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Email :editorijhess@gmail.com

GC-MS Analysis Of Bioactive Compounds From Ethanol Extract Of Yellow Wood Stems (*Arcangelisia flava*) AS Anti-Inflammatory And Anti-Hyperuricemia

[1]*Ajeng Intan Estri Amanda, [2]Salni, [3]Ziske Maritska, [4]Fatmawati

[1]Department of Histology, Faculty of Medicine, Universitas Sriwijaya,Palembang, Indonesia
[2]Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Sriwijaya,Palembang, Indonesia
[3]Department of Biology Medicine, Faculty of Medicine, Universitas Sriwijaya, Palembang, Indonesia
Department of Biochemistry, Faculty of Medicine, Universitas Sriwijaya, Palembang, Indonesia

*Coresponding Author: ajengintan@unsri.ac.id

Abstract

Yellow wood (Arcangelisia flava) is a wild plant that can be found in Indonesia although it is not yet widely cultivated. The stems of yellow wood is known to contain various metabolite compounds, including saponins, flavonoids, and tannins. Recent research has found that the flavonoid content in the roots and stemss of yellow wood has xanthine oxidase inhibitory effects that can be used to prevent inflammation and hyperuricemia. This research uses the maceration method, where yellow wood stemss will be made into extract using ethanol as a solvent, and the compound contained in the extract will be analyzed using Gas Chromatography-Mass Spectrometry (GC-MS). The GC-MS analysis result showed that the ethanol extract of yellow wood stemss contain 2-(4-tert-butylphenyl)cyclopropanecarboxylic acid (isomer 2); Tetracyclo [5.2.1.0(2,6).0(3,5)] decane, 4,4-dimethyl; Olean-12-en-28-oic acid, 3-hydroxy-, methyl ester (3 beta); 9-octadecenoic acid, methyl ester, (E); and hexadecanoic acid, methyl ester. These compounds have benefit as anti-inflammatory and antihyperuricemic agent, which can serve as advantageous medicinal ingredient for humans. The result of analysis in the yellow wood stems can serve as a reference for further research to develop the potential of yellow wood stemss leading to traditional medicine.

Keywords: Yellow Wood, GC-MS, Traditional Medicine, Anti-inflammatory, Antihyperuricemic

INTRODUCTION

As a tropical country, Indonesia has a high biodiversity in flora and fauna. Indonesia is one of the eight mega biodiversity country in the world and the distribution is also extensive with several types being endemic or can only grow in one particular place. Among 30,000 plant species exist in Indonesia, 940 have known to be used to treat various diseases (Aprilianti, 2022; Subiandono & Heriyanto, 2019).

The wide range of ethnic groups in Indonesia has rise to different cultures, customs, and traditional knowledge. Using the various elements of the local environment as treatments for different illnesses is one example of this traditional knowledge. People have been aware of and use the medicinal qualities of numerous plants to cure various conditions for a long time. Despite being aware of the ingredients found in these plants, people rarely uses them. The use of medicinal plants in Indonesia is related to knowledge of their properties and involves proving their compound content. Thus, the use of these medicinal plants can be developed in the pharmaceutical industry (Diliarosta et al., 2021).

Yellow wood or *Arcangelisia flava* is a wild plant that can be found in Indonesia, although it is not yet widely cultivated. Yellow Wood is a woody plant that can grow up to 20 meters in length.

Its stems can reach a diameter of 5 cm with gray bark, while the yellow wood itself has a bright color (Ariyanti, 2001; Diliarosta et al., 2021; Sulistiarini et al., 2020). Yellow Wood is known to contain various metabolic compounds, including saponins, flavonoids, and tannins. In addition, its roots also contain glycosides and alkaloids, especially from the isoquinoline group such as berberine, jatrorrhizine, and palmatine. There are also several minor alkaloids such as columbamine, dehydrocorydaline, homoaromoline, and talifendine, as well as terpenes such as fibraleucin and fibraurin (Ariyanti, 2001; Diliarosta et al., 2021). Recent studies have found that the flavonoid content in the roots and stemss of yellow wood has xanthine oxidase inhibitory effects, which can be used to prevent inflammation and hyperuricemia (Hasnaeni, 2021; Tavita et al., 2022).

