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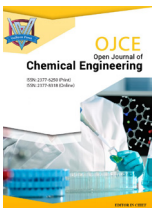

ARTICLE

MOLECULES AND FUNCTIONS OF ROSEWOOD: *DALBERGIA OLIVERI*

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ABSTRACT

Dalbergia oliveri Gamble products have a certain human health function. In this paper, Dalbergia oliveri Gamble's human health components are studied by using PY-GC-MS, TDS-GC-MS, and GC-MS. The composition of known human health functions was studied by reviewing associated literature. 1H-Cycloprop[e]azulene, 1a,2,3,5,6,7,7a,7b-octahydro-1,1,4,7-tetramethyl-,[1aR- (1a.alpha., 7.alpha. , 7a.beta., 7b.alpha.)]- has a protective effect to acetaminophen-induced renal tissue necrosis. 6-Isopropenyl-4,8a-dimethyl-1,2,3,5,6,7,8,8a-octahydro-naphthalen-2-ol exhibits antifungal and antitumor activity. 1-Heptatriacotanol has anti-hypercholesterolemic effects.

KEYWORDS

Pterocarpus; dalbergia oliveri gamble; PY-GC-MS; GC-MS; TDS-GC-MS; health care ingredients.

1. INTRODUCTION

Dalbergia oliveri Gamble—belonging to Papilionaceae, Dalbergia, Dalbergia cochinchinensis Pierre—mainly grows in Myanmar, Thailand, and Laos, Dalbergia oliveri Gamble heartwood is red, and sapwood is light yellow. The tube hole contains brownish yellow gum. Wood has high strength, large hardness, strong corrosion resistance, staggered surface texture, and an air-dry density of 1.00 g/cm^3. Dalbergia oliveri Gamble commonly used was to produce high-end furniture, handicrafts, and so on [1,2]. Traditionally, Dalbergia oliveri Gamble was often considered to have human health functions, even being used to make herbs. Therefore, the Dalbergia oliveri Gamble powder was analyzed by PY-GC-MS, TDS-GC-MS, TG. and FT-IR. The extracts of ethanol, ethanol/benzene, and ethanol/methanol in the Dalbergia oliveri Gamble were analyzed by GC-MS and FT-IR. The figurative effect of human care function was used to determine the active molecules of Dalbergia oliveri Gambler.

2. MATERIALS AND METHODS

2.1 Materials

The Dalbergia oliveri Gamble used in the experiment are first pulverized and then tested with the obtained wood powder. The ethanol, benzene, and methanol used in the experiments were purely chromatographed. Quantitative filter paper was extracted with ethanol for 12 h. The three extracts used in the experiment were ethanol, ethanol/benzene (volume ratio of 1:2), and ethanol/methanol (volume ratio of 1:1) [3,4].

2.2 Experimental methods

2.2.1 Extraction method

The crushed and processed Dalbergia oliveri Gamble's powder was weighed in 3 parts with a mass of 10 g (accuracy was 1.0 mg). A well-weighed powder and 250 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. They were then refluxed at 85 °C, 82 °C, and 80 °C for 4.5 hours. The obtained extract was subjected to suction filtration on a circulating water type vacuum pump (YUHUA SHZ-D (III)) using a quantitative filter paper subjected to ethanol extraction treatment for 12 hours [5]. Finally, the obtained extract was steamed and concentrated by a rotary evaporator (YUHUA RE-2000A).

2.2.2 FT-IR analysis

Dalbergia oliveri Gamble's powder and the concentrated extract refluxed by three kinds of extractants were subjected to FT-IR detection (ThermoFisher Nicolet, 670FT-IR). The scanning of each powder was collected at a spectral resolution of 4 cm^{-1}, and the spectral range was 400 cm^{-1}-4000 cm^{-1} [6,7].

2.2.3 TG analysis

The powder of Dalbergia oliveri Gamble was analyzed by thermogravimetric analyzer (TGA Q50 V20.8 Build 34). 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 started at 10 °C and rose to 250 °C at a rate of 5 °C/min. During the test, the weight (%) and Deriv. Weight (%/°C) of the sample were recorded [8,9].

2.2.4 GC-MS analysis

The three extracts were analyzed using a gas chromatography-mass spectrometer (Agilent GC-MS 7890B 5977A). Column HP-5MS (30

m×250 μm×0.25 μm). Elastic quartz capillary column, the carrier gas used for high purity helium, had a flow rate of 1 mL/min. The split ratio was 20:1. The temperature program of the GC started at 50 °C, rose to 250 °C at a rate of 8 °C/min, and then rose to 300 °C at a rate of 5 °C/min. MS program was set to scan a 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 [10,11].

