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LETTER TO THE EDITOR

Molecules and Atmosphere Effect of Rosewood: *Millettia Leucantha*

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The organic solvent extracts were analyzed by FTIR and GC-MS. *Millettia leucantha* Kurzwas analyzed by TG and Py-GC-MS. Next, pyrolysis products were analyzed by GC-MS. The results showed that *Millettia leucantha* extract contains high amounts of bioactive ingredients, such as alkanes, phenols, alcohols, olefins and acids. *Millettia leucantha* extract has very good application prospects in the fields of bioenergy, biomedicine, cosmetics, skin care products and spices. The extraction and analysis of the chemical constituents of *Millettia leucantha* provide a scientific basis for the development and utilization of this plant.

I Introduction

Millettia leucantha Kurz, commonly known as Burmese chicken-wing wood, belongs to medium trees, with a timber harvesting period of about 150-200 years. Its wood contains scattered holes, being a smooth and delicate raw material. The heartwood is purple brown or dark chocolate brown, often with black stripes; obviously different from the sapwood. Tree heart sandstone heart, that is similar to the same thing as sandstone, and radial lines by the tree heart outward expansion. *Millettia leucantha*is mainly found in Myanmar and Thailand. Its wood is characterized by weak luster, no special smell and taste, slightly staggered texture, and uniform structure. Moreover, *Millettia leucantha* wood is very heavy and hard (moisture content 12% density of 1.02g/cm^3), with high strength and good drying performance, although fine cracks can sometimes appear on its surface. Regarding decay the wood is very resistant, with heartwood being barely harmed by any type of insects (Ma and Huang 2018, Phrutivorapongkul et al. 2003).

Millettia leucantha has a unique wood grain and occupies a special place in mahogany, being regarded as one of the finest materials in the production of high-grade furniture. In recent years, timber aesthetic studies have focused on macrostructural features, microstructural features, aesthetic principles, and pattern creation of wood (Marschall et al. 2014, Mohajerani et al. 2018). In particular, Wiccan has received great attention due to its special and beautiful patterns. The research and design of *Millettia leucantha*'s aesthetics pattern, which is a combination of humanity and nature, makes the unique value of the chicken wing wood more fully utilized and provides a broader space for related design fields.

This paper is a study of *Millettia leucantha*and's extracts. The extracted organic solvens were analyzed by FT-IR, TG, GC-MS, and PY-GC-MS. The spectra of FT-IR, TG, GC-MS and PY-GC-MS were established, respectively. Furthermore, the utilization of *Millettia leucantha*timber, which is a high-grade resource, was discussed.

II Material and Methods

Materials. *Millettia leucantha* extracts were named B1, B2, and B3, after being extracted by ethanol, ethanol/benzene (1:2), and ethanol/methanol (1:1), respectively. Following further extraction, the solid powder samples were named B1-1, B2-2, and B3-3. The log was named B0.

Experimental methods

The FT-IR spectra of the samples were obtained on a FT-IR spectrophotometer (IR100), using KBr discs containing 1.00% finely ground sample (Tjeerdsma and Militz 2005, Danon et al. 2016).

Samples of *Millettia leucantha* were analyzed by a thermogravimetric analyzer (TGA Q50 V20.8 Build 34). The nitrogen release rate was 60 ml/min. The temperature program of TG started at 30ºC and rose to 250ºC, at a rate of 5 ºC/min (Paama et al. 2000, Wachowski and Hofman 2006, Lam et al. 2019).

Powdered samples of *Millettia leucantha* were analyzed by thermal cracking-GC-MS (CDS5200-trace1310 ISQ). The carrier gas used was high purity helium, the pyrolysis temperature was 500ºC, the heating rate was 20ºC/ms, and the pyrolysis time was 15 s. The pyrolysis product transfer line and the injection valve temperature were set to 300ºC; column TR-5MS; capillary column (30 mm × 0.25 mm × 0.25 μm); shunt mode, split ratio of 1:60, shunt rate of 50 mL/min. The temperature for the GC program started at 40ºC for 2 min, rose to 120ºC at a rate of 5ºC/min, and then rose to 200ºC at a rate of 10ºC/min for 15 min. The ion source (EI) was at a temperature of 280ºC, while the scanning range was placed between 28-500 amu (Wang et al. 2012, Jeon et al. 2013).

