(Tidak Ada Judul)

Dari: erwin akkas (winulica@yahoo.co.id)
Kepada: editorofijpbs@yahoo.com
Cc: editorijpbs@rediffmail.com
Tanggal: Senin, 10 November 2014 14.06 WITA

To the Editorial Department of IJPBS, INDIA

Dear Sir,
I would like to send my manuscript, hopely can be published in IJPBS.
Thanks for your attention.

Best regards

Erwin

Cover Letter to email body.doc
109.5kB

cover-letter IJPBS.doc
303kB

manuscript erwin.docx
1020.1kB

Regarding your manuscript for publication.

Dari: Editor of Int Journal of Pharma and Bio Sciences (editorofijpbs@yahoo.com)

Kepada: winulica@yahoo.co.id

Tanggal: Senin, 10 November 2014 14.50 WITA

Respected Author,

Ref manuscript number MS:5974

We have received your manuscript titled “ISOLATION AND MS STUDY OF FRIEDELINOL FROM THE LEAVES OF TERAP (ARTOCARPUS ODORATISSIMUS BLANCO)“ but we need the completed copy right form.With this email we have attached the Copy right form. If you could not find the “Copy right form “ with this email , you can email us back (or) you can download at www.ijpbs.net and then clicking “Copy Right Transfer form” . Kindly take print out of this form ,fill and provide author’s/corresponding author’s signature . Scan and send . We would be sending your manuscript to our reviewer (Reviewer 1) for evaluation. We need your paper also to be reviewed by another Reviewer (Reviewer 2) of your choice. So We have also sent a copy of your manuscript with this email. The reviewer should be Ph.D/ M.D (5 years of experience)./Head of the institute or college .The reviewer should be expertise/specialized in your manuscript field of interest and should not be any of
the authors of your manuscript. With this email we are sending you the “comment/Suggestion” form . Download the “Comments/suggestion form” . Get the “comment/Suggestion” from the reviewer and revise your manuscript and get signature from the Reviewer .Send the completed /signed “Comments/suggestion form”to us along with the revised manuscript. Decision of acceptance will be taken within 3-4 days from the date of receiving “Comments/suggestion form” . so do not delay. You can visit the youtube link to watch the videos of how to fill the copy right form. The video is available at http://youtu.be/7uRHvzByRBw.

Also Kindly note that your manuscript may cite not less than one reference of articles published in “International Journal of Pharma and Bio sciences (IJPBS)” (i.e Any one IJPBS articles may be cited as references in your manuscript . You can use relevant key words along with the word - www.ijpbs.net in google/google scholar or any other search engines to get related IJPBS articles . If you face any problem with this citing of IJPBS articles do email us and we will help you).This may help to favor the decision on your manuscript acceptance.
You can check your manuscript status available at www.ijpbs.net as “check manuscript status” or visit this link http://www.ijpbs.net/search_manuscript.php
If you have any further queries kindly email/phone to us referring your manuscript number at editorijpbs@rediffmail.com (or) editorofijpbs@yahoo.com (or) prasmol@rediffmail.com.
(or) call +91 9989275978(india).
Kindly note that you have to send us the filled “comments/suggestion form” and ‘the revised manuscript” Decision of acceptance will be taken within one week from the date of receiving “Comments/suggestion form” , so do not delay.

Personal Assistant to Managing Editor
Mdm: Swarupa

Managing Editor,
International Journal of Pharma and Bio Sciences,
ISSN 0975-6299
Indexed in scopus and embase (Elsevier Bibliographic database)

On Mon, 10/11/14, erwin akkas <winulica@yahoo.co.id> wrote:

Subject:
To: "editorofijpbs@yahoo.com" <editorofijpbs@yahoo.com>
Cc: "editorijpbs@rediffmail.com" <editorijpbs@rediffmail.com>
Date: Monday, 10 November, 2014, 6:06 AM

To
the Editorial Department of IJPBS, INDIA

Dear
Sir,I
would like to send my manuscript, hopely can be published
in IJPBS. Thanks for your

attention.
Best
regards
Erwin

MS 5974.doc
1.1MB

comments form (new version).doc
83kB

CTA form (new version).docx
50.4kB

Re:

Dari: Editor of Int Journal of Pharma and Bio Sciences (editorofijpbs@yahoo.com)

Kepada: winulica@yahoo.co.id

Tanggal: Rabu, 12 November 2014 11.50 WITA

Respected Author

Ref Ms:5974

Note :Kindly send the revised manuscript which you would have revised based on your reviewer (Reviewer-2) comments.

We have received your email of your manuscript but you have not send the comments form (comments/suggestion of Reviewer2). With this email we have attached the empty format. Kindly complete the form and send to us. you can watch the video of how to fill the comments form available at http://youtu.be/aQAvK9hHNLM

Personal Assistant to Managing Editor
Mdm:Swarupa

Managing Editor,
International Journal of Pharma and Bio Sciences,
ISSN 0975-6299
Indexed in scopus and embase (Elsevier Bibliographic database)

On Wed, 12/11/14, erwin akkas <winulica@yahoo.co.id> wrote:

Subject:
To: "editorofijpbs@yahoo.com" <editorofijpbs@yahoo.com>
Date: Wednesday, 12 November, 2014, 2:24 AM

To the Managing Editorial, IJPBS
This is the CTA
form (attached), I'll send to you again. Sorry,
I've been looking the IJPBS, but I did't find the
article that relevant with my article in this journal. About
the reviewer 2, until this time I have no idea and
I'll send you soon as that
reviewer. Thank you
Best
Regards

Erwin

comments form (new version).doc
83kB

HAL: manuscript revision

Dari: winulica (winulica@yahoo.co.id)

Kepada: editorofijpbs@yahoo.com

Tanggal: Selasa, 18 November 2014 11.43 WITA

To editor IJPBS
This is my manuscript (attached), I'll send you again. The manuscript have been corrected by reviewer 2. I hope information about my manuscript. Thank you very much.

Best regards

Erwin

Terkirim dari Samsung Mobile

To editor IJPBS
This is my manuscript (attached), I'll send you again. The manuscript have been corrected by reviewer 2. I hope information about my manuscript. Thank you very much.

Best regards

Erwin

Terkirim dari Samsung Mobile

-------- Pesan asli --------
Dari: Editor of Int Journal of Pharma and Bio Sciences <editorofijpbs@yahoo.com>
Tanggal: 12/11/2014 11:50 AM (GMT+08:00)
Ke: erwin akkas <winulica@yahoo.co.id>
Subjek: Re:

Respected Author

Ref Ms:5974

Note :Kindly send the revised manuscript which you would have revised based on your reviewer (Reviewer-2) comments.