2.2.5 TDS-GC-MS analysis

The Dalbergia oliveri Gamble powder was analyzed with thermal desorption-gas chromatography-mass spectrometry. TDS had a starting temperature of 30 °C for 1min, then at a 10 °C/min rate it rose to 100 °C; it was then kept at this state for 5 min, then at a rate of 10 °C/min it rose to 200 °C, with the transmission line temperature of 230 °C. CIS had a starting temperature of -50 °C, held for 0.1 min, and then at a rate of 10 °C/s it rose to 230 °C and kept for 1 min. Gas Chromatography-Mass Spectrometer (Agilent GC-MS 7890B 5977A). The temperature program of the GC started at 50 °C, and rose to 250 °C at a rate of 8 °C/min, and then rose to 300°C at a rate of 5 °C/min. MS program was set to scan a mass range of 30 amu-600 amu, had an ionization voltage of 70 eV, and an ionization current of 150 μA electron ionization (EI). The ion source and the quadrupole temperature were set at 230 °C and 150 °C, respectively. The analytical standard library was analyzed by NIST14. L [12,13].

2.2.6 PY-GC-MS analysis

The powder of Dalbergia oliveri Gamble was analyzed by thermal cracking-gas chromatography-mass spectrometry (CDS5200-trace1310 ISQ). The carrier gas was used for high purity helium, the pyrolysis temperature was 500 °C, the heating rate was 20 °C/ms, and the pyrolysis time was 15 s. 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; and shunt rate of 50 mL/min. The temperature of the GC program starts at 40 °C for 2 min, rose to 120 °C at a rate of 5 °C/min, and then rose to 200 °C at a rate of 10 °C/min for 15 min, where the ion source (EI) temperature was at 280 °C, and the scanning range was 28 amu-500 amu [14,15].

3. RESULTS AND DISCUSSION

3.1 Analysis of FT-IR

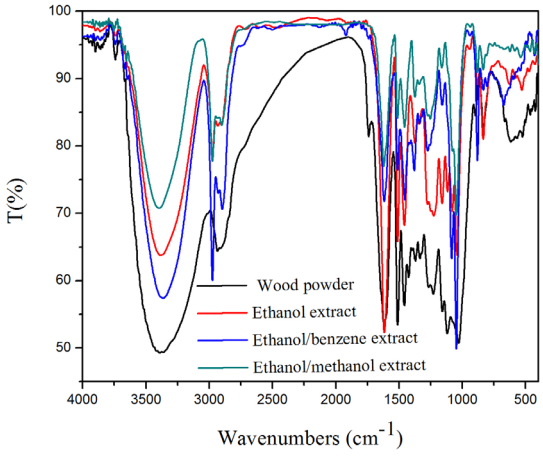

Figure 1: FT-IR comparison spectra of Dalbergia oliveri Gamble powders and three extracts.

Figure 1 shows the infrared comparison spectra of the Dalbergia oliveri Gamble powder and the three extracts. The infrared spectrum of 3360 cm^{-1} is O-H stretching vibration in the cellulose, phenol, alcohol, and carboxylic acid compounds. The infrared spectrum of 2900 cm^{-1} is the C-H stretching vibration and C-H bending vibration in the cellulose and hemicellulose [16]. The infrared spectrum of 1600 cm^{-1} is the lignin aromatic carbon skeleton vibration. The infrared spectra of 1126 cm^{-1} and 1033 cm^{-1} are C-H aromatic in-plane bending vibrations [17].

3.2 Analysis of TG

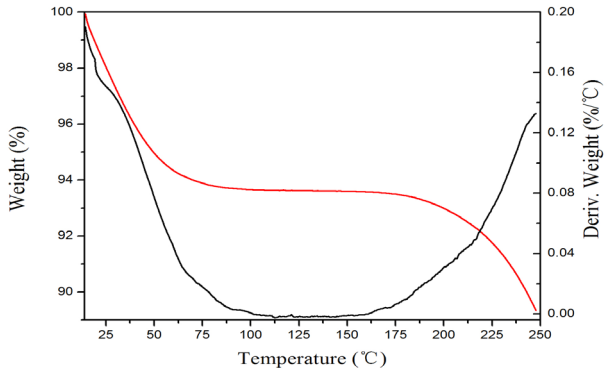

Figure 2: Dalbergia oliveri Gamble's TG curve.