III. Results and Discussion

FT-IR analysis

The infrared spectrum of *Millettia leucantha* was analyzed according to the relationship between the infrared spectrum of the organic compound and the functional group. Figure 1 shows the infrared contrast spectra of *Millettia leucantha* and the three extracts.

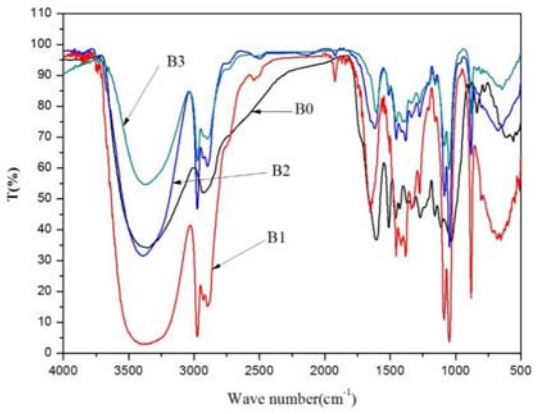

Figure 1. FT-IR spectra of B0, B1, B2, and B3

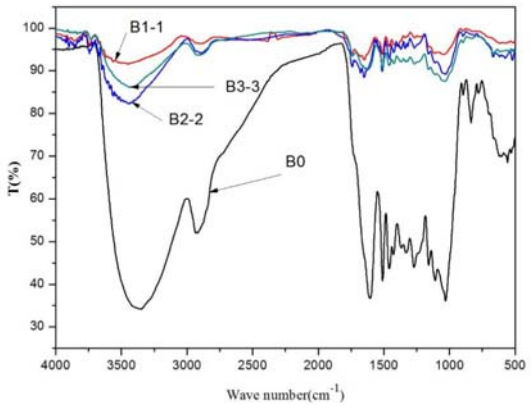

Figure 2. FT-IR spectra of B0, B1-1, B2-2, and B3-3.

The infrared absorption peak at 3400 cm^{-1} is probably the stretching vibration or anti-stretching vibration of free hydroxyl in liquid water. The broad peak is the intermolecular absorption peak at 3400 cm^{-1}. The absorption peak at 3050-3000 cm^{-1} is formed by the antisymmetric stretching of CH_2. The absorption peak at 3000-2850 cm^{-1} is due to the symmetric stretching of CH_2. The absorption peak at 1950-1900 cm^{-1} may be due to the stretching vibrations of carbon-carbon double bonds. The absorption peak at 1650-1600 cm^{-1} is the angular vibration of H_2O and the stretching vibration of carbon-carbon double bonds. The absorption peaks at 1550 cm^{-1} and 1450 cm^{-1} are formed by the vibrations of NO_2 and CH_2, respectively. The absorption peak at 1200 cm^{-1} is the C-O-C stretching vibration.

The absorption peaks at 1050 cm^{-1} and 950 cm^{-1} are the C-O stretching vibration and the C-H bending vibration, respectively (Stoppa et al. 1995, Lebron and Tan 2010). The slightly weakened chemical composition indicated by thecellulose absorption peak (2948 cm^{-1}), hemicellulose peak (1730 cm^{-1}), and lignin peak (1739 cm^{-1}, 1611 cm^{-1}, 1501 cm^{-1} and 812 cm^{-1}) suggests that this part is hydrolyzed (Pérez et al. 2002). As can be seen from Figure 1 and Figure 2, the absorption peaks of the extract of *Millettia leucantha* mainly concentrated at 3700-3000 cm^{-1}, 3000-2800 cm^{-1}, 1800-1350 cm^{-1} and 1200-800 cm^{-1}. The main associated chemical components are phenols, alcohols, ethers, fatty acids, hydrocarbons and aromatics. In addition, the characteristic absorption peaks were decreased, indicating that these components were partially extracted.

