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GC-MS ANALYSIS OF ACTIVE COMPOUNDS OF CINNAMON LEAF EXTRACTS (CINNAMOMUM BURMANNI BLUME)

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ABSTRACT

The plant of the type *Cinnamomum burmanni* Blume that belongs to the family of Lauraceaein Bali-Indonesia is known as cinnamon. This plant has many benefits namely a specific medicine for impaired digestion, stomach pain with nausea, condiments, and serves as anti-bacterial and fungi. This study was conducted to determine the GC-MS analysis of the methanol extracts of cinnamon leaves. There were ten chemical compounds identified, the dominant chemical compounds were Azulene (CAS) Cylopentacycloheptene (52.5%), Azulene (CAS) Cylopentacycloheptene (21.5%) and Phenol, 2,2'-methylene bis [6- (1 , 1-dimethylethy) -4-ethyl (12.1%).

KEYWORDS: *Cinnamomum burmanni Blume, phytochemicals, GC-MS analysis, Azulene*

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INTRODUCTION

Species of *Cinnamomum burmanni* Blume (Lauraceae) in Indonesia are known as the cinnamon. This plant is widely grown in the village of Belok Sidan Badung regency of Bali province of Indonesia. This plant has many benefits such as food flavoring used both domestically and industrially. Cinnamon bark oil is also used in the manufacture of soaps and perfumes, anti-bacterial and fungi,[1-3] antibiofilm agents,[4] Antipyretic,[5] antioxidant.[6] Cinnamon (*C. burmanni* Blume) leaf methanol extract is an anti-fungal and can control Fusarium wilt disease in tomato plants found in Bali-Indonesia both in-vitro and ex-vivo[7]. This study was conducted to determine the compounds contained in the extracts of cinnamon leaves that act as an anti-fungal compound by GC-MS analysis.

MATERIAL AND METHODS

Extraction method

Cinnamon leaves (*Cinnamomum burmanni* Blume) used in this study came from the village of Bilok, district of Petang, Badung regency, Bali Province, Indonesia. Cinnamon leaves used were the fourth leaves up to the ninth leaves from the tip that had been green in color. The leaves were first cleaned of surface contaminants using clean water, and then chopped into small pieces and subsequently dried for 3 days at room temperature. The leaves that had been wind dried were then blended until they became a powder. A total of approximately 1000 g powder leaves were macerated in methanol for 48 hours in a dark place at room temperature. The filtrate obtained by filtering through 4 layers of gauze and Whatman filter paper no. 2. The process of extraction with the same procedure was performed three times. The filtrate obtained were combined and evaporated using a vacuum rotary evaporator [Rotapavor R-210 (buchi)] at a temperature of 40° C to obtain a crude extract used for further testing.[8]

GC-MS Analysis

Identification of active compounds that had fungicidal activity against the fungus *Fusarium oxysporum* f.sp. l*ycopersici* causing wilt disease in tomato plants was identified using gas chromatography-mass spectroscopy (GC-MS). A snapshot of most active and a relatively pure fraction was analyzed by gas chromatography-mass spectrometry. Through suitability of molecular weight and fragmentation pattern of the isolated compounds with the compounds in the library (WILEY or NIST) in the GC-MS system then isolated compounds could be known of the name, formula and molecular structure.[9-10] GC-MS test conducted at the Joint Laboratory of the Faculty of Mathematics and Natural Sciences (MIPA) University of Udayana, Jl. Kampus Bukit Jimbaran, Badung-Bali. GC-MS tool used was GC-MS-QP2010 Ultra SHIMADZU. Column temperature was programmed between 80°C and 250°C at a rate of 1:18 mL / min. The temperatures in the injector and detector were respectively 250°C and 220°C.

RESULT

Gas chromatogram analysis results showed 10 peaks. Each peak was identified more with mass spectroscopy, in which each compound had a specific mass fragmentation pattern (Figure 1-2). Identification of compounds at each peak was made by comparing the mass spectrum of each peak in the mass spectrum of compounds that had been known and programmed in the data base of GC-MS, so compounds making up the methanol extract of cinnamon leaves, the molecular weight compound, molecular formula, peak area and molecular structure could be presumed (Table 1-2, Figure 3a-j).