Figure 2 shows the TG curve of the Dalbergia oliveri Gamble. In the 10-80 °C temperature section in the figure, the quality of Dalbergia oliveri Gamble changed more quickly, which is mainly attributable to the water and a small amount of oil evaporation. The 80-180°C temperature section is the continuous endothermic process of wood flour; Dalbergia oliveri Gamble powder had more violent pyrolysis reactions in the 180-250 °C temperature range, making the quality of wood powder decrease faster [18].

3.3 Analysis of GC-MS

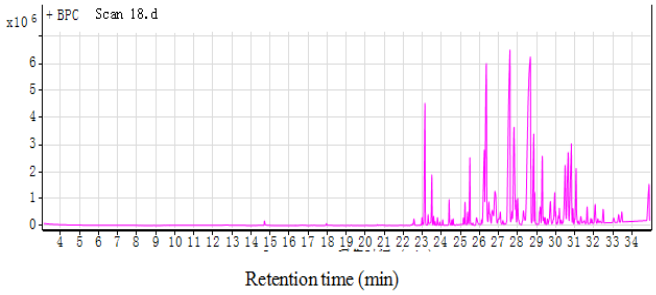

Figure 3: Total ion chromatogram of ethanol extract of Dalbergia oliveri Gamble.

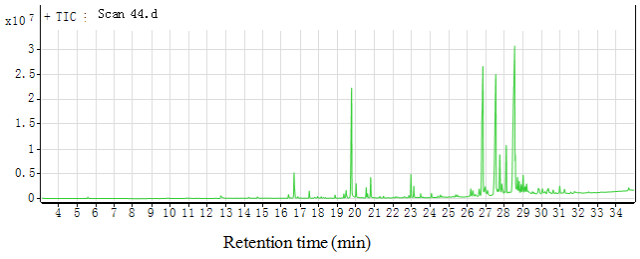

Figure 4: Total ion chromatogram of ethanol/benzene extract of Dalbergia oliveri Gamble.

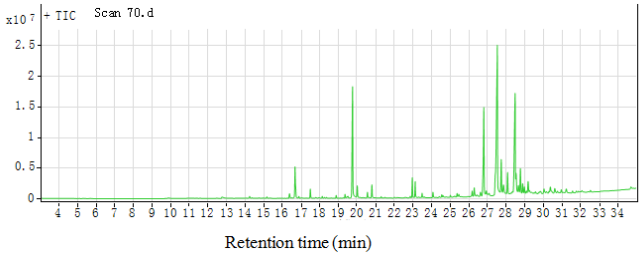

Figure 5: Total ion chromatogram of ethanol/methano extract of Dalbergia oliveri Gamble.

Table 1: Ethanol extract of GC-MS analysis results.

Peak number	Keep time (min)	Peak area (%)	Compounds
1	22.978	1.01	cis-Trismethoxyresveratrol
2	23.496	6.53	Phenol, 4-methyl-2-[5-(2-thienyl) pyrazol-3-yl]-
3	23.587	0.96	Naphthalene, 2,7-bis(1,1-dimethylethyl)-
4	24.065	0.73	Benzene, 1,3-dimethoxy-5-[(1E)-2-phenylethenyl]-
5	25.495	9.02	3,3',4,4'-Tetramethoxystilbene
6	26.491	9.24	4H-1-Benzopyran-4-one, 2,3-dihydro-5,7-dihydroxy-2-phenyl-, (S)-
7	26.659	5.67	10,11-Dihydro-10-hydroxy-2,3-dimethoxydibenz(b,f)oxepin
8	26.808	12.53	10,11-Dihydro-10-hydroxy-2,3-dimethoxydibenz(b,f)oxepin
9	27.093	3.82	10,11-Dihydro-10-hydroxy-2,3-dimethoxydibenz(b,f)oxepin
10	27.817	24.02	S-Indacene-1,7-dione, 2,3,5,6-tetrahydro-3,3,4,5,5,8-hexamethyl-
11	28.671	10	10,11-Dihydro-10-hydroxy-2,3,6-trimethoxydibenz(b,f)oxepin
12	28.852	15.37	2H-1-benzopyran-2-one, 7-hydroxy-3-(4-methoxyphenyl)-
13	28.904	3.74	6a,12a-Dihydro-6H-(1,3)dioxolo(5,6) benzofuro(3,2-c)chromen-3-ol
14	29.298	8.32	6a,12a-Dihydro-6H-(1,3)dioxolo(5,6) benzofuro(3,2-c)chromen-3-ol
15	30.663	13.83	4H-1-Benzopyran-4-one, 7-hydroxy-3-(4-methoxyphenyl)-

Table 2: Ethanol/Benzene extract of GC-MS analysis results.

