Mahogany seeds oil: isolation and characterizations

by Sri Mursiti

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Mahogany seeds oil: isolation and characterizations

Sri Mursiti[1,*], Endah Fitriani Rahayu[1], Yuan Maylia Rosanti[1], Intan Nurjaya[1]

[1] Chemistry Department, Faculty of Mathematics and Natural Sciences, Universitas Negeri Semarang, Semarang, Indonesia

* Corresponding author: kumalasari_berliana@yahoo.com

Abstract. A study of isolation and characterizations mahogany seeds oil has been conducted. Mahogany seeds oil was taken by maceration using n-hexane solvent for 3 x 24 hours. The n-hexane extract was evaporated until all the solvents were lost to obtain mahogany seeds oil and then characterizations using GC-MS, IR spectrometers, and UV spectrometers to identified the compounds. The result showed that ester of Linoleic acid (81.56%) was the dominant compound in mahogany seeds oil.

Keywords: mahogany seeds oil, maceration, Linoleic acid

1. Introduction

Various ways were done by researchers to detect the presence of compounds found in plant tissues. All of them do economically various types of high-level plants to get useful medicinal ingredients. One of the plants known as medicinal plants is mahogany which is very easy to grow in Indonesia and produces many seeds. Mahogany is the Melliaceae family of Swietenia species seeds. Mahogany is the Melliaceae family of Swietenia species. This species is found in lowland forests at an altitude of 400 meters above sea level and mixed forests of various species from the family Meliaceae. Swietenia is a plant that contains secondary metabolites including flavonoids, alkaloids, and saponins [1]. The use of mahogany seeds has been known primarily by people in Java, namely as a drug for diabetes, high blood pressure, gout, eczema, fat laxative, and colds [2, 3]. Given the use of mahogany as a drug based only on hereditary experience, it is necessary to research the compounds contained in it. [1] studied mentions that mahogany seeds were effective as blood glucose-lowering (anti-DM) white mice. Mahogany seeds oil can be used as an alternative raw material for biodiesel [4]. According [5] mahogany seeds oil has inhibitor activity (inhibitor) amylase so it can reduce the glucose absorption and effective in controlling diabetes. Research showed that petroleum ether extract mahogany seeds from *Swietenia macrophylla* had activity antihyperglycemic in intraperitoneal tolerant test glucose.

Based on the description above, it can be concluded that even though mahogany was a widely available medicinal plant in Indonesia, yet in-depth scientific research has not been widely carried out. The research needs to be done to determine the compound content. So that it can be used effectively and efficiently, synthesized into other more useful compounds, or as a model for compounds.

Isolation of oil contained in plant seeds can be done by extraction using non-polar, for example petroleum ether or n-hexane. IR spectra have been used extensively in the translation of organic molecular structures. Several cluster positions in the structure were found and showed the frequency of absorption of IR, UV, GC, GC-MS, 1HNMR as well as other techniques.

2. Method

2.1. Sample Preparation

Mahogany seeds were cleaned, dried and mashed to obtain powder then 3000 grams of mahogany seed powder macerated with n-hexane for 24 hours (3 times) to extract the oil. The extract obtained was concentrated at low pressure using an evaporator Buchii until all the solvents were lost and the mahogany seed oil was obtained.

2.2. Detection and Analysis with GC-MS and IR spectrometers.

Mahagony seeds oil was detected by reactants for alkaloids, flavonoids, saponins, terpenoids, and steroids, then boiling points and optical rotation determination. Molecular structure was determined by IR and GC-MS spectroscopy. The melting point was determined using Fisher John's micro melting point setting. Optical rotation was determined using a Polarimeter Perkin Elmer 341. The IR spectrum was measured using Shimadzu FTIR 8201 PC GC-MS spectrum was measured using a chromatograph Shimadzu GCMS-QP2010S Shimadzu mass spectrometer.

3. Result and Discussion

The isolation of mahogany seed oil was carried out by the modification [6, 7]. Non-polar (n-hexane) solvent took the non-polar compounds by extraction method. This study used n-hexane solvent because n-hexane is a solvent which very easy to obtain, relatively cheaper, and easy to handle than other organic solvents. The results of isolation obtained from mahogany seeds oil with n-hexane solvents are presented in Table 1.