This study aims to conduct a comprehensive analysis of the bioactive compounds contained in the ethanol extract of yellow wood stems (*Arcangelisia flava*) using Gas Chromatography-Mass Spectrometry (GC-MS) techniques. Through this analysis, it is expected that various bioactive compounds with potential as traditional medicines, especially antihyperuricemic agents, can be identified, including an evaluation of their chemical structures and quantities. Thus, this study is expected to contribute to the development of natural-based medicines and enhance knowledge of the therapeutic potential of yellow wood stemss as a source of traditional medicine.

METHOD

This research was conducted in January 2024 at the Regional Health Laboratory of DKI Jakarta Province. This study is an exploratory type of research aimed at identifying and comprehensively analyzing the bioactive compounds contained in the ethanol extract of the yellow wood stems using Gas Chromatography-Mass Spectrometry (GC-MS) techniques. The main objective of this study is to reveal the profile of bioactive compounds that potentially have therapeutic value, particularly antihyperuricemic, as well as to evaluate the potential applications of these compounds in traditional medicine. Through this study, it is expected that detailed information on the chemical composition of the ethanol extract of the yellow wood stems can be obtained, which can later serve as a basis for further development in the pharmaceutical and medical fields, especially in the formulation of evidence-based traditional medicines.

Preparation Of Ethanol Extract From Yellow Wood Stemss

Preparation Of Yellow Wood Stemss

Collecting materials for the extraction of yellow wood stemss is a process that involves several important steps, starting from the selection of raw materials to the initial preparation before the extraction process.

Yellow wood stemss are subjected to wet sorting, then washed until clean and drained. Once clean, slice the yellow wood stemss thinly to speed up the drying process. Air-dried the yellow wood stemss and place them in an oven to further dry the stemss. After the results are dry, grind them using a simplisia grinder until they become powder.

Extraction Of Yellow Wood Stemss

Weigh 1000 g of Arcangelisia flava stems crude drug, then macerate it using ethanol solution for 3x24 hours. Next, stir several times during the maceration process. The resulting filtrate will be collected and evaporated using a rotary evaporator until it becomes a thick (concentrated) extract.

Analysis Of Compounds In Ethanol Extract Of Yellow Wood Stemss

GC-MS analysis was conducted at the Regional Health Laboratory of DKI Jakarta Province. The ethanol extract of yellow wood stemss was analyzed using gas chromatography (Agilent 7890) with a mass spectrometer detector (Agilent 5975) equipped with an Agilent automatic injector and an HP Ultra 2 capillary column (capillary column with a length of 30 m X 0.20 mm I.D X 0.11 µm film thickness). Chromatograms were analyzed, and the relative percentage of the compounds was calculated. The compound structures were designed using the GC-MS Acquisition Mode program for Balitro.

RESULT AND DISCUSSION

The GC-MS analysis of the ethanol extract from the yellow wood stemss produced a chromatogram, which can be seen in Figure 1, and the interpretation of the results from the chromatogram can be seen in Table 1.