GC-MS Analysis

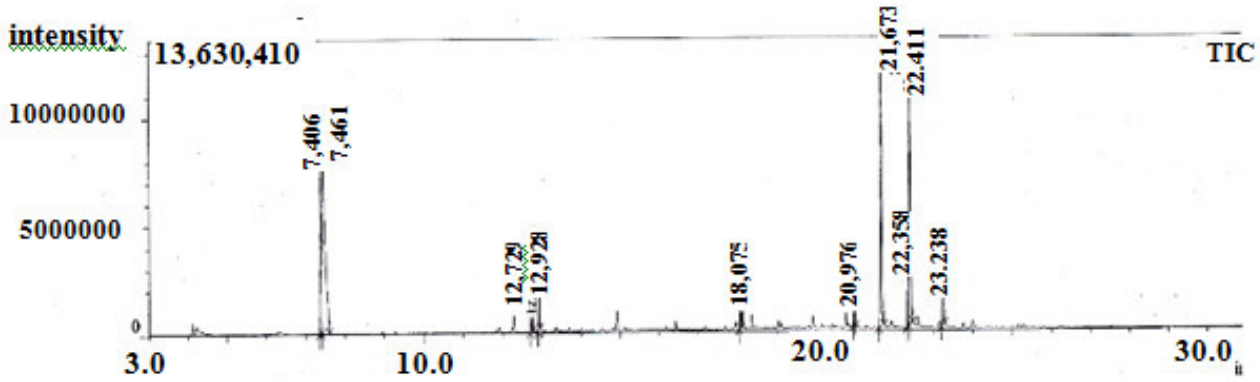
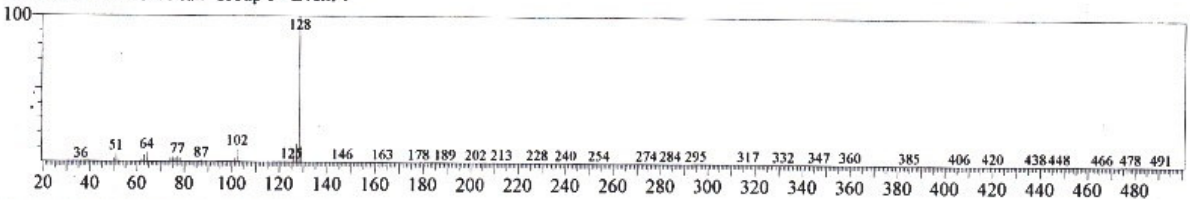


Figure 1
GC-MS Chromatogram of Methanol Leaf Extract of Cinnamomum burmanni Blume

Spectrum

<< Target >>
Line#:1 R.Time:7.405(Scan#:882) MassPeaks:268
RawMode:Averaged 7.400-7.410(881-883) BasePeak:128.10(2837573)
BG Mode:Calc. from Peak Group 1 - Event 1