Peak number	Keep time (min)	Peak area (%)	Compounds
1	5.578	0.53	.alpha.-Methylstyrene
2	9.866	0.5	m-Guaiacol
3	12.738	1.92	1,4-Benzenediol, 2-methoxy-
4	14.705	0.66	Ethylparaben
5	16.678	8.33	2-Naphthalenemethanol, decahydro-.alpha.,.alpha.,4a-trimethyl-8-methylene-, [2R-(2.alpha.,4a.alpha.,8a.beta.)]-
6	17.493	1.9	trans-Valerenyl acetate
7	18.884	0.81	(1R,4aR,7R,8aR)-7-(2-Hydroxypropan-2-yl)-1,4a-dimethyldecahydronaphthalen-1-ol
8	19.356	1.11	2-Propen-1-ol, 3-(2,6,6-trimethyl-1-cyclohexen-1-yl)-
9	19.77	41.34	Tricyclo[4.4.0.0(2,7)]dec-8-ene-3-methanol, .alpha.,.alpha.,6,8-tetramethyl-, stereoisomer
10	20.016	3.97	2-Propen-1-ol, 3-(2,6,6-trimethyl-1-cyclohexen-1-yl)-
11	20.63	1.13	1,2-Benzenedicarboxylic acid, butyl 2-methylpropyl ester
12	22.965	5.55	cis-Trismethoxyresveratrol
13	26.84	64.52	Homopterocarpin

Table 3: Ethanol/methanol extract of GC-MS analysis results.

Peak number	Keep time (min)	Peak area (%)	Compounds
1	9.873	0.6	m-Guaiacol
2	12.758	1.86	1,4-Benzenediol, 2-methoxy-
3	14.239	0.93	1H-Cycloprop[e]azulene, 1a,2,3,5,6,7,7a,7b-octahydro-1,1,4,7-tetramethyl-, [1aR-(1a.alpha.,7.alpha.,7a.beta.,7b.alpha.)]-
4	16.678	13.76	2-Naphthalenemethanol, decahydro-.alpha.,.alpha.,4a-trimethyl-8-methylene-, [2R-(2.alpha.,4a.alpha.,8a.beta.)]-
5	17.493	2.99	trans-Valerenyl acetate
6	18.14	0.71	6-Isopropenyl-4,8a-dimethyl-1,2,3,5,6,7,8,8a-octahydro-naphthalen-2-ol
7	18.884	0.92	(1R,4aR,7R,8aR)-7-(2-Hydroxypropan-2-yl)-1,4a-dimethyldecahydronaphthalen-1-ol
8	19.356	1.3	2-Propen-1-ol, 3-(2,6,6-trimethyl-1-cyclohexen-1-yl)-
9	19.466	0.59	(4aS,7R)-7-(2-Hydroxypropan-2-yl)-1,4a-dimethyl-4,4a,5,6,7,8-hexahydronaphthalen-2(3H)-one
10	19.764	46.48	Tricyclo[4.4.0.0(2,7)]dec-8-ene-3-methanol, .alpha.,.alpha.,6,8-tetramethyl-, stereoisomer
11	20.009	4.23	2-Propen-1-ol, 3-(2,6,6-trimethyl-1-cyclohexen-1-yl)-
12	22.966	6.3	cis-Trismethoxyresveratrol
13	26.802	41.74	Homopterocarpin
14	27.733	13.17	S-Indacene-1,7-dione, 2,3,5,6-tetrahydro-3,3,4,5,5,8-hexamethyl-
15	28.076	7.2	4H-1-Benzopyran-4-one, 2-(3,4-dimethoxyphenyl)-7-hydroxy-
16	28.477	55.51	10,11-Dihydro-10-hydroxy-2,3,6-trimethoxydibenz(b,f)oxepin
17	28.529	8.84	10,11-Dihydro-10-hydroxy-2,3,6-trimethoxydibenz(b,f)oxepin
18	28.762	9.82	6a,12a-Dihydro-6H-(1,3)dioxolo(5,6) benzofuro(3,2-c)chromen-3-ol
19	29.176	5.19	6a,12a-Dihydro-6H-(1,3)dioxolo(5,6) benzofuro(3,2-c)chromen-3-ol

Figures 3, 4, 5 show the total ion chromatograms of the extracts of ethanol, ethanol/benzene and ethanol/methano, respective. Table 1, 2, 3 were the results of GC-MS analysis of extracts of ethanol, ethanol/benzene and ethanol/methanol of Dalbergia oliveri Gamble.

The chemical constituents of three extracts of Dalbergia oliveri Gamble were determined by GC-MS qualitative analysis technique. A total of 66 peaks were isolated by GC-MS gas chromatographic analysis of the ethanol extract of Dalbergia oliveri Gamble, and 11 compounds were identified. The results show that the components are: 10,11-Dihydro-10-hydroxy-2,3-dimethoxydibenz(b,f)oxepin (32.02%), S-Indacene-1, 7-dione, 2,3,5,6-tetrahydro-3,3,4,5,5,8-hexamethyl- (24.02%), 2H-1-benzopyran-2-one, 7-hydroxy-3-(4-methoxyphenyl)- (15.37%), 4H-1-

Benzopyran-4-one,7-hydroxy-3-(4-methoxyphenyl)- (13.83%), 6a,12a-Dihydro-6H-(1,3)dioxolo(5,6)benzofuro(3,2-c)chromen-3-ol (12.06%), 4H-1-Benzopyran-4-one,2,3-dihydro-5,7-dihydroxy-2-phenyl-,(S)- (9.24%), 3,3',4,4'- Tetramethoxystilbene (9.02%), Phenol, 4-methyl-2-[5-(2-thienyl)pyrazol-3-yl]- (6.53%), cis-Trismethoxyresveratrol (1.01%), Naphthalene, 2,7-bis(1,1-dimethylethyl)- (0.96%), and Benzene, 1,3-dimethoxy -5-[(1E)-2-phenylethenyl]- (0.73%).

A total of 60 peaks were isolated by GC-MS gas chromatographic analysis of the Ethanol/benzene extract, and 13 compounds were identified. The results show that the components are: Homopterocarpin (64.52%), Tricyclo[4.4.0.0(2,7)]dec-8-ene-3-methanol, .alpha., .alpha.,6,8 -tetramethyl-, stereoisomer (41.34%), 2-Naphthalenemethanol, decahydro-. alpha.,.alpha.,4a-trimethyl-8-methylene-, [2R-(2. alpha.,4a.alpha.,8a.beta.)]- (8.33%), cis-Trismethoxyresveratrol (5.55%), 2-Propen-1-ol, 3-(2,6, 6-trimethyl-1-cyclohexen-1-yl)- (3.97%), 1,4-Benzenediol, 2-methoxy- (1.92%), trans-Valerenyl acetate (1.9%), 1,2-Benzenedicarboxylic acid, butyl 2-methylpropyl ester (1.13%), 2-Propen-1-ol, 3-(2,6,6-trimethyl-1-cyclohexen-1-yl)- (1.11%), (1R,4aR,7R,8aR)-7-(2-Hydroxypropan-2-yl)-1,4a-dimethyldecahydronaphthalen-1-ol (0.81%), Ethylparaben (0.66%), .alpha.-Methylstyrene (0.53%), and m-Guaiacol (0.5%).

A total of 71 peaks were isolated by GC-MS gas chromatographic analysis of the Ethanol/methanol extract, and 16 compounds were identified. The results show that the components are: 10,11-Dihydro-10-hydroxy-2,3,6-trimethoxydibenz(b,f)oxepin (64.35%), Tricyclo[4.4.0.0(2,7)]dec-8-ene-3-methanol, .alpha.,.alpha.,6,8-tetramethyl-, stereoisomer (46.48%), Homopterocarpin (41.74%), 6a,12a-Dihydro-6H-(1, 3)dioxolo(5,6) benzofuro(3,2-c)chromen-3-ol (15.01%), 2-Naphthalenemethanol, decahydro-.alpha.,.alpha.,4a-trimethyl-8-methylene-, [2R-(2.alpha.,4a. alpha., 8a.beta.)]- (13.76%), S-Indacene-1,7-dione, 2,3,5,6-tetrahydro-3,3,4,5,5,8-hexamethyl- (13.17%), 4H-1-Benzopyran-4-one, 2-(3, 4-dimethoxyphenyl)-7-hydroxy- (7.2%), cis-Trismethoxyresveratrol (6.3%), 2-Propen-1-ol, 3-(2,6,6-trimethyl-1-cyclohexen-1-yl)- (5.53%), trans-Valerenyl acetate (2.99%), 1,4-Benzenediol, 2-methoxy- (1.86%), 1H-Cycloprop[e]azulene, 1a,2,3,5,6,7,7a,7b-octahydro-1,1,4,7-tetramethyl-,[1aR-(1a.alpha.,7.alpha.,7a.beta.,7b. alpha.)]- (0.93%), (1R,4aR,7R,8aR)-7-(2-Hydroxypropan-2 -yl)-1,4a-dimethyldecahydronaphthalen-1-ol (0.92%), 6-Isopropenyl-4, 8a-dimethyl-1,2,3,5,6,7,8,8a-octahydro-naphthalen-2-ol (0.71%), m-Guaiacol (0.6%), and (4aS,7R)-7-(2-Hydroxypropan-2-yl)-1,4a-dimethyl-4,4a,5,6,7,8-hexahydronaphthalen-2(3H)-one (0.59%).

3.4 Analysis of TDS-GC-MS

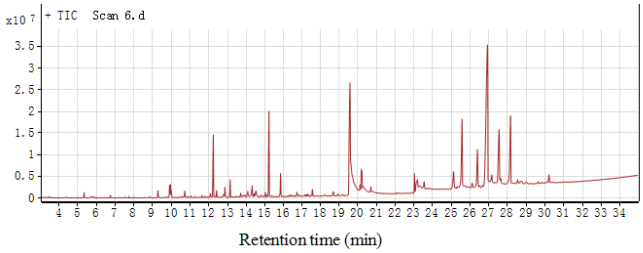

Figure 6: Total ion chromatogram of Dalbergia oliveri Gamble powder.

Table 4: Dalbergia oliveri Gamble powder of TDS-GC-MS analysis results.

Peak number	Keep time (min)	Peak area (%)	Compounds
1	5.343	1.27	Benzaldehyde
2	6.755	0.63	Benzaldehyde, 2-hydroxy-
3	9.288	1.88	Ethanol, 1-(2-butoxyethoxy)-
4	9.918	2.95	m-Guaiacol
5	10.725	2.18	Cinnamaldehyde, (E)-
6	12.262	17.76	Ethanol, 2-(2-butoxyethoxy)-, acetate
7	12.439	1.62	Propanoic acid, 2-methyl-, 3-hydroxy-2,2,4-trimethylpentyl ester
8	12.88	2.64	Methyleugenol
9	13.157	3.83	1H-3a,7-Methanoazulene, 2,3,4,7,8,8a-hexahydro-3,6,8,8-tetramethyl-, [3R-(3.alpha.,3a.beta.,7. beta.,8a.alpha.)]-
10	13.724	0.9	Dimethyl phthalate
11	13.863	0.57	.beta.-Guaiene
12	14.342	4.42	Naphthalene, 1,2,4a,5,8,8a-hexahydro-4,7-dimethyl-1-(1-methylethyl)-, (1.alpha.,4a.beta.,8a. alpha.)-(.+/-.)-
13	14.43	0.82	1H-Cycloprop[e]azulene, 1a,2,3,5,6,7,7a,7b-octahydro-1,1,4,7-tetramethyl-, [1aR-(1a.alpha.,7. alpha.,7a.beta.,7b.alpha.)]-
14	14.543	2.87	2H-Indeno[1,2-b]furan-2-one, 3,3a,4,5,6,7,8,8b-octahydro-8,8-dimethyl
15	15.047	1.02	1H-Cycloprop[e]azulene, 1a,2,3,5,6,7,7a,7b-octahydro-1,1,4,7-tetramethyl-, [1aR-(1a.alpha.,7. alpha.,7a.beta.,7b.alpha.)]-
16	15.237	21.68	Benzene, 1,2,3-trimethoxy-5-(2-propenyl)-
17	15.854	5.48	2,2,4-Trimethyl-1,3-pentanediol diisobutyrate
18	17.14	0.52	1-Heptatriacotanol
19	19.572	82.23	1,2-Benzenedicarboxylic acid, bis(2-methylpropyl) ester
20	20.114	1.43	1,2-Benzenedicarboxylic acid, bis(2-methylpropyl) ester
21	23.025	3.46	cis-Trismethoxyresveratrol
22	26.932	10	Homopterocarpin
23	28.167	28.62	4H-1-Benzopyran-4-one, 2-(3,4-dimethoxyphenyl)-7-hydroxy-

Figure 6 shows the total ion chromatogram of Dalbergia oliveri Gamble powder. The chemical constituents of Dalbergia oliveri Gamble powder were determined by TDS-GC-MS qualitative analysis technique. A total of 60 peaks were isolated by TDS-GC-MS gas chromatographic analysis of Dalbergia oliveri Gamble powder, and 21 compounds were identified.

Table 4 shows the results of TDS-GC-MS analysis of Dalbergia oliveri Gamble powder. The results show that the components are: 1,2-Benzenedicarboxylic acid, bis(2-methylpropyl) ester (83.66%), 4H-1-Benzopyran-4-one, 2-(3,4-dimethoxyphenyl)-7-hydroxy- (28.62%), Benzene, 1,2,3-trimethoxy-5-(2-propenyl)- (21.68%), Ethanol, 2-(2-butoxyethoxy)-, acetate (17.76%), Homopterocarpin (10%), 2,2,4-Trimethyl-1,3-pentanediol diisobutyrate (5.48%), Naphthalene, 1,2,4a,5,8,8a-hexahydro-4,7-dimethyl-1-(1-methylethyl)-, (1.alpha.,4a.beta.,8a.alpha.)-(.+/-.)- (4.42%), 1H-3a,7-Methanoazulene, 2,3,4,7,8,8a-hexahydro-3,6,8,8-tetramethyl-, [3R-(3.alpha.,3a. beta.,7.beta.,8a.alpha.)]- (3.83%), cis-Trismethoxyresveratrol (3.46%), m-Guaiacol (2.95%), 2H-Indeno[1,2-b]furan-2-one, 3,3a,4,5,6,7,8,8b-octahydro-8,8-dimethyl (2.87%), Methyleugenol (2.64%), Cinnamaldehyde, (E)- (2.18%), Ethanol, 1-(2-butoxyethoxy)- (1.88%), 1H-Cycloprop[e]azulene, 1a,2,3,5,6,7,7a,7b-octahydro-1,1,4,7-tetramethyl-, [1aR-(1a.alpha.,7.alpha.,7a.beta.,7b.alpha.)]- (1.84%), Propanoic acid, 2-methyl-, 3-hydroxy-2,2,4-trimethylpentyl ester (1.62%), Benzaldehyde (1.27%), Dimethyl phthalate (0.9%), Benzaldehyde, 2-hydroxy- (0.63%), .beta.-Guaiene (0.57%), and 1-Heptatriacotanol (0.52%).

3.5 Analysis of Py-GC-MS

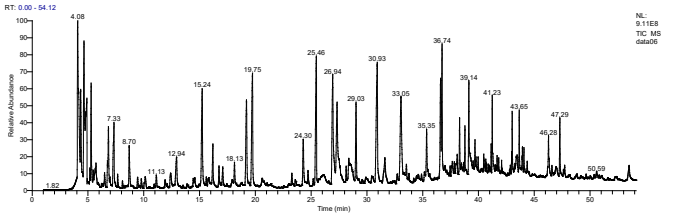

Figure 7: Relative abundance curve of the Dalbergia oliveri Gamble powder.

Table 5: Dalbergia oliveri Gamble powder of PY-GC-MS analysis results.

Peak number	Keep time (min)	Peak area (%)	Compounds
1	4.08	38.83	Carbamic acid, monoammonium salt
2	4.90	15.03	Ammonium acetate
3	5.28	33.46	2-Propanone, 1-hydroxy-
4	12.41	5.95	2(5H)-Furanone
5	19.75	24.06	Phenol, 2-methoxy-
6	27.33	7.80	m-Guaiacol
7	28.37	4.6	1,2-Benzenediol, 3-methoxy-
8	29.03	3.61	Phenol, 4-ethyl-2-methoxy-
9	30.93	19.72	2-Methoxy-4-vinylphenol
10	33.05	17.50	Phenol, 2,6-dimethoxy-
11	33.54	2.39	Phenol, 2-methoxy-4-propyl-
12	39.68	2.50	Phenol, 2,6-dimethoxy-4-(2-propenyl)-
13	41.23	10.28	Phenol, 2,6-dimethoxy-4-(2-propenyl)-

Figure 7 shows the relative abundance curve of the Dalbergia oliveri Gamble powder. The chemical constituents of Dalbergia oliveri Gamble powder were determined by PY-GC-MS qualitative analysis technique. A total of 50 peaks were isolated by PY-GC-MS gas chromatographic analysis of Dalbergia oliveri Gamble powder, and 12 compounds were identified.

Table 5 shows the results of PY-GC-MS analysis of Dalbergia oliveri Gamble powder. The results show that the components are: Carbamic acid, monoammonium salt (38.83%), 2-Propanone, 1-hydroxy- (33.46%), Phenol, 2-methoxy- (24.06%), 2-Methoxy-4-vinylphenol (19.72%), Phenol, 2,6-dimethoxy- (17.5%), Ammonium acetate (15.03%), Phenol, 2,6-dimethoxy-4-(2-propenyl) (12.78%), m-Guaiacol (7.8%), 2(5H)-Furanone (5.95%), 1,2-Benzenediol, 3-methoxy- (4.6%), Phenol, 4-ethyl-2-methoxy- (3.61%), and Phenol, 2-methoxy-4-propyl- (2.39%).

3.6 Dalbergia oliveri Gamble's health care ingredients and functions

Pterocarpus is commonly used to produce high-end furniture, but it also has a certain human health function. The qualitative analysis and analysis of Dalbergia oliveri Gamble were carried out by using PY-GC-MS, TDS-GC-MS, and GC-MS, and the related compounds were obtained. By reviewing the relevant literature and reports, it has been confirmed that it has a human health function within the composition. 6a,12a-Dihydro-6H-(1,3)dioxolo(5,6)benzofuro(3,2-c)chromen-3-ol is of medical value and has anti-angiogenic activity [19]. 2-Naphthalenemethanol, decahydro-.alpha.,. Alpha., 4a-trimethyl-8-methylene-, [2R- (2.alpha., 4a.alpha., 8a.beta.)]- has a high medical value, and it has cough and phlegm, detoxification, and diuretic effects [20]. 1,2-Benzenedicarboxylic acid, butyl 2-methylpropyl ester has antipyretic cough effect, but it also affects the immune function of the human body [21]. 1H-Cycloprop[e] azulene, 1a,2,3,5,6,7,7a,7b-octahydro-1,1,4,7-tetramethyl-,[1aR-(1a.alpha., 7.alpha. , 7a.beta., 7b.alpha.)]- has a protective effect to acetaminophen-induced renal tissue necrosis [22]. 6-Isopropenyl-4,8a-dimethyl-1,2,3,5,6,7,8,8a-octahydro-naphthalen-2-ol exhibits antifungal and antitumor activity [23]. Benzaldehyde has inhibitory effects on the activity of phenoloxidase from larvae [24]. Propanoic acid,2-methyl-, 3-hydroxy- 2,2,4-trimethylpentyl ester can be used to synthesize drugs for the treatment of cancer [25]. Benzene,1,2,3-trimethoxy-5-(2-propenyl)- has antioxidant, anti-inflammatory, anti-thrombosis, and hypolipidemic human health effects [26]. 1-Heptatriacotanol has anti-hypercholesterolemic effects [27,31]. Homopterocarpin inhibits and kills cancer cell activity. It can inhibit human laryngeal cancer cells and human hepatocellular carcinoma cells at low concentrations, and can kill them at high concentrations [28,29]. Phenol, 4-ethyl-2-methoxy- can be inhibited by NR1/NR2B -methyl-D-aspartate channel to protect neurons from excitotoxicity [30,32].

4. CONCLUSION

As revealed by the GC-MS analysis, a total of 66 peaks were isolated by GC-MS gas chromatographic analysis of the ethanol extract of Dalbergia oliveri Gamble, and 11 compounds were identified; a total of 60 peaks were isolated by GC-MS gas chromatographic analysis of ethanol/benzene extract, and 13 compounds were identified; a total of 71 peaks were isolated by GC-MS gas chromatographic analysis of ethanol/methanol extract, and 16 compounds were identified. For the TDS-GC-MS analysis, a total of 60 peaks were isolated by TDS-GC-MS gas chromatographic analysis of Dalbergia oliveri Gamble powder, and 21 compounds were identified. Based on the PY-GC-MS analysis, a total of 50 peaks were isolated by PY-GC-MS gas chromatographic analysis of Dalbergia oliveri Gamble powder, and 12 compounds were identified.

With access to the literature and related reports, it has been supported that Dalbergia oliveri Gamble contains human health ingredients and functions. 1H-Cycloprop[e]azulene,1a,2,3,5,6,7,7a,7b-octahydro-1,1,4,7-tetramethyl-,[1aR-(1a.alpha.,7.alpha.,7a.beta.,7b.alpha.)]- has a protective effect to acetaminophen-induced renal tissue necrosis. 6-Isopropenyl-4,8a-dimethyl-1,2,3,5,6,7,8,8a-octahydro-naphthalen-2-ol exhibits antifungal and antitumor activities. 1-Heptatriacotanol has anti-hypercholesterolemic effects. Propanoic acid,2-methyl-, 3-hydroxy-2,2,4-trimethylpentyl ester can be used to synthesize drugs for the treatment of cancer.

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