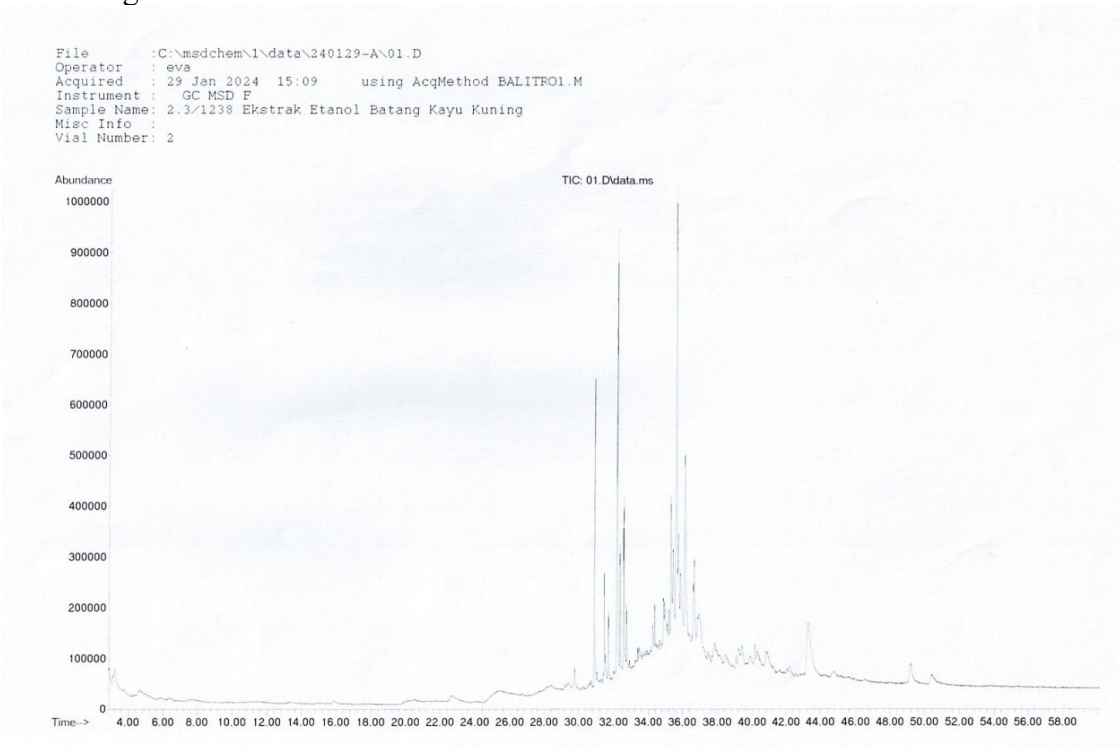

Figure 1. GC-MS Chromatogram of Ethanol Extract of Yellow Wood Stemss

Table 1. Interpretation of GC-MS Test Results of Ethanol Extract of Yellow Wood Stems

No	RT	Quality	Senyawa	Kandungan (%)
1	30.882	99	Hexadecanoic acid, methyl ester	5,46
2	32.137	99	9,12-Octadecanoic acid (Z,Z)-, methyl ester	4,68
3	32.171	99	9-Octadecanoic acid, methyl ester, (E)-	8,33

4	35.316	47	2,6,10,10-Tetramethylbicyclo [7.2.0] undeca-2,6-diene	5,08
5	35.433	50	3-Cyclohexene-1-ethanol, beta, 4-dimethyl-, [S-(R*,S*)]-	4,54
6	35.612	59	2-(4-tert-Butylphenyl) cyclopropanecarboxylic acid (isomer 2)	15,39
7	35.743	25	Quinoline, 4-methyl-,1-oxide	4,79
8	35.874	47	1-Cycloheptene, 1,4-diethyl-3-(2-methyl-1-propene-1-yl)-4-vinyl-	4,61
9	36.115	38	Tetracyclo [5.2.1.0(2,6).0(3,5)] decane, 4,4-dimethyl	9,73
10	343.287	87	Olean-12-en-28-oic acid, 3-hydroxy-, methyl ester (3 beta)-	8,51

Based on the GC-MS test chromatogram results in Table 1, there are ten compounds which quality closely matches their reference compounds (indicated by the % total that is closest), but only the five highest contents were subjected to further literature review, namely 2-(4-tert-butylphenyl) cyclopropanecarboxylic acid (isomer 2); Tetracyclo [5.2.1.0(2,6).0(3,5)] decane, 4,4-dimethyl; Olean-12-en-28-oic acid, 3-hydroxy-, methyl ester (3 beta); 9-octadecanoic acid, methyl ester, (E); and hexadecanoic acid, methyl ester. These five compounds are derivatives of fatty acids, unsaturated fatty acids, aromatic carboxylic acids and cyclopropane, polycyclic hydrocarbons, and triterpenoids that possess biological activity. (Rizvi et al., 2023)