We have received your email of your manuscript but you have not send the comments form (comments/suggestion of Reviewer2). With this email we have attached the empty format. Kindly complete the form and send to us. you can watch the video of how to fill the comments form available at http://youtu.be/aQAvK9hHNLM

Personal Assistant to Managing Editor
Mdm:Swarupa

Managing Editor,
International Journal of Pharma and Bio Sciences,
ISSN 0975-6299
Indexed in scopus and embase (Elsevier Bibliographic database)

On Wed, 12/11/14, erwin akkas <winulica@yahoo.co.id> wrote:

Subject:
To: "editorofijpbs@yahoo.com" <editorofijpbs@yahoo.com>
Date: Wednesday, 12 November, 2014, 2:24 AM

To the Managing Editorial, IJPBS

This is the CTA
form (attached), I'll send to you again. Sorry,
I've been looking the IJPBS, but I did't find the
article that relevant with my article in this journal. About
the reviewer 2, until this time I have no idea and
I'll send you soon as that
reviewer. Thank you
Best
Regards

Erwin
Respected Author

Ref Ms:5974

Note :Kindly send the revised manuscript which you would have revised based on your reviewer (Reviewer-2) comments.

We have received your email of your manuscript but you have not send the comments form (comments/suggestion of Reviewer2). With this email we have attached the empty format. Kindly complete the form and send to us. you can watch the video of how to fill the comments form available at http://youtu.be/aQAvK9hHNLM

Personal Assistant to Managing Editor
Mdm:Swarupa

Managing Editor,
International Journal of Pharma and Bio Sciences,
ISSN 0975-6299
Indexed in scopus and embase (Elsevier Bibliographic database)

On Wed, 12/11/14, erwin akkas <winulica@yahoo.co.id> wrote:

Subject:
To: "editorofijpbs@yahoo.com" <editorofijpbs@yahoo.com>
Date: Wednesday, 12 November, 2014, 2:24 AM

To the Managing Editorial, IJPBS
This is the CTA
form (attached), I'll send to you again. Sorry,
I've been looking the IJPBS, but I did't find the
article that relevant with my article in this journal. About
the reviewer 2, until this time I have no idea and
I'll send you soon as that
reviewer. Thank you
Best
Regards

Erwin

manuscript revision.doc
1.4MB

comment form .pdf
1MB

Acceptance email IJPBS

Dari: Editor of Int Journal of Pharma and Bio Sciences (editorofijpbs@yahoo.com)

Kepada: winulica@yahoo.co.id

Tanggal: Selasa, 18 November 2014 19.37 WITA

Respected author ,

Ref M.S.No: 5974

Your Research/Review manuscript submitted for publishing in International Journal of Pharma and Bio Sciences have been provisionally accepted for publishing in our journal- International Journal of pharma and Biosciences. With this mail we have send “Invoice form ” detailing the processing fees and the bank account details as an attachment File.

If you need any extension of date you can email your request mentioning the manuscript number and the possible date of submission.
we request you to send the corresponding authors passport size photo as a scanned image (gif or jpeg) file as an attAchment file(via email)..This is an optional requirement from the author and is not mandatory.
If there is any technical/scientific corrections needed by you from our reviewers (reviewer1) for your manuscript, it would be intimated to you in near future through galley proof . We hope you could cooperate towards speedy reply favoring rapid publication.
To know the time frame/time line of processing the manuscript by our journal office kindly visit http://ijpbs.net/Time_frame_new_version.pdf
If you have any queries kindly email/phone to us referring your manuscript number at editorijpbs@rediffmail.com (or) editorofijpbs@yahoo.com (or) prasmol@rediffmail.com. If you do not receive any reply within 4 working days from any one of the above email, kindly send a copy to the other two emails (or) call – 09989275978.

Personal Assistant to Managing Editor
Mdm:Swarupa

Managing Editor,
International Journal of Pharma and Bio Sciences,
ISSN 0975-6299
Indexed in scopus and embase (Elsevier Bibliographic database)

Invoice form of MS 5974.doc
81.5kB

Galley proof sent for your approval-www.ijpbs.net

Dari: Editor of Int Journal of Pharma and Bio Sciences (editorofijpbs@yahoo.com)

Kepada: winulica@yahoo.co.id

Tanggal: Rabu, 26 November 2014 19.39 WITA

Respected author ,

Ref M.S.No: 5974

We hereby sending you the galley proof of your manuscripts as an attachment file. If there are any corrections /comments it will be shown in the manuscript .check those corrections/comments and also rest of the manuscript. The corrections /comments might be highlighted by red/blue colour fonts .you can do the correction (include/delete any sentence or word) which will be suitably highlighted .If you do not agree with those corrections made by us , you can delete and keep the correct word/sentences or right click the mouse to accept/reject the corrections and mention those corrections by the page and line number in a separate MS word file. If your manuscript has any plagiarized sentences/phrases it will be highlighted with suitable comments. Either edit/delete/cite the reference in the reference section. If there is any comments mentioned in your manuscript send us a suitable explanation.
If you face any problem you can email us back or call (refer “contact” of www.ijpbs.net with your manuscript number)
Kindly note that once the galley proof is approved by you then no other corrections would be entertained strictly. so review the galley proof for any corrections.
Send us back the corrected galley proof within 3-5 days for next stage of processing. Once the galley proof is approved by author, no changes in the manuscript would be entertained further
Once we receive the galley proof approval from you , we further process for eprint(electronic) which would be sent to you within one week.
Send your email to “editorijpbs@rediffmail.com” (or) “editorofijpbs@yahoo.com” (or) “prasmol@rediffmail.com”. If you do not receive any reply within 4 working days from any one of the above email, kindly send a copy to the other two emails (or) call – 09989275978.
To know the time frame/time line of processing the manuscript by our journal kindly visit http://ijpbs.net/Time_frame_new_version.pdf. You can check your manuscript status available at www.ijpbs.net as “check manuscript status” or visit this link http://www.ijpbs.net/search_manuscript.php

If you face any problem in making changes in galley proof kindly email us (or) call to 0863- 2335978.

If you need Reprints {Print on Acid free permanent poly coated paper(Black and white print)} kindly fill the “Reprint Request Form” which is attached with this email and send to us.

Personal Assistant to Managing Editor
Mdm : .Swarupa

Managing Editor,
International Journal of Pharma and Bio Sciences,
ISSN 0975-6299
Indexed in scopus and embase (Elsevier Bibliographic database)

MS 5974.doc
307kB

Reprint Request Form - MS 5974.doc
38.5kB

Your paper is published in IJPBS

Dari: EditorIJPBS (prasmol@rediffmail.com)

Kepada: winulica@yahoo.co.id

Tanggal: Sabtu, 17 Januari 2015 19.31 WITA

Respected Author ,
We congratulate that your manuscript submitted for publication in âœInternational journal of Pharma and bio sciences âœ has been published in current issue [Volume 6, Issue 1, 2015(Jan â“ March)].We hope that your article would attract more citation.
To locate your manuscript kindly visit www.ijpbs.net , then click âœCurrent issuesâ and then click âœPharmaceutical Sciencesâ and locate your manuscript with the help of page numbers (know your page number from the eprint which we have already sent to you).
We also partner with the conference / seminars /symposia .If your organization / institute /university is organizing or planning to organize conference / seminars /symposia we freely enlist the event in our âœConference and seminarsâ(events calendar) page which is available at our home page â“ www.ijpbs.net.Kindly visit âœhttp://ijpbs.net/conference_page.phpâ to view our events calendar. We also publish abstracts presented (oral/poster) in the conference / seminars /symposia. Kindly visit âœhttp://ijpbs.net/conference_page.phpâ to view our events calendar. If you need any querries to be answered kindly emailat âœeditorijpbs@rediffmail.comâ (and) âœprasmol@rediffmail.comâ (or) call â“ 09989275978.
The âœconference and seminarsâ page is available in our home page âœwww.ijpbs.netâ
If you face any problem , kindly email us. Kindly let us know your suggestions for improvement of our service . We welcome your feed back.