<< Target >>
Line#:2 R.Time:7.460(Scan#:893) MassPeaks:266
RawMode:Averaged 7.455-7.465(892-894) BasePeak:128.10(2787319)
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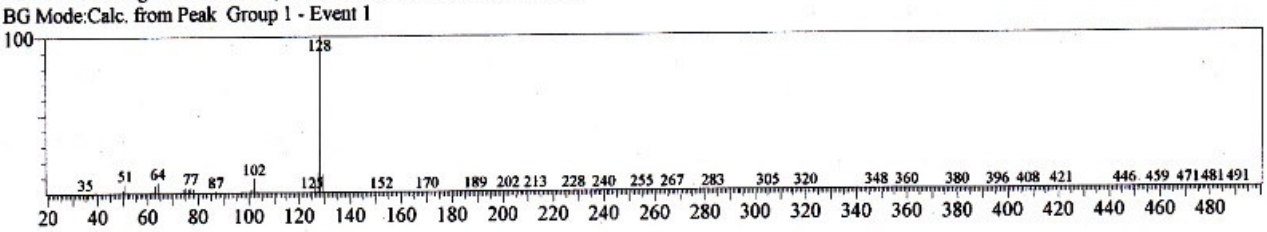
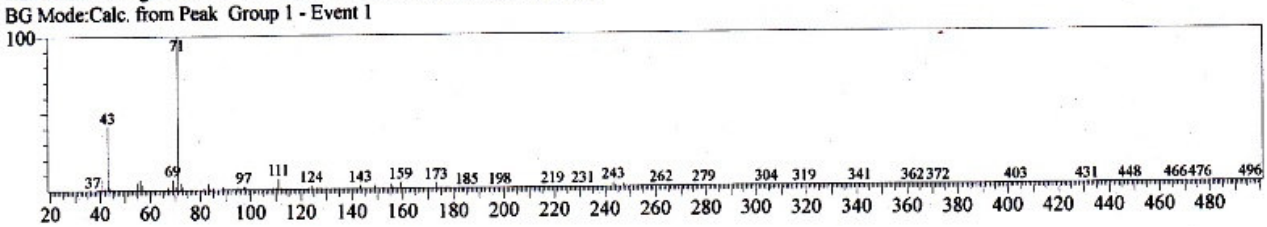
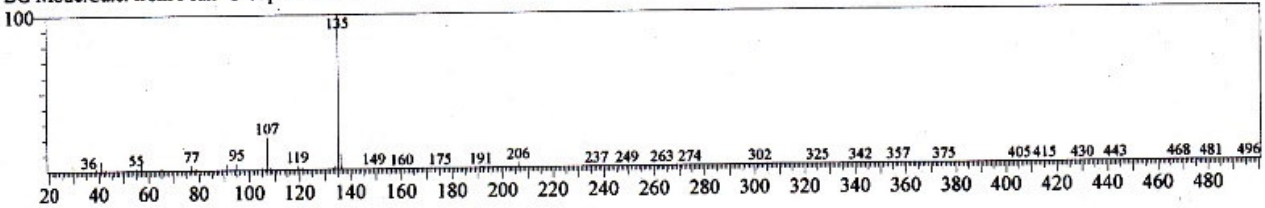


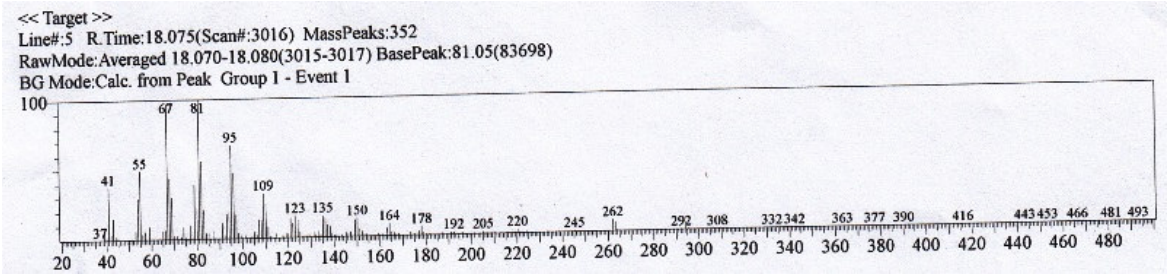
<< Target >>
Line#:3 R.Time:12.730(Scan#:1947) MassPeaks:318
RawMode:Averaged 12.725-12.735(1946-1948) BasePeak:71.05(284454)
BG Mode:Calc. from Peak Group 1 - Event 1



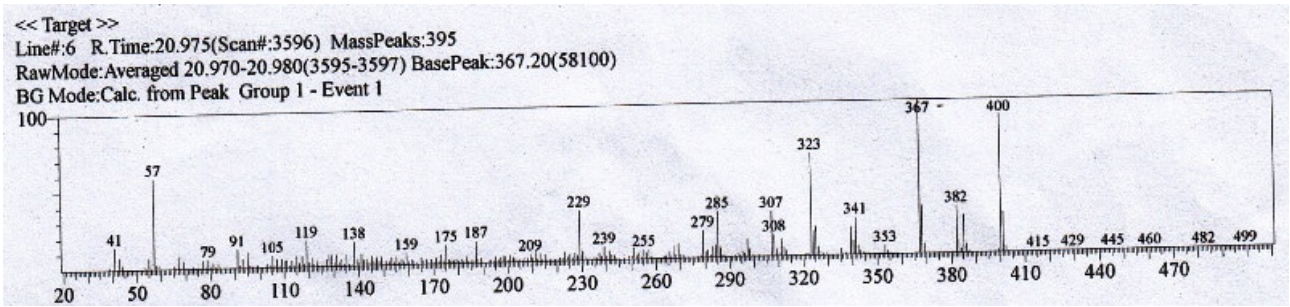
<< Target >>
Line#:4 R.Time:12.930(Scan#:1987) MassPeaks:302
RawMode:Averaged 12.925-12.935(1986-1988) BasePeak:135.10(858509)
BG Mode:Calc. from Peak Group 1 - Event 1