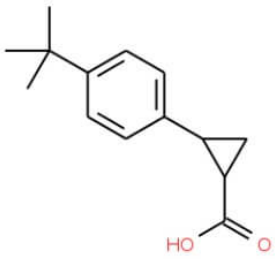

Figure 2. 2-(4-tert-butylphenyl)cyclopropanecarboxylate acid

The compound 2-(4-tert-butylphenyl) cyclopropanecarboxylate acid (isomer 2) can be seen in its chemical structure in Figure 2. It is the compound with the highest content in the GC-MS results and is a derivative of cyclopropanecarboxylate that has anti-inflammatory potential. Research shows that this compound acts as an anti-inflammatory by modulating the production of inflammatory mediators and affecting immune responses. This compound also exhibits antibacterial inhibitory effects. It is known that 2-(4-tert-butylphenyl) cyclopropanecarboxylate

acid (isomer 2); Tetracyclo[5.2.1.0(2,6).0(3,5)] decane, 4,4-dimethyl; and olean-12-en-28-oic acid, 3-hydroxy-, methyl ester (3 beta) belong to the triterpenoid class of compounds, which are polycyclic secondary metabolites found in many terrestrial plants.

Triterpenoids are a combination of carbon skeletons consisting of six isoprene units, biosynthetically derived from acyclic C30 hydrocarbons with complex cyclic structures, either in the form of alcohols, aldehydes, or carboxylic acids. Triterpenoids are known to have anti-inflammatory activity and function as immunomodulators in many studies. In addition to being anti-inflammatory, triterpenoids are also known to act as antiviral, antimicrobial, antitumor agents, and immunomodulatory components. The potential of this compound in inhibiting the occurrence of edema in the feet of rats in several studies is closely related to its potential as an anti-inflammatory agent. Previous studies have shown that its anti-inflammatory effect is better than commonly used anti-inflammatory agents such as phenylbutazone. This compound is beneficial for managing inflammation, especially those related to rheumatoid arthritis, joint diseases, collagen diseases, bursitis, gouty arthritis, and spondylitis, when administered at the appropriate dose. It is also known that hexadecanoic acid, methyl ester, has properties as a secondary antioxidant that can combat free radicals and support cell regeneration. At normal levels, this compound can help regulate purine metabolism and reduce the risk of hyperuricemia. Similarly, 9-octadecanoic acid, methyl ester, has similar antioxidant properties, which can help protect body cells and reduce the risk of hyperuricemia through proper regulation of purine metabolism. (Rizvi et al., 2023; Naik et al., 2021)

CONCLUSION

The GC-MS analysis results of the ethanol extract of yellow wood stemss contain the compounds 2-(4-tert-butylphenyl) cyclopropanecarboxylic acid (isomer 2); Tetracyclo [5.2.1.0(2,6).0(3,5)] decane, 4,4-dimethyl; Olean-12-en-28-oic acid, 3-hydroxy-, methyl ester (3 beta); 9-octadecenoic acid, methyl ester, (E); and hexadecanoic acid, methyl ester. These five compounds are derivatives of fatty acids, unsaturated fatty acids, aromatic carboxylic acids and cyclopropanes, polycyclic hydrocarbons, and triterpenoids. These compounds have benefits as anti-inflammatory and antihyperuricemic agents, which could serve as advantageous medicinal substances for humans.

ADVICE

The identification of GC-MS compounds needs to be developed into In Silico, In Vivo, and In Vitro studies to observe the benefits of the compounds in yellow wood stems extract as anti-inflammatory and anti-hyperuricemic agents.

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