TG and DTG analysis

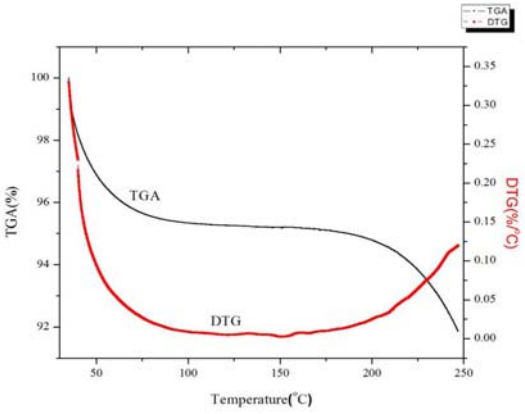

Figure 3. TGA and DTG thermal curves

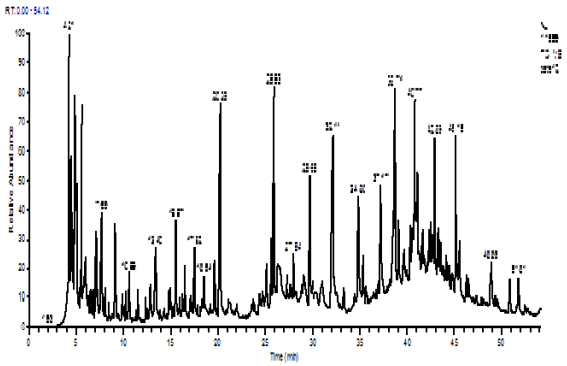

Figure 4. Total ion chromatograms Py-GC-MS

TG is a thermal analysis technique that measures the relationship between the mass of a sample and the change in temperature, at a programmed temperature. The thermogravimetric analysis shows the composition of the sample and its possible intermediates, thermal stability, thermal decomposition and other information. To a large extent, the thermal stability of white flower bean wood determines its excellent flame retardant properties. Therefore, the analysis of thermal stability is also an effective way to evaluate the flame retardant properties of wood (Afify 2008). Consequently, we used TG to study the thermal stability of red sandalwood. Shown in Figure 3, are the TGA curve and DTG curve. t1wt%, t4wt%, and t8wt% are expressed as 1%, 4%, and 8%, respectively, of the weight loss. The Figures correspond to 36ºC, 65ºC and 246ºC, respectively. The TGA and DTG descent curves are broadly divided into three phases. The first phase is from the initial temperature to 80ºC, and, at this stage, the TGA curve decreases at a faster rate, with the material content decreasing by about 4.5%. The DTG curve also gradually decreased toward 0, at this time. As this part of the decline is mainly due to the temperature rise, it results in a partial evaporation of water and volatile gases. The second stage is from 80ºC to 200ºC. At this stage the TGA curve presents only a small decline, indicating a total loss of only 0.8% of the sample content. Meanwhile, the DTG curve at this time is nearly equal to zero. This part may only be due to the lack of an adequate amount of water. In the third stage, from 200ºC to 250ºC, the TGA began to resume its decline, with a decrease of 2.7%. Simultaneously, DTG gradually increased from 0, indicating that the rate of decline is also gradually accelerated. This part of the decline may be due to the high temperature combustion of cellulose and lignin after the temperature reaches the appropriate level. Nevertheless, it can be seen from the overall curve that a total loss of only 8% of the *Millettia leucantha* was registered during the temperature rise from 0ºC to 250ºC, which illustrates the good thermal stability of *Millettia leucantha,* especially between 80ºC to 200ºC, at which the content decreased only slightly.

GC-MS analysis

According to the results of the GC-MS analysis, 72 peaks were detected in the B1 sample, and 8 chemical

constituents were identified. The results show that the contents of these substances are as follows:m-guaiacol(3.61%),1,4-benzenediol,2-methoxy-(3.2%),Phenol,4-methyl-2-[5-(2-thienyl)pyrazol-3-yl]-(53.76%),3,3',4,4'-tetramethoxystilbene(19.14%),10,11-dihydro-10-hydroxy-2,3,6-trimethoxydibenz(b,f)oxepin(27.69%),2H-1-benzopyran-2-one,7-hydroxy-3-(4-methoxyphenyl)-(100%), 7-methyl-Z-tetradecen-1-ol acetate (3.24%).