<< Target >>
Line#:5 R.Time:18.075(Scan#:3016) MassPeaks:352
RawMode:Averaged 18.070-18.080(3015-3017) BasePeak:81.05(83698)
BG Mode:Calc. from Peak Group 1 - Event 1



<< Target >>
Line#:6 R.Time:20.975(Scan#:3596) MassPeaks:395
RawMode:Averaged 20.970-20.980(3595-3597) BasePeak:367.20(58100)
BG Mode:Calc. from Peak Group 1 - Event 1



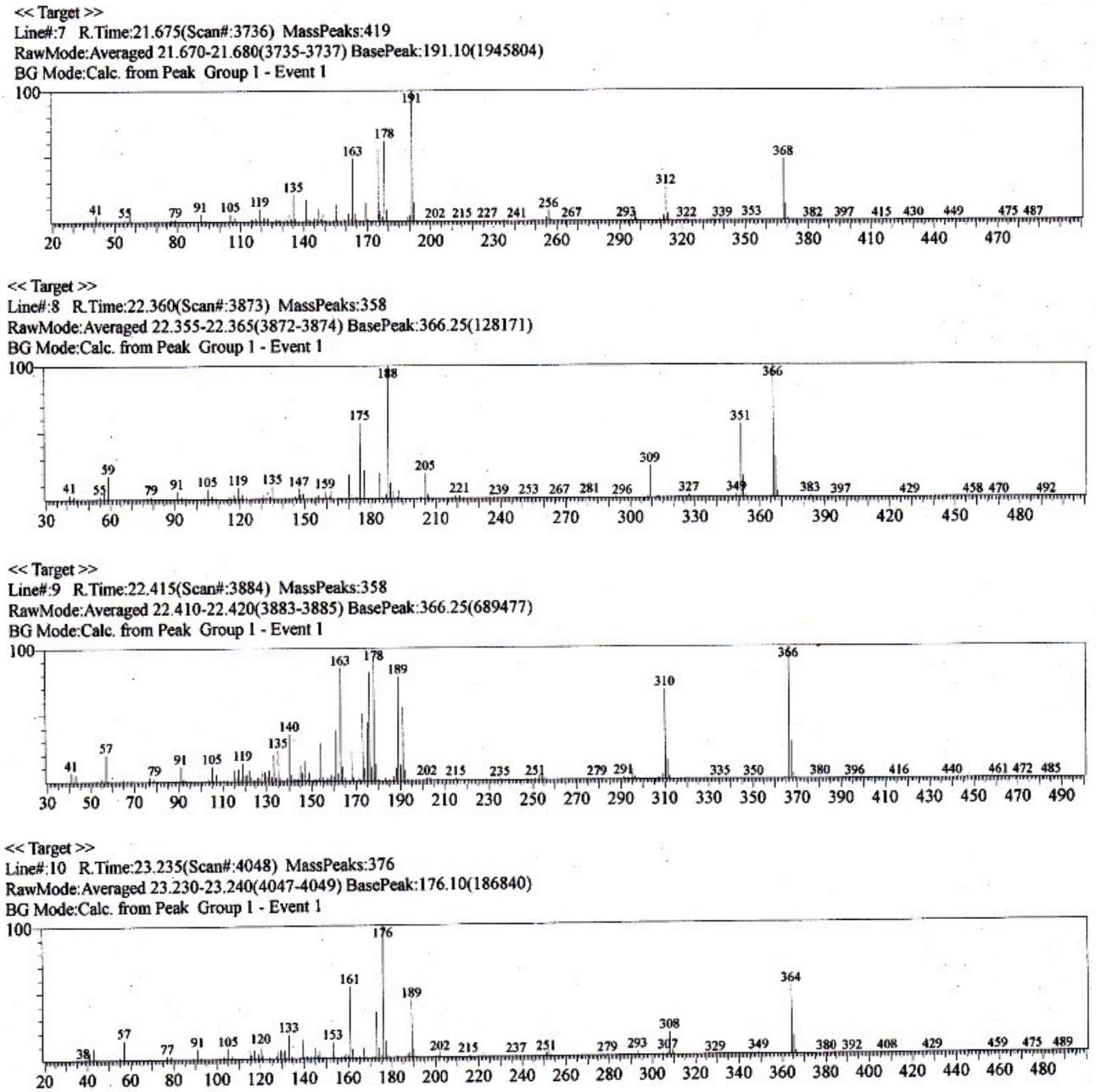


Figure 2
Spectrum of the Ten Compounds Detected in the Methanol leaf Extract of Cinnamomum burmanni Blume

Table 1
Components Detected in The Methanol Leaf Extract of Cinnamomum burmanni Blume

Peak	RT	Name of The Compound	MW	Molecular Formula	Peak area (%)
1	7.406	Azulene (CAS) Cylopentacycloheptene	128	$C_{10}H_8$	21.5
2	7.461	Azulene (CAS) Cylopentacycloheptene	128	$C_{10}H_8$	52.5
3	12.729	Propanoic acid, 2-methyl -,1-(1,1-dimethyleth)	286	$C_{16}H_{30}O_4$	1.3
4	12.928	Phenol, 4-(1,1,3,3-tetra methylbutyl)-	206	$C_{14}H_{22}O$	3.9
5	18.075	9,12-octadecadienoic acid (Z,Z)-, methyl ester	294	$C_{19}H_{34}O_2$	0.4
6	20.976	Cholest-8(14)-en-15-one, 3-hydroxy-, (3 beta, 5 alpha)	400	$C_{27}H_{44}O_2$	0.3
7	21.673	Phenol, 2,2'-methylene bis[6-(1,1-dimethylethy)-4-ethyl	368	$C_{25}H_{36}O_2$	12.1
8	22.358	4,8B-Dimethoxy-1,2-Diphenyl-4,8B-Dihydro cyclobutana (A) Naphthalene	366	$C_{26}H_{22}O_2$	1.6