Managing Editor
International Journal of Pharma and Bio Sciences
indexed in scopus & embase
www.ijpbs.net
ISSN 0975-6299

INTERNATIONAL JOURNAL OF PHARMA AND BIO SCIENCES
CODEN IJPBJ2 Chemical Abstract Services (USA)
Int J Pharm. Bio. Sci. INTERNATIONALLY INDEXED JOURNAL ISSN 0975-6299 www.ijpbs.net

Comments/Suggestions cum Approval of Reviewer 2

Title of the manuscript - (write or type the manuscript title below)

ISOLATION AND MS STUDY OF FRIEDELINOL FROM THE FROM LEAVES OF TERAP (*ARTOCARPUS ODORATISSIMUS* BLANCO)

Page Number	Comments/Suggestions
Abstract	Minor revision in english
1-3 and 6	Minor revision and english

(More Row/pages can be included if these rows/page is insufficient for the Comments/Suggestions)

Declaration of the Reviewer (Reviewer2)

Name with Qualification	Dr. Bohari Yusuf
Designation and Department	Department of Chemistry, Mulawarman University
Field of Expertise/Interest	Analytical Chemistry/Instrumental chemistry
Address of the Institute	Jl. Barong Tongkok
	Samarinda
	Indonesia, 75116
Email Id	bohari@fmipa.unmul.ac.id
Phone (Mobile &/or Land line)	06281350766766
(kindly enter the details of the reviewer)(All above Fields are mandatory)	

Respected Editor,

As per your request, i have reviewed the manuscript

" Isolation and MS Study of Friedelinol from the leaves of Terap (*Artocarpus odoratissimus* Blanco" submitted by "Erwin (corresponding author)". The comments/suggestions given above by me on this comments and suggestion form has been rectified by the author and found satisfactory to the best of my knowledge and expertise and have advised the author to resubmit the reviewed paper along with the list of comments/suggestions (page 2). I authorise and recommend the corresponding author for submission of this reviewed manuscript to "International Journal of Pharma and Bio Sciences" towards publication. I also take personal responsibility over this manuscript for its quality for publication. If any future litigation arises after publication, I and authors would be responsible and would cooperate with the decision of the Managing Editor of this journal.

Signature of the Reviewer
(Official seal)

ISOLATION AND MS STUDY OF FRIEDELINOL FROM THE LEAVES OF *TERAP* (*ARTOCARPUS ODORATISSIMUS* BLANCO)

*ERWIN[1], SRI SULISTYANINGSIH[1], AND IRAWAN W.KUSUMA[2]

[1] Department of Chemistry, Faculty of Mathematic and Natural Sciences, Mulawarman University, Samarinda, East Kalimantan
[2] Department of Forest Products, Faculty of Forestry, Mulawarman University, Samarinda, East Kalimantan

ABSTRACT.

Artocarpus odoratissimus Blanco (local name: *Terap*) is one of the *Artocarpus* species ~~collected~~ was taken from the tropical forests of East Kalimantan. ~~From leaves extracts of this plant, a triterpene, friedelinol has been isolated~~. A friedelinol (triterpene) was isolated from the leaves extracts of the plant and the compound structure was ~~The structure of the compound~~ was established from the FT-IR and mass spectral data and confirmed by a standard compound. The compound ~~possessed~~ has moderate cytotoxicity against a brine shrimp, *A. salina* with LC_{50} 48.39 ppm.

KEYWORDS: Artocarpus, Terap, friedelinol.

*Corresponding author

ERWIN
Department of Chemistry, Faculty of Mathematic and Natural Sciences, Mulawarman University,
Samarinda, East Kalimantan, Indonesia
E-mail address: winulica@yahoo.co.id
Phone : +62 85393691224

INTRODUCTION

Moraceae is a large plant family consists of 60 genera and 1400 species, three of them ~~which~~ include a large genus : they are ~~that is~~, Artocarpus, Morus, and Fiscus[1]. *Artocarpus*, one of the main genus of Moraceae consisting of 50 species and spread ~~distributed~~ on tropical and sub-tropical region from South Asia, Southeast Asia to the Solomon Islands, Pacific Islands, North Australia and Central America [2,3,4]. Economically, the genus is of appreciable importance as a source of edible fruit, and yield fairly good timber [5]. Artocarpus typically grows as large and tall trees. The wood can be used as building materials, home furnishings, and bridges. In Indonesia, ~~since~~ the first several of Artocarpus species are widely used in folk medicines as root decoction of Artocarpus integra Merr finely used to treat fever [6].

Various species of this plant has been creating ~~created~~ as a traditional medicine known as *jamu* (Indonesia) [7]. In Borneo, there are 25 species, and ~~of which~~ 13 species are endemic, but only two species are used [3]. Several species of Artocarpus ~~many~~ produce many triterpene, terpenoids, steroids, and phenolics including; flavonoids, stilbenoid, arilbenzofuran, jacalin, and Diels-Alder addition compounds [8].

The unique structure of secondary metabolites in Artocarpus produce a very wide effect, such as anti-bacterial [9] anti-platelet [10], antifungal [11], antimalarial [12,13], toxic and cytotoxic [14,15,16,17,18], and antidiabetic [3]. *Artocarpus odoratissimus* Blanco is one of the *Artocarpus* species was found as endemic species in tropical forests of Kalimantan (Borneo), Indonesia [19]. Traditionally, local people used leaves of *A. odoratissimus* as diabetic-treating drug and ash obtained from leaves is used as an antidote for centipede bite and scorpion stings, while the wood and bark were ~~can be~~ used as an anti-malarial [20,21]. in Sumatera (Indonesia), *A. odoratissimus* used as a natural pesticide to repel mice [22]. Fruits and their by-products are rich sources of antioxidant, with significant high level of phenolic and flavonoid content[23].

Previous studies on *A. odoratissimus* reported the availability of artosimmin, traxateryl acetate and anthocyanin [23,24]. Our further work on the genus *Artocarpus* was to investigate the leaves of *A. odoratissimus* and to elucidate one of the molecular structure ~~one of~~ of triterpene type compounds.

MATERIALS AND METHODS

Materials

The leaves of of *A. odoratissimus* were collected from Sungai Siring, Samarinda city, East Kalimantan. The plant was identified by a staff at the Laboratory of Physiology, Mulawarman University. The silica gel used for flash column chromatography was a silica gl 60, 230-400 mesh (Merck, Darmstad-Germany). Thin layer chromatography aluminium sheets (Silica gel 60 F254, 0,25 mm) were purchased from Merck (Darmstadt, Germany). All other materials or solvents were of the highest purity or high-performance liquid chromatography (HPLC) grade.

Instrumentation

IR spectra were measured with PERKIN ELMER Spectrum one L.R. 64912C spectrophotometers. Mass spectra was ~~were~~ recorded on a Shimadzu GC-MS QP 5050A (Shimadzu Corp., Kyoto, Japan) at an electron energy of 70 eV (direct inlet). Melting point of

the compound was measured by using Yanaco micro melting point apparatus (Yanaco Co., Ltd., Kyoto, Japan) and were uncorrected.