Table 1. Isolation of mahogany seeds oil.

Item	Quantity
Weight of mahogany seeds (g)	3000
Volume of mahogany seeds oil (mL)	1289
Color of mahogany seeds oil	Yellow
Density (g/mL)	0.89
Boiling point of mahogany seeds oil (°C)	209
Optical rotation	34

Mahogany seeds oil obtained from the press of 5000 g of mahogany seeds with hydraulic press tools carried out by [8] was 1400 mL (28%), while using maceration method obtained yield of 43% mahogany seeds oil, so it can be concluded that the maceration method using n-hexane solvent could produce more oil. To find out the presence of secondary metabolite compounds in oil, qualitative tests were carried out. Qualitative test results are presented in table 2.

Table 2. Qualitative test results of mahogany seed oil.

Reagents	Results	Presence
Dragendorff	-	No alkaloid
HCl + Mg	-	No flavonoid
Water	-	No saponin
H_2SO_4 + Anhydride acetic acid	-	No steroid
Anhydride acetic acid	-	No terpenoid

Overall qualitative identification showed that there was no secondary metabolite in mahogany seeds oil. In addition to qualitative identification using reagents, analysis of the content of compounds in oil was also carried out by using an IR spectrometer instrument to determine the type of functional group contained in the compounds. The IR spectrum of mahogany seeds oil is shown in Fig. 1.

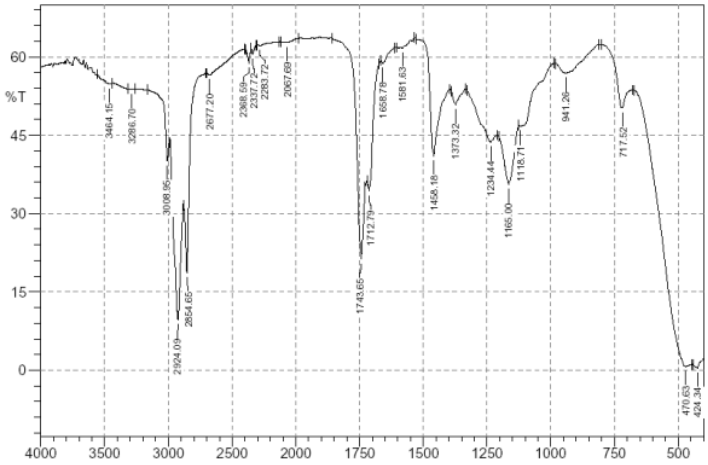

Figure 1. The IR Spectrum of Mahogany seeds oil.

Based on the IR spectrum of mahogany seeds oil, it was seen that the absorption at 2924.09 cm^{-1} showed the presence of -CH and 2854.65 cm^{-1} with a range of $-CH_2$, and absorption at 1373.32 cm^{-1} showed the presence of $-CH_3$ group. The absorption at 1712.79 cm^{-1} showed the presence of C-O esther group reinforced by 3464.15 cm^{-1} absorption. Absorption at 1581.63 cm^{-1} and 1458.18 cm^{-1} showed the presence of an aromatic ring. This suggests that in mahogany seeds oil there were maybe contain the esther compounds. Analysis was also carried out with GC-MS instruments. Analysis with GC-MS instruments was used to determine the number and estimated types of compounds in mahogany seeds oil. The results of the analysis with GC-MS is shown in Fig. 2. Based on GC-MS analysis in mahogany seeds oil there were 11 peaks which showed 11 compounds. Retention times and estimates of types of compounds in mahogany oil are found in Table 3.

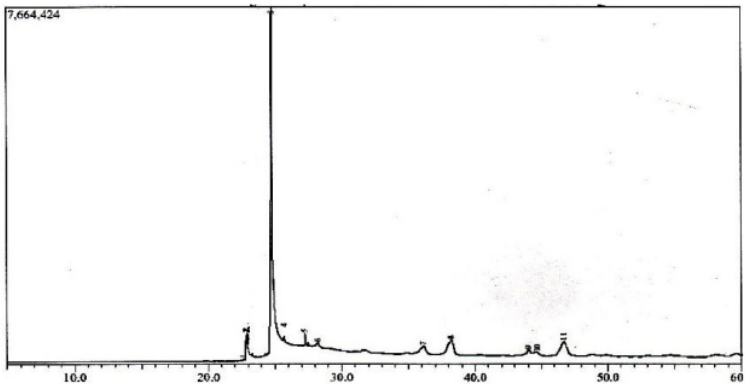

Figure 2. The GC-MS Spectrogram of Mahogany seeds oil.