9	22.411	Phenol, 2,2'-methylene bis[6-(1,1-dimethylethy)-4-ethyl	368	$C_{25}H_{36}O_2$	4.9
10	23.238	Cannabispiran	246	$C_{15}H_{18}O_3$	1.5

key:RT= Retention Time, WM= Weight Molecule

Table 2
Biological Activities of Phytocomponents Identified in The Methanol Leaf Extract of C. burmanni Blume

S/N	Name of the compound	Nature of compound	**Activity
1	Azulene	Organic compound	Antimicrobial, Anti-inflammatory
2	Azulene	Organic compound	Antimicrobial, Anti-inflammatory agents
3	Propanoic acid, 2-methyl -,1-(1,1-dimethyleth)	Ester compound	Antiviral, antitumor, anticancer
4	Phenol, 4-(1,1,3,3-tetra methylbutyl)-	Phenol compound	Antifungal
5	9,12-octadecadienoic acid (Z,Z)-, methyl ester	Ester compound	No activity reported
6	Cholest-8(14)-en-15-one, 3-hydroxy-, (3 beta, 5 alpha)	Sterol compound	Precursor of vitamin D3
7	Phenol, 2,2'-methylene bis[6-(1,1-dimethylethy)-4-ethyl	Phenol compound	Antimicrobial
8	4,8B-Dimethoxy-1,2-Diphenyl-4,8B-Dihydro cyclobutana (A) Naphthalene	Organic compound	Antibacterial, antifungal
9	Phenol, 2,2'-methylene bis[6-(1,1-dimethylethy)-4-ethyl	Phenol compound	Antimicrobial
10	Cannabispiran	Organic compound	Antifungal, antibacterial

Source: Pubchem/ Open Chemistry Database.[11]