Extraction

The dried powder of the plant's leaves (3 kg) were ~~was~~ macerated with methanol for 24 h at room temperature and repeated 4 times. The methanol extract obtained was ~~then~~ concentrated by a rotary vacuum evaporator to yield 40.19 g of total extract. Furthermore, the total extract was fractionated with *n*-hexane and concentrated by using a rotary vacuum evaporator to obtain 18.95 g of solid.

Isolation and purification

n-Hexane fraction from the methanol extract of *A. odoratissimus* leaves was subjected to a flash column chromatography over silica gel using the *n*-hexane and ethyl acetate in increasing polarity. The column chromatography yielded 50 tubes fractions that were pooled together based on their polarity into 4 fractions, fraction A (tubes 1-7, 190 mg), fraction B (tubes 8-15, 410 mg), fraction C (tubes 16-22, 1000 mg), and fraction D (tubes 23-50, 2790 mg). Fraction B was in the form of white crystals. Ten miligrams of the crystal B was recrystallized by using hot *n*-hexane to yield 6 mg of the pure compound **1**.

Phytochemical test

1 mg of compound 1 was put into a test tube following by addition of 2 drops of anhydride acetate and 1 drop of sulfuric acid (Liebermann-Burchard reagent). The formation of green indicated of the occurence of steroid.

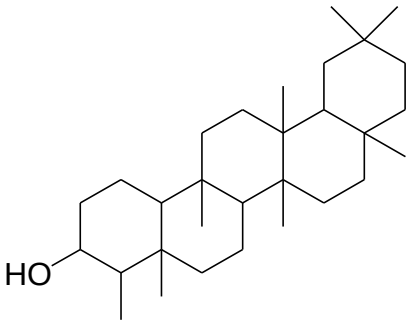
Biological assay

Compound 1 was tested for the toxicity by the brine shrimp lethality test against *Artemia salina* using previous report [25].

RESULT AND DISCUSSION

Compound 1 was obtained as a white powder having melting point at 285 - 287^{o}C. It showed ~~showing~~ positive reaction with Liebermann Burchard reagent indication of terpenoid. Mass spectral data showed a peak at m/z 428 (M^{+}) that in accordance with molecular formula $C_{30}H_{52}O$. IR spectral data showed maximum absorbance at 3479.58 cm^{-1}, suggested stretching absorption of hydroxyl group. This suggestion was supported by appearance of bending absorption of secondary cyclic C-OH at 1018.41 cm^{-1}. Peaks with sharp intensity at 2931.8 cm^{-1} and 2870.08^{-1} showed a C-H streching of CH_3 and CH_2, that was ~~is~~ supported by a bending at 1388.75 cm^{-1}. A peak with sharp intensity at 1705.07 cm^{-1} suggested the occurence of non conjugated C=O. Peak at 1635.64^{-1} suggested the presence of non conjugated C=C. A finger print area at 1172.72 cm^{-1} suggested the presence of C-O bond. Based on infra red spectral data,

it was ~~can be~~ concluded that compound 1 consisted hydroxil, CH_3 and CH_2, C=O, C=C double bond and C-O groups.



(1)

Figure 1. Friedelinol

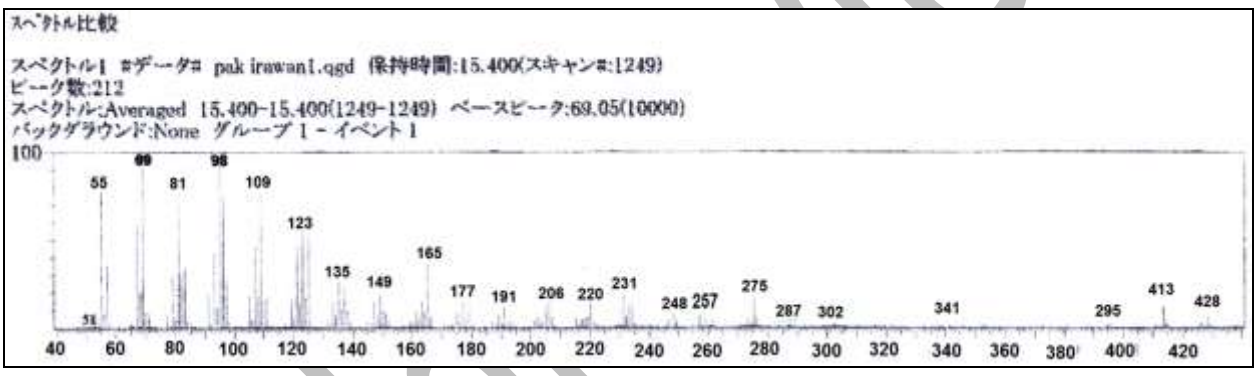


Figure 2. MS spectrum of friedelinol

Tabel 1. Comparison of Mass Fragmentation of Compound 1 and Friedelinol.

No	Mass spectra fragmentation pattern	
	Compound 1 (*m/z*)	Friedelinol (*m/z*)
1	428	428
2	413	413
3	382	-
4	341	-
5	275	275
6	257	257
7	248	248
8	231	231
9	220	220

10	206	206
11	191	189
12	177	177
13	165	165
14	149	147
15	135	137
16	123	125
17	109	109
18	98	98
19	81	81
20	55	55