Table 3. Retention times of mahogany seeds oil.

Peak	Retention times (min.)	Abundance (%)	Fragmentation	Estimated compounds	*Similary Index*
1	22.642	0.14	112; 97; 83; 69; 55; 41	9-hexadecenoic acid ($C_{16}H_{30}O_2$) Mr=254	93
2	22.866	3.66	256; 227; 213; 185; 171; 157; 143; 129; 115; 98; 85; 73; 60	Palmitic Acid ($C_{16}H_{32}O_2$) Mr=256	96
3	24.772	81.56	280; 264; 222; 180; 165; 151; 137; 123; 109; 95; 81; 67; 55; 41	Linoleic acid ($C_{18}H_{32}O_2$) Mr=280	93
4	25.692	0.32	500; 408; 377; 355; 333; 285; 256; 239; 223; 207; 181; 151; 137; 116; 98; 83; 57; 43; 41	2-hydroxy-1- (hydroxymethyl) hexadecanoic acid ethylester ($C_{19}H_{38}O_4$) Mr=330	80
5	27.295	1.30	283; 264; 236; 221; 207; 191; 179; 166; 151; 137; 121; 95; 81; 67; 55; 41	Olealdehyde ($C_{18}H_{34}O$) Mr=266	88
6	28.246	1.65	586; 573; 531; 512; 500; 476; 464; 446; 432; 416; 396; 388; 370; 345; 328; 313; 301; 281; 267; 255; 231; 207; 183; 173; 157; 149; 137; 119; 105; 91; 77; 59; 43; 33	Pregn-5-en-20-on, 21- (acetyloxy) - 16,17-epoxy-3- hydroxy- (3 beta, 16 alpha) ($C_{23}H_{32}O_5$) Mr=388	49
7	36.146	3.02	510; 488; 465; 450; 429; 405; 370; 354; 329; 310; 295; 279; 255; 237; 223; 199; 185; 171; 147; 119; 105; 95; 81; 69; 43; 41	Holotoxinogenin 3 beta-acetate ($C_{32}H_{48}O_6$) Mr=528	51
8	38.217	2.89	510; 474; 446; 432; 414; 386; 372; 343; 326; 315; 301; 283; 267; 255; 239; 223; 208; 187; 173; 161; 137; 119; 105; 95; 79; 69; 43; 41	13-acetoxymethyl-17-acetyl-9-hydroxy-10-oxo-2,3,6,7,8,9,10-acetate ($C_{25}H_{34}O_7$) Mr=446	66
9	44.025	1.55	564; 456; 428; 409; 391; 374; 356; 342; 325; 311; 297; 283; 271; 257; 245; 231; 207; 185; 173; 149; 133; 109; 95; 83; 69; 55; 41	17- (1,5 dimethyl- hex-4- enyl) - 4,4,10,13,14-pentametyl- 1,2,4,5,6,7,10,11,12,13,14. ($C_{30}H_{48}O$) Mr=424	72
10	44.667	1.44	591; 584; 563; 538; 510; 483; 468; 448; 446; 433; 405; 377; 346; 331; 305; 281; 265; 245; 231; 209; 191; 175; 147; 129; 121; 109; 95; 72; 57; 43; 37	Capsanthin ($C_{40}H_{56}O_3$) Mr=584	42
11	46.733	2.46	552; 437; 363; 232; 214; 175; 159; 145; 133; 121; 105; 95; 83; 69; 55; 41	Tigloildisoxilin ($C_{31}H_{36}O_9$) Mr=552	70

Based on the results of the analysis, one type of compound in mahogany oil with the largest percentage is Linoleic acid ester (81.56%). Research of Mohan *et al*. [6] concluded that mahogany seeds oil contains oleic, linoleic, palmitic, and stearic acid, as major fatty acid.

4. Conclusion

Isolation of oil from mahogany seeds can be done using n-hexane solvents. Mahogany seed oil did not contain secondary metabolites but contain ester compounds.

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