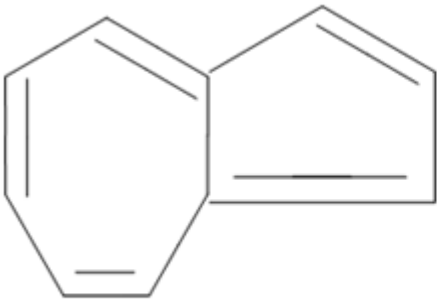


Figure 3a
Structure of Azulene

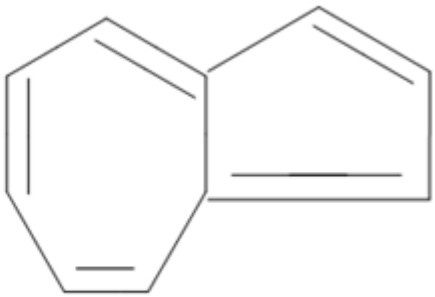


Figure 3b
Structure of Azulene

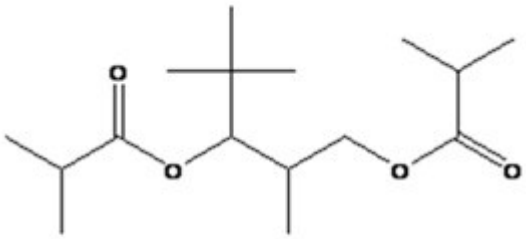


Figure 3c
Structure of Propanoic acid. 2-methyl -,1-(1,1-dimethyleth)

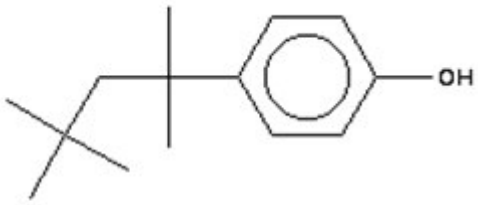


Figure 3d
Structure of Phenol, 4-(1,1,3,3-tetra methylbutyl)

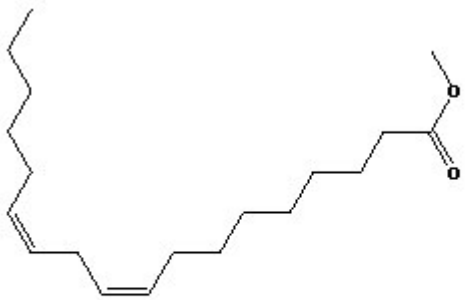


Figure 3e
Structure of 9,12-octadecadienoic acid (Z,Z)-, methyl ester

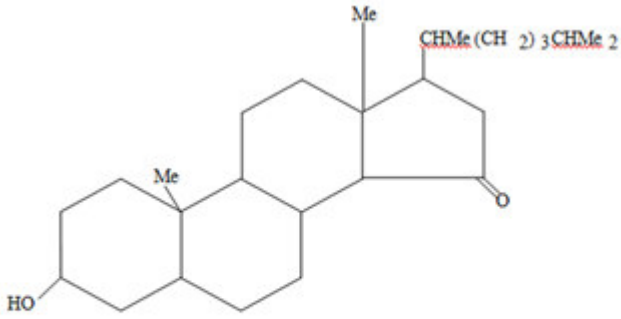


Figure 3f
Structure of Cholest-8(14)-en-15-one, 3-hydroxy-, (3 beta, 5 alpha)

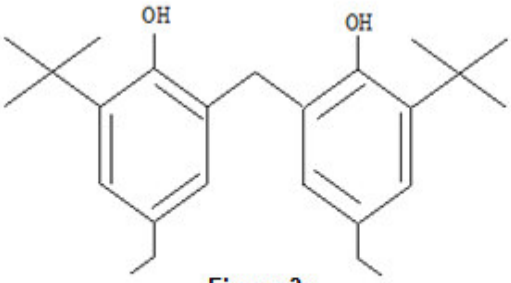


Figure 3g
Structure of Phenol, 2,2'- methylene bis[6-(1,1-dimethylethy)-4-ethyl

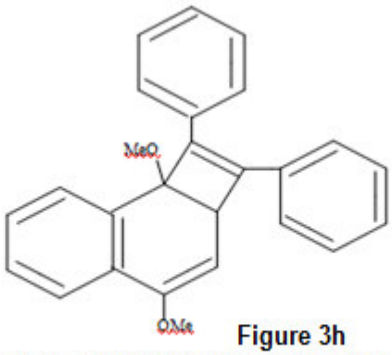


Figure 3h
Structure of 4,8B-Dimethoxy-1,2-Diphenyl-4,8B-Dihydro cyclobutana (A) Naphthalene