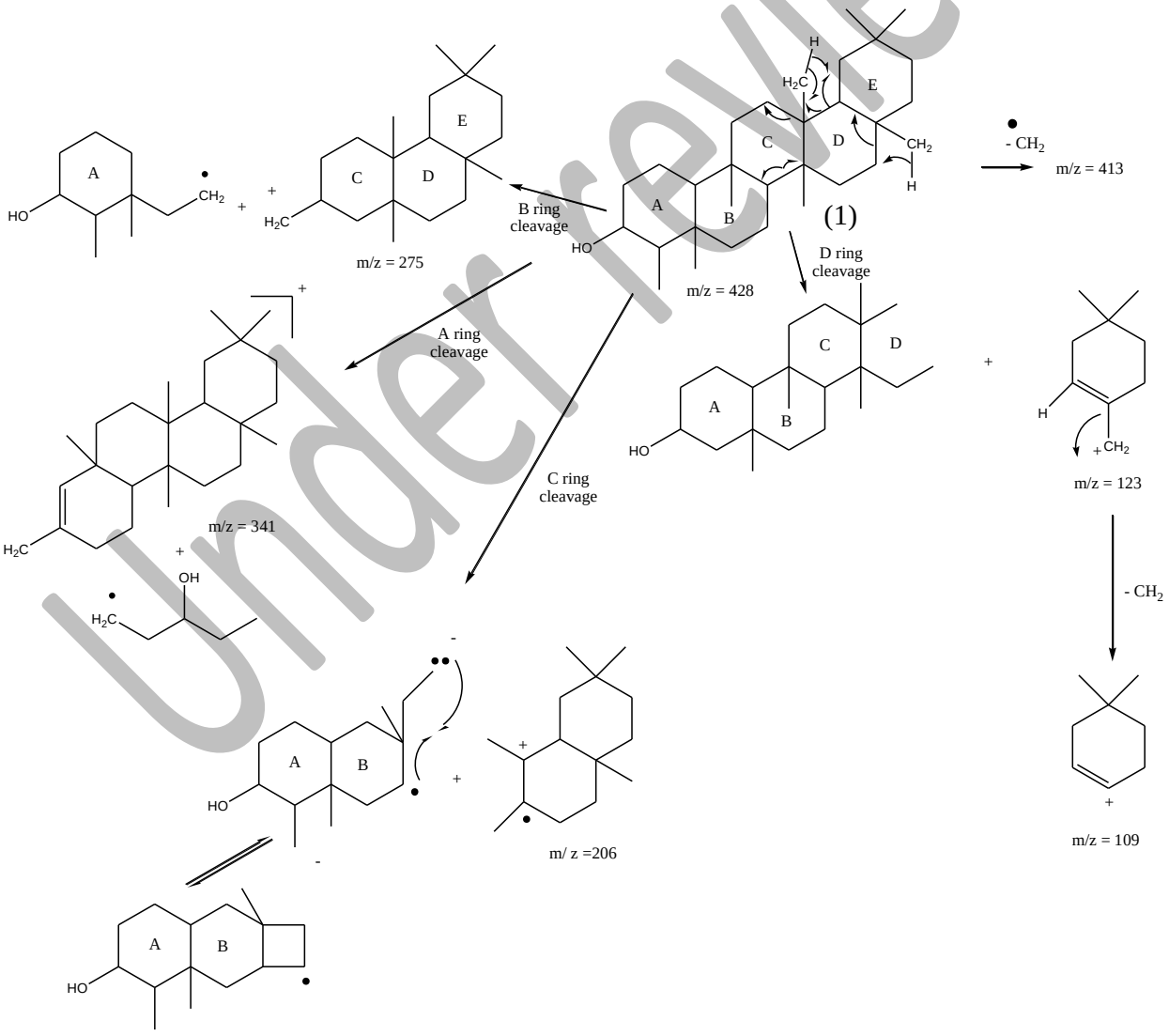


Figure 3. Mass Fragmentation Pattern of Compound 1.

The result of GC-MS analysis displayed a molecular peak at *m/z* 428 (M^+) suggested the molecular weight of compound **1**, that matched to the molecular formula $C_{30}H_{52}O$. Fragmentation pattern of compound **1** was ~~as~~ presented at Fig 1 and indicated the possibility of the compound **1** as a triterpene, friedelinol. Comparison of mass spectral fragmentation pattern of compound **1** to that of friedelinol was ~~as~~ presented at Table 1, it showed a good match. Based on the descri~~b~~ption ~~ed~~ of physicochemical properties, therefore, the compound **1** was identified as friedelinol.

CONCLUSION

Based on the spectroscopical analysis of FT-IR and GC-MS, an isolated compound from *A. odoratissimus* was identified as triterpene, friedelinol. The compound has~~possessed~~ moderate cytotoxicity against a brine shrimp, *A. salina* with LC_{50} 48.39 ppm.

ACKNOWLEDGEMENT

A kind support from Prof. Sanro Tachibana of Ehime University, Japan in measurement of GC-MS spectra and melting point is gratefully acknowledged.

REFERENCES

1. Nomura, T; Hano, Y; Aida, M. **1998**, *Heterocycles*, *47*(2), 1179-1205
2. Ferlinahayati.; Hakim, E.H.; Achmad, S.A.; Aimi, N.; Kitajima, M.; Makmur, L. *Proc. National Seminar of Natural Products Chemistry'99 Indonesia*, **1999**, 162 - 167, Jakarta
3. Verheij, E. W. M., Coronel, R. E. (eds). 1992. *Plant Resources of South Asia No. 2 486-491 Edible Fruits and Nuts*. Prosea Foundation Bogor.
4. Kochummen, K. M. 1987. *Moracea in Tree Flora of Malaya. Vol. 2. Forest Research Institute*. Kepong. Malaysia.
5. Jagtap, U.B. and Bapat, V.A. 2010, *Artocarpus*: A review of its traditional uses, phytochemistry and pharmacology, *Journal of Ethnopharmacology*, Vol. 129 (2), 142–166.
6. Heyne, K. 1987, Useful Plants of Indonesia, Vol. II, Department of Forestry, 668-683
7. Nomura T.Hano Y. and Aida M. (1998) Isoprenoid-substituted flavonoids from *Artocarpus* plants (moraceae). *Heterocycles*, 47(2), 1179–1205.
8. Nasution, R. 2013. *Isolation and Structure Determination of Steroid Compounds from Leaves of Plant Kulu (Artocarpus camansi: Breadfruit seed) Characteristically Antidiabetes*., Disertation, university of Sumatera Utara. Medan.
9. Khan, M. R. Omoloso, Ad. Kihara, M. 2003. Antibacterial activity of Artocarpusheterophyllus. *Fitoterapia* 74: 501-505
10. Weng, J.R. Chan, S.C. Lu, Y.H. Lin, H.C. Ko, H.H. and Lin, C.N. 2006. Antiplatelet Prenylflavonoid from *Artocarpus communis*. *Phytochem* 67: 824-829
11. Jayasinghe, L. Balasooriya, BAIS, Padmini, W.C. Hara, N, and Fujimoto, Y. 2004. Geranyl Chalcone Derivatives with Antifugal and Radical Scavenging. *Phytochem.* 65: 1287-1290.

12. Widyawaruyanti A, Subehan, Kalauni S K, Awale S, Nindatu M, Zaini N C, Syarifruddin D, Asih P B S, Tezuka Y, Kadota S. 2007. New Prenylated Flavones from Artocarpuschampeden, and Their Antimalarial Activity InVitro. *J Nat Med*, 61: 410-413.
13. Boonlaksiri, C, Oonanant, W. Kongsaeree, P. Kittakoop, P. Tanticharoen, M. and Thebtaranonth, Y. 2000. An Antimalarial Stilbene from *Artocarpus integer*. *Phytochem*, 54: 415-417.
14. Erwin, Hakim, E.H: Achmad, S.A: Syah, Y.M: Aimi, N: Kitajima, M: Makmur, L: Mujahidin, D: Takayama, H. 2001, *Bulletin the Indonesian Society of Natural Products Chemistry*, 1(1), 20-27.
15. Erwin, 2004, Artocarpin and cycloartocarpin from wood of Artocarpus altilis (PARK.) FOSB wich toxic against *Artemia Salina*, *Journal of Frontir*, 18 (1), 45-49.
16. Ko. H. H, Lu, Y.H. Yang S.Z. Won S.J. and Lin, C.N. 2005. Cytotoxic Prenyl flavonoids from Artocarpus elasticus. *J Nat Prod* 68: 1692-1695.
17. Hakim, A. 2011. Secondary Metabolites Diversity genus *Artocarpus* (Moraceae). *Bioteknologi*, 8 (2): 86-98.
18. Syah Y M, Juliawaty L D, Achmad S A, Hakim E H, and Ghisalberti E L. 2006. Cytotoxic Prenylated Flavones from Artocarpus champeden. *Journa lNatural Medicine*, 60: 308-312.
19. Siregar, M. 2006. R E V I E W: Species Diversity of Local Fruit Trees in Kalimantan: Problems of Conservation and Its Development, *B I O D I V E R S I T A S*, Vol. 7 (1), 94-99.
20. Shaffiq, S. M. S., Sidik, B. J., Harah, Z.M., and Devi, R.S., 2013, Marketable wild fruits of Serawak, Borneo: Their mode of consumption, uses and sugar profiles, *Indian Journal of Traditional Knowledge*, 12 (2), 195-201.
21. Chai, P. P. K. 2006. *Medicinal Plants of Sarawak*. Lee Ming Press. Malaysia.
22. Asmaliyah, Wati, E.E.H., Utami, S., Mulyadi, K., Yudhistira dan Sari, F.W., 2010, The introduction producing plants of natural pesticide and utilization of traditional, Ministry of Forestry Research Agency Forestry Research and Development Center and Forest Productivity Development, Jakarta, page 51.
23. Bakar M.F.A, Mohamed, M., Rahmat, A., and Fry, J. 2009, Phytochemicals and antioxidant activity of different parts of bambangan (*Mangifera pajang*) and tarap (*Artocarpus odoratissimus*), *Food Chemistry*, 113 (2), 479-483.
24. Gwendoline, C.L. Ee,; Siow H. T,Rahmani, Chan M.; K. L,; Yang M. L, and Choon F.J. B. 2010, Artosimmin - A Potential Anti-Cancer Lead Compound *from Artocarpus odoratissimus*, *Letters in Organic Chemistry*, Vol.7 (3), 240-244, Bentham Science Publishers.
25. Erwin, 2014, Phytochemical and bioactivity screening of extracts and isolates from *Terap* Leaves (*Artocarpus odoratissimus* Blanco), *Proceedings of Seminar of Chemistry*, Samarinda, 89-92.