According to the results of the GC-MS analysis, 74peaks were detected intheB2 samples, and 12 chemical constituents were identified. The results show that the contents of these substances are as follows:Phenol,4-methyl-2-[5-(2-thienyl)pyrazol-3-yl]-(16.86%),S-indacene-1,7-dione,2,3,5,6-tetrahydro-3,3,4,5,5,8-hexamethyl-(26.86%),S10,11-dihydro-10-hydroxy-2,3,6-trimethoxydibenz(b,f)oxepin(100%),2H-1-benzopyran-2-one,7-hydroxy-3-(4-methoxyphenyl)-(61.12%),4H-1-benzopyran-4-one,7-hydroxy-3-(4-methoxyphenyl)-(17.05%).

According to the results of the GC-MS analysis, 89 peaks were detected in the B3 sample, and 14 chemical constituents were identified. The results show that the contents of these substances are as follows:m-guaiacol(6.97%),1,4-benzenediol,2-methoxy-(5.24%),Benzene,1,2,3-trimethoxy-5-(2-propenyl)-(0.56%),(-)-spathulenol(4.44%),5-hydroxymethyl-1,1,4a-trimethyl-6-phenol,4-methyl-2-[5-(2-thienyl)pyrazol-3-yl]-(100%),S-indacene-1,7-dione,2,3,5,6-tetrahydro-3,3,4,5,5,8-hexamethyl-(17.02%),2,3-diol(1.92%),corymbolone(1.56%),10,11-dihydro-10-hydroxy-2,3,6-trimethoxydibenz(b,f)oxepin (77.2%).

Py-GC-MSanalysis

According to the results of Py-GC-MS, the total ion chromatograms of Py-GC-MS has been shown in Figure 4. Of these, the most abundant compounds are: carbamic acid, monoammonium salt (10.68%), 1-propen-2-ol, acetate (4.27%), acetaldehyde, hydroxy- (4.41%), furfural (2.50%), 1,2-cyclopentanedione (2.77%), phenol, 2-methoxy-(8.17%), creosol (8.71%), catechol (3.08%), phenol, 4-ethyl-2-methoxy-(3.51%),2-methoxy-4-vinylphenol(8.87%),phenol,2-methoxy-3-(2-propenyl)-(4.05%), ,trans-isoeugenol(5.96%),benzene,1,2,3-trimethoxy-5-(2-propenyl)-(4.65%),D-allose(2.51%).

Conclusion

As evidenced by our study, the *Millettia leucantha* extracts obtained by different solvents have varying degrees of change in infrared transmittance. According to FT-IR results, the main absorption peaks of *Millettia leucantha* areat 3700-3000 cm^{-1}, 3000-2800 cm^{-1}, 1800-1350 cm^{-1} and 1200-800 cm^{-1}. The results of the TGA and DTG tests show that the process is roughly divided into three stages. During the whole process, the sample content decreased by only 8%, even when the sample temperature increased to 250ºC, which fully illustrates the thermal stability of *Millettia leucantha*.

In the GC-MS test, 72 peaks were detected in the extract of *Millettia leucantha*obtained using ethanol, and 8 chemical constituents were identified. The extract of *Millettia leucantha*obtained by ethanol/benzene (1:2) had 74 peaks and 12 identified compounds, whereas 89 peaks were observed for the ethanol/methanol (1:1) extract of *Millettia leucantha*, associated with 14 compounds. In the TDS-GC-MS test, *Millettia leucantha* volatiles were isolated from 50 peaks, and 21 compounds were identified, whereas using the Py-GC-MS test, 50 *Millettia leucantha* compounds were identified.

From the above results it can be concluded that there is a wide variety of active ingredients in *Millettia leucantha*. 2-Methoxy-4-methylphenol, 4-ethyl-2-methoxyphenol and isopropenyl acetate are often used as main ingredients for food flavoring. In summary, although the majority of *Millettia leucantha* extracts are toxic, they are also an integral part of the industrial, food and pharmaceutical industries. Therefore, it is necessary to analyze the composition of this material, and to optimize the extraction process.

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