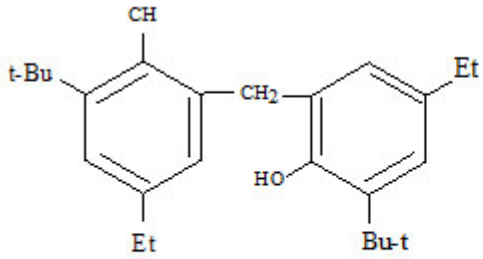


Figure 3i
Structure of Phenol, 2,2'-methylene bis[6-(1,1-dimethylethy)-4-ethyl

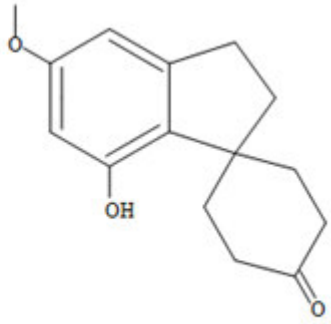


Figure 3j
Structure of Cannabispiran

DISCUSSIONS

The dominant chemical compounds contained in the methanol extract of cinnamon leaves (*C. burmanni* Blume) is Azulene (CAS) Cylopentacycloheptene (52.5%), Azulene (CAS) Cylopentacycloheptene (21.5%) and Phenol, 2,2'- methylene bis [6- (1,1-dimethylethy) -4-ethyl (12.1%). Azulene is a compound whose existence is abundant in essential oils, are included in the class seskuiterpen.[12] Aromatic compounds belonging to the terpenoids can act as an anti-fungal, anti-bacterial. In another study, it is reported that azulene compounds contained in the leaf essential oil of patchouli (*Pogostemon cablin*) can inhibit the development of the fungus *Candida albicans* in vitro by inhibition zone diameter of 30-32 mm.[13] Compounds azulenes, phenatrene of *Inola viscosa* plant species (Compositae family) proved to have anti-fungal properties. The methanol extract of leaves *Inola viscosa* has a high ability to inhibit growth of fungal spores in 4 fungi tests are *Botrytis cinerea*, *Alternaria solani*, *Cladosporium* sp. and *Fusarium oxysporum* f. sp. *melonis*. *Inola viscosa* leaf methanol extract can inhibit the growth of the four fungi respectively 100%, 89%, 100% and 97% .[14] Phenol can cause lysis of the yeast cells. Fungi cell structure consists of a cell wall composed of mannoprotein, β- (1-6) glucan, β- (1-3) glucans and chitin, whereas plasma membrane contains ergosterol. Mechanism of action of phenolic compounds are first damage of the plasma membrane ergosterol, the fungus affects the synthesis of nucleic acids and a third work on the main elements of the fungal cell wall are chitin, β glucans and mannoprotein.[15] natural phenol compounds contained in the cashew nut shell has unique characteristics, which plays a role in the industry, it also has anti bakteri.[16] Phenol compounds may decide crosslinking of peptidoglycan in an attempt to break through the cell walls. After breaking through the cell walls of phenolic compounds, there will be leakage of nutrients from within the cells because the hydrophobic bond of phenol can damage components of cell membranes as well as the dissolution of phospholipid proteins and other components that bind hydrophobic. These circumstances result in decreased cell permeability. Damage to the cell membrane and lead to inhibition of the activity of specific biosynthetic enzymes required in the process of metabolism.[17]

CONCLUSION

The analysis results of Gas Chromatogram-Mass Spectrometry (GC-MS) of the methanol extract of cinnamon leaves (*Cinnamomum burmanni* Blume) identified ten compounds. The compounds identified may be an antimicrobial such as antifungal, antibacterial, antiviral and can be used to treat some diseases. The research findings have shown that the leaf of cinnamon is extensively rich in secondary metabolites.

CONFLICT OF INTEREST

Conflict of interest declared none.

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