ISOLATION AND MS STUDY OF FRIEDELINOL FROM THE LEAVES OF *TERAP* (*ARTOCARPUS ODORATISSIMUS* BLANCO)

*ERWIN[1], SRI SULISTYANINGSIH[1], AND IRAWAN W.KUSUMA[2]

[1] Department of Chemistry, Faculty of Mathematic and Natural Sciences, Mulawarman University, Samarinda, East Kalimantan
[2] Department of Forest Products, Faculty of Forestry, Mulawarman University, Samarinda, East Kalimantan

ABSTRACT.

Artocarpus odoratissimus Blanco (local name: *Terap*) is one of the *Artocarpus* species was taken from the tropical forests of East Kalimantan. . A friedelinol (triterpene) was isolated from the leaves extracts of the plant and the compound structure was was established from the FT-IR and mass spectral data and confirmed by a standard compound. The compound has moderate cytotoxicity against a brine shrimp, *A. salina* with LC_{50} 48.39 ppm.

KEYWORDS: Artocarpus, Terap, friedelinol.

*Corresponding author

ERWIN
Department of Chemistry, Faculty of Mathematic and Natural Sciences, Mulawarman University,
Samarinda, East Kalimantan, Indonesia
E-mail address: winulica@yahoo.co.id
Phone : +62 85393691224

INTRODUCTION

Moraceae is a large plant family consists of 60 genera and 1400 species, three of them include a large genus : they are , Artocarpus, Morus, and Fiscus[1]. *Artocarpus*, one of the main genus of Moraceae consisting of 50 species and spread on tropical and sub-tropical region from South Asia, Southeast Asia to the Solomon Islands, Pacific Islands, North Australia and Central America [2,3,4]. Economically, the genus is of appreciable importance as a source of edible fruit, and yield fairly good timber [5]. Artocarpus typically grows as large and tall trees. The wood can be used as building materials, home furnishings, and bridges. In Indonesia, the first several of Artocarpus species are widely used in folk medicines as root decoction of Artocarpus integra Merr finely used to treat fever [6].

Various species of this plant has been creating as a traditional medicine known as *jamu* (Indonesia) [7]. In Borneo, there are 25 species, and 13 species are endemic, but only two species are used [3]. Several species of Artocarpus produce many triterpene, terpenoids, steroids, and phenolics including; flavonoids, stilbenoid, arilbenzofuran, jacalin, and Diels-Alder addition compounds [8].

The unique structure of secondary metabolites in Artocarpus produce a very wide effect, such as anti-bacterial [9] anti-platelet [10], antifungal [11], antimalarial [12,13], toxic and cytotoxic [14,15,16,17,18], and antidiabetic [3]. *Artocarpus odoratissimus* Blanco is one of the *Artocarpus* species was found as endemic species in tropical forests of Kalimantan (Borneo), Indonesia [19]. Traditionally, local people used leaves of *A. odoratissimus* as diabetic-treating drug and ash obtained from leaves is used as an antidote for centipede bite and scorpion stings, while the wood and bark were used as an anti-malarial [20,21]. in Sumatera (Indonesia), *A. odoratissimus* used as a natural pesticide to repel mice [22]. Fruits and their by-products are rich sources of antioxidant, with significant high level of phenolic and flavonoid content[23].

Previous studies on *A. odoratissimus* reported the availability of artosimmin, traxateryl acetate and anthocyanin [23,24]. Our further work on the genus *Artocarpus* was to investigate the leaves of *A. odoratissimus* and to elucidate one of the molecular structure of triterpene type compounds.

MATERIALS AND METHODS

Materials

The leaves of of *A. odoratissimus* were collected from Sungai Siring, Samarinda city, East Kalimantan. The plant was identified by a staff at the Laboratory of Physiology, Mulawarman University. The silica gel used for flash column chromatography was a silica gl 60, 230-400 mesh (Merck, Darmstad-Germany). Thin layer chromatography aluminium sheets (Silica gel 60 F254, 0,25 mm) were purchased from Merck (Darmstadt, Germany). All other materials or solvents were of the highest purity or high-performance liquid chromatography (HPLC) grade.

Instrumentation

IR spectra were measured with PERKIN ELMER Spectrum one L.R. 64912C spectrophotometers. Mass spectra was recorded on a Shimadzu GC-MS QP 5050A (Shimadzu Corp., Kyoto, Japan) at an electron energy of 70 eV (direct inlet). Melting point of the compound

was measured by using Yanaco micro melting point apparatus (Yanaco Co., Ltd., Kyoto, Japan) and were uncorrected.

Extraction

The dried powder of the plant's leaves (3 kg) were macerated with methanol for 24 h at room temperature and repeated 4 times. The methanol extract obtained was concentrated by a rotary vacuum evaporator to yield 40.19 g of total extract. Furthermore, the total extract was fractionated with *n*-hexane and concentrated by using a rotary vacuum evaporator to obtain 18.95 g of solid.

Isolation and purification

n-Hexane fraction from the methanol extract of *A. odoratissimus* leaves was subjected to a flash column chromatography over silica gel using the *n*-hexane and ethyl acetate in increasing polarity. The column chromatography yielded 50 tubes fractions that were pooled together based on their polarity into 4 fractions, fraction A (tubes 1-7, 190 mg), fraction B (tubes 8-15, 410 mg), fraction C (tubes 16-22, 1000 mg), and fraction D (tubes 23-50, 2790 mg). Fraction B was in the form of white crystals. Ten miligrams of the crystal B was recrystallized by using hot *n*-hexane to yield 6 mg of the pure compound **1**.

Phytochemical test

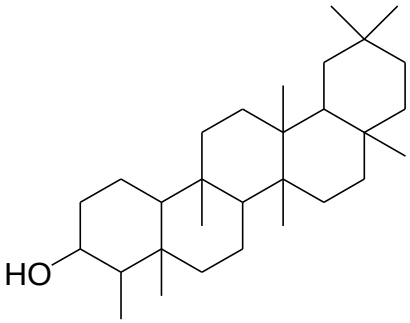
1 mg of compound 1 was put into a test tube following by addition of 2 drops of anhydride acetate and 1 drop of sulfuric acid (Liebermann-Burchard reagent). The formation of green indicated of the occurence of steroid.

Biological assay

Compound 1 was tested for the toxicity by the brine shrimp lethality test against *Artemia salina* using previous report [25].

RESULT AND DISCUSSION

Compound 1 was obtained as a white powder having melting point at 285 - 287^{o}C. It showed positive reaction with Liebermann Burchard reagent indication of terpenoid. Mass spectral data showed a peak at m/z 428 (M^{+}) that in accordance with molecular formula $C_{30}H_{52}O$. IR spectral data showed maximum absorbance at 3479.58 cm^{-1}, suggested stretching absorption of hydroxyl group. This suggestion was supported by appearance of bending absorption of secondary cyclic C-OH at 1018.41 cm^{-1}. Peaks with sharp intensity at 2931.8 cm^{-1} and 2870.08^{-1} showed a C-H streching of CH_3 and CH_2, that was supported by a bending at 1388.75 cm^{-1}. A peak with sharp intensity at 1705.07 cm^{-1} suggested the occurence of non conjugated C=O. Peak at 1635.64^{-1} suggested the presence of non conjugated C=C. A finger print area at 1172.72 cm^{-1} suggested the presence of C-O bond. Based on infra red spectral data, it was concluded that compound 1 consisted hydroxil, CH_3 and CH_2, C=O, C=C double bond and C-O groups.



(1)

Figure 1. Friedelinol

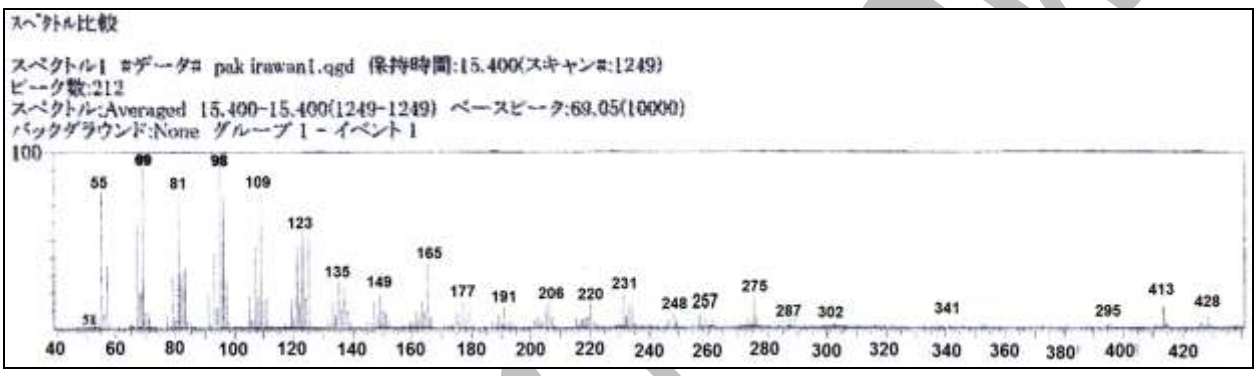


Figure 2. MS spectrum of friedelinol

Tabel 1. Comparison of Mass Fragmentation of Compound 1 and Friedelinol.

No	Mass spectra fragmentation pattern	
	Compound 1 (*m/z*)	Friedelinol (*m/z*)
1	428	428
2	413	413
3	382	-
4	341	-
5	275	275
6	257	257
7	248	248
8	231	231
9	220	220
10	206	206
11	191	189
12	177	177

13	165	165
14	149	147
15	135	137
16	123	125
17	109	109
18	98	98
19	81	81
20	55	55

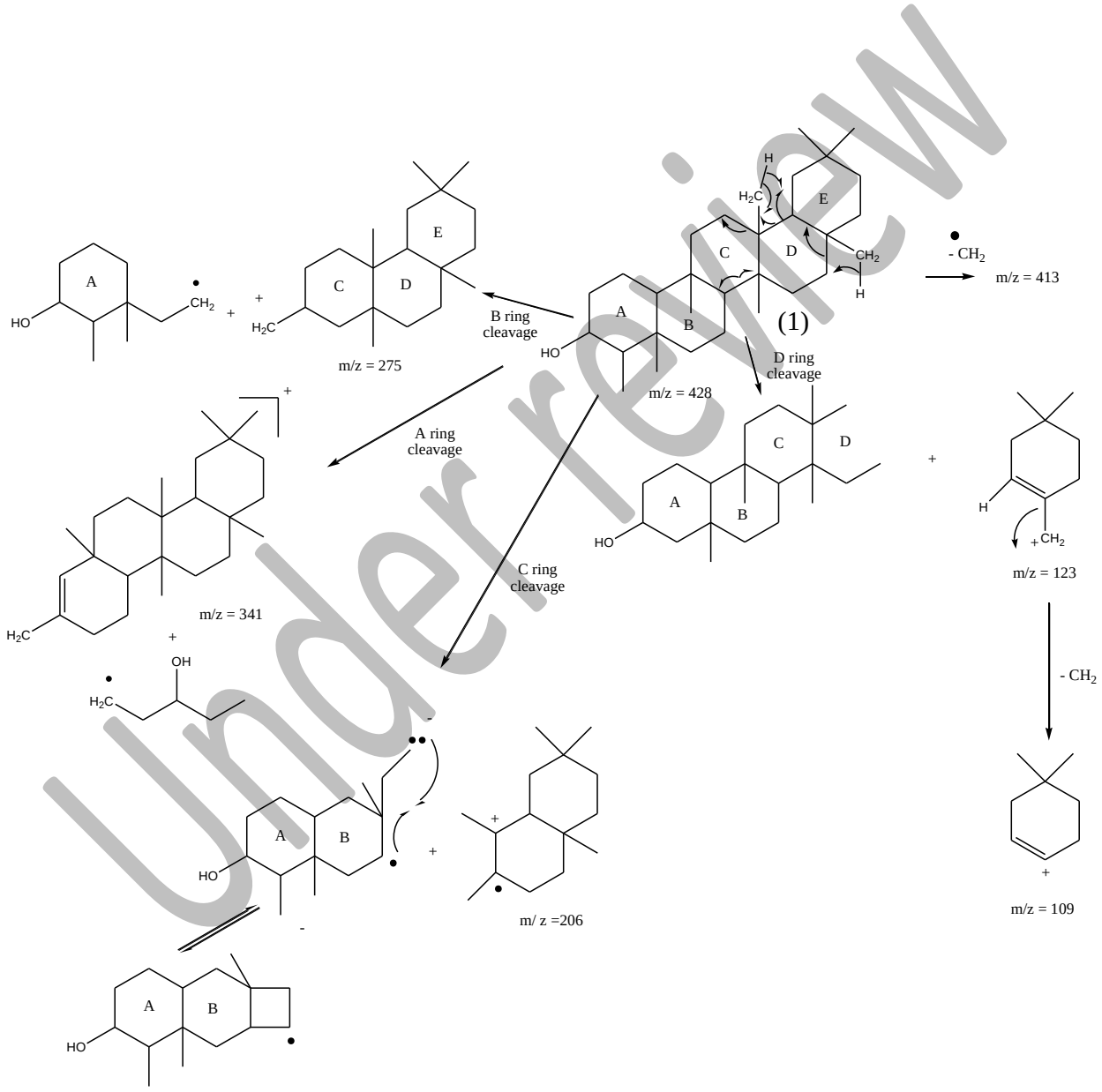


Figure 3. Mass Fragmentation Pattern of Compound 1.

The result of GC-MS analysis displayed a molecular peak at *m/z* 428 (M^+) suggested the molecular weight of compound **1**, that matched to the molecular formula $C_{30}H_{52}O$. Fragmentation pattern of compound **1** was presented at Fig 1 and indicated the possibility of the compound **1** as a triterpene, friedelinol. Comparison of mass spectral fragmentation pattern of compound **1** to that of friedelinol was presented at Table 1, it showed a good match. Based on the description of physicochemical properties, therefore, the compound **1** was identified as friedelinol.

CONCLUSION

Based on the spectroscopical analysis of FT-IR and GC-MS, an isolated compound from *A. odoratissimus* was identified as triterpene, friedelinol. The compound has moderate cytotoxicity against a brine shrimp, *A. salina* with LC_{50} 48.39 ppm.

ACKNOWLEDGEMENT

A kind support from Prof. Sanro Tachibana of Ehime University, Japan in measurement of GC-MS spectra and melting point is gratefully acknowledged.

REFERENCES

1. Nomura, T; Hano, Y; Aida, M. **1998**, *Heterocycles*, *47*(2), 1179-1205
2. Ferlinahayati.; Hakim, E.H.; Achmad, S.A.; Aimi, N.; Kitajima, M.; Makmur, L. *Proc. National Seminar of Natural Products Chemistry'99 Indonesia*, **1999**, 162 - 167, Jakarta
3. Verheij, E. W. M., Coronel, R. E. (eds). 1992. *Plant Resources of South Asia No. 2 486-491 Edible Fruits and Nuts*. Prosea Foundation Bogor.
4. Kochummen, K. M. 1987. *Moracea in Tree Flora of Malaya. Vol. 2. Forest Research Institute*. Kepong. Malaysia.
5. Jagtap, U.B. and Bapat, V.A. 2010, *Artocarpus*: A review of its traditional uses, phytochemistry and pharmacology, *Journal of Ethnopharmacology*, Vol. 129 (2), 142–166.
6. Heyne, K. 1987, Useful Plants of Indonesia, Vol. II, Department of Forestry, 668-683
7. Nomura T.Hano Y. and Aida M. (1998) Isoprenoid-substituted flavonoids from *Artocarpus* plants (moraceae). *Heterocycles*, 47(2), 1179–1205.
8. Nasution, R. 2013. *Isolation and Structure Determination of Steroid Compounds from Leaves of Plant Kulu (Artocarpus camansi: Breadfruit seed) Characteristically Antidiabetes*., Disertation, university of Sumatera Utara. Medan.
9. Khan, M. R. Omoloso, Ad. Kihara, M. 2003. Antibacterial activity of Artocarpusheterophyllus. *Fitoterapia* 74: 501-505
10. Weng, J.R. Chan, S.C. Lu, Y.H. Lin, H.C. Ko, H.H. and Lin, C.N. 2006. Antiplatelet Prenylflavonoid from *Artocarpus communis*. *Phytochem* 67: 824-829
11. Jayasinghe, L. Balasooriya, BAIS, Padmini, W.C. Hara, N, and Fujimoto, Y. 2004. Geranyl Chalcone Derivatives with Antifugal and Radical Scavenging. *Phytochem.* 65: 1287-1290.
12. Widyawaruyanti A, Subehan, Kalauni S K, Awale S, Nindatu M, Zaini N C, Syarifruddin D, Asih P B S, Tezuka Y, Kadota S. 2007. New Prenylated Flavones from Artocarpuschampeden, and Their Antimalarial Activity InVitro. *J Nat Med*, 61: 410-413.

13. Boonlaksiri, C, Oonanant, W. Kongsaeree, P. Kittakoop, P. Tanticharoen, M. and Thebtaranonth, Y. 2000. An Antimalarial Stilbene from *Artocarpus integer*. *Phytochem*, 54: 415-417.
14. Erwin, Hakim, E.H: Achmad, S.A: Syah, Y.M: Aimi, N: Kitajima, M: Makmur, L: Mujahidin, D: Takayama, H. 2001, *Bulletin the Indonesian Society of Natural Products Chemistry*, 1(1), 20-27.
15. Erwin, 2004, Artocarpin and cycloartocarpin from wood of Artocarpus altilis (PARK.) FOSB wich toxic against *Artemia Salina*, *Journal of Frontir*, 18 (1), 45-49.
16. Ko. H. H, Lu, Y.H. Yang S.Z. Won S.J. and Lin, C.N. 2005. Cytotoxic Prenyl flavonoids from Artocarpus elasticus. *J Nat Prod* 68: 1692-1695.
17. Hakim, A. 2011. Secondary Metabolites Diversity genus *Artocarpus* (Moraceae). *Bioteknologi*, 8 (2): 86-98.
18. Syah Y M, Juliawaty L D, Achmad S A, Hakim E H, and Ghisalberti E L. 2006. Cytotoxic Prenylated Flavones from Artocarpus champeden. *Journa lNatural Medicine*, 60: 308-312.
19. Siregar, M. 2006. R E V I E W: Species Diversity of Local Fruit Trees in Kalimantan: Problems of Conservation and Its Development, *B I O D I V E R S I T A S*, Vol. 7 (1), 94-99.
20. Shaffiq, S. M. S., Sidik, B. J., Harah, Z.M., and Devi, R.S., 2013, Marketable wild fruits of Serawak, Borneo: Their mode of consumption, uses and sugar profiles, *Indian Journal of Traditional Knowledge*, 12 (2), 195-201.
21. Chai, P. P. K. 2006. *Medicinal Plants of Sarawak*. Lee Ming Press. Malaysia.
22. Asmaliyah, Wati, E.E.H., Utami, S., Mulyadi, K., Yudhistira dan Sari, F.W., 2010, The introduction producing plants of natural pesticide and utilization of traditional, Ministry of Forestry Research Agency Forestry Research and Development Center and Forest Productivity Development, Jakarta, page 51.
23. Bakar M.F.A, Mohamed, M., Rahmat, A., and Fry, J. 2009, Phytochemicals and antioxidant activity of different parts of bambangan (*Mangifera pajang*) and tarap (*Artocarpus odoratissimus*), *Food Chemistry*, 113 (2), 479-483.
24. Gwendoline, C.L. Ee,; Siow H. T,Rahmani, Chan M.; K. L,; Yang M. L, and Choon F.J. B. 2010, Artosimmin - A