73 peaks were isolated via TDS-GC-MS gas chromate graphic analysis of *Dalbergia granadillo* powder, and 40 compounds were identified.

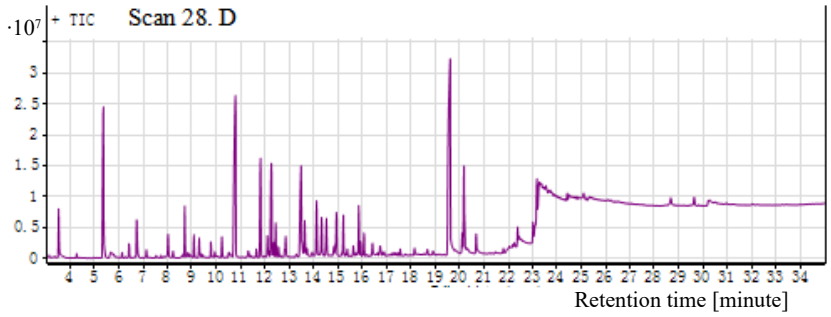

Figure 6. Total ion chromate grams of *Dalbergia granadillo* powder

The PY-GC-MS analysis

Figure 7 shows the relative abundance curve of the *Dalbergia granadillo* powder. The chemical constituents of *Dalbergia Granadillo* powder were determined via PY-GC-MS qualitative analysis technique [33]. A total of 50 peaks were isolated via PY-GC-MS gas chromate graphic analysis of *Dalbergia granadillo* powder, and 16 compounds were identified.

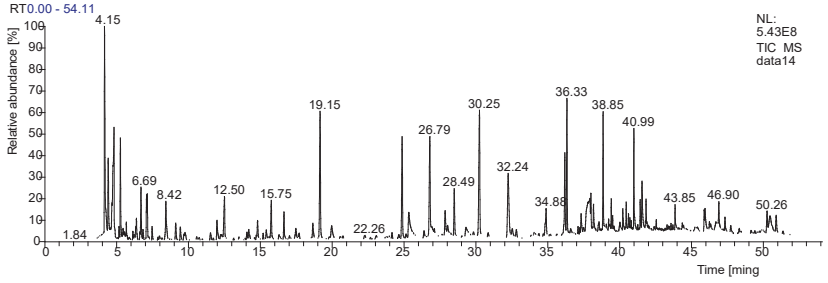

Figure 7. Relative abundance curve of the *Dalbergia granadillo* powder

Discussion

The *Dalbergia granadillo's* human health function. The PY-GC-MS, TDS-GC-MS, and GC-MS techniques were used to qualitatively analyze *Dalbergia granadillo*, and the related compounds were obtained:

- Cinnamaldehyde, (E) has strong acaricidal activity, and in addition to the ticks pecies of larvae also achieve high killing [34].
- Phenol, 2-methoxy-3-(2-propenyl) is antibacterial, showing high antibacterial activity.
- Propanoic acid, 2-methyl-, 3-hydroxy-2, 2,4-trimethylpentylester has detoxification, cough, and has orante and reinforcing effect of blood.

Blood can be used to treat acute and chronic bronchitis, pharyngitis, and tonsillitis [35, 36]; Benzene, 1,2,3-trimethoxy-5-(2-propenyl)-itself has antioxidant effects, and can play an anti-inflammatory and antithrombotic effect in the human body, in addition to hyperlipidemia crowd it also has the effect to flowering blood pressure [37]; Cedrol has a clear sedative effect on the emotional stability has a certain role in promoting [38]; 7-Methyl-Z-tetradecen-1-ol acetate has the effect of removing heat and relieving cough in the human body and effectively treating dry cough and sore throat caused by fire [39]; 1,2-Benzenedicarboxy licacid, bis(2-methylpropyl) ester have a certain anti-canceractivity, and pharmaceutical applications can be used for the synthesis of cancer drugs [40].

Conclusions

A total of 51 peaks were isolated via GC-MS gas chrome to graphic analysis of the ethanol extractives of *Dalbergia granadillo*, and non-ecompounds were identified; a total of 70 peaks were isolated via GC-MS gas chrome to graphic analysis of ethanol/benzene extractives, and 14 compounds were identified; a total of 61 peaks were isolated via GC-MS gas chrome to graphic analysis of ethanol/methanol extractives, and 10 compounds were identified.

A total of 73 peaks were isolated via TDS-GC-MS gas chrome to graphic analysis of *Dalbergia granadillo* powder, and 40 compounds were identified.

Through access to the literature and relevant reports, we clarified that *Dalbergia granadillo* contains human health in gradients and functions. Cedrol has a clear sedative effect on the emotional stability has a certain role in promoting; 7-Methyl-Z-tetradecen-1-olacetate has the effect of removing heat and relieving cough in the human body and effectively treating the dry cough and sore throat caused by fire; 1,2-Benzenedicarboxylic acid, bis(2methylpropyl) ester have a certain anti-cancer activity, pharmaceutical applications can be used for the synthesis of cancer drugs.

Acknowledgment

This research was supported by The Hunan Science Fund for Distinguished Young Scholars (16JJ1028), the major scientific and technological achievements transformation projects of strategy ice merging 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 24, 2019
Paper revised: August 30, 2019
Paper accepted: September 7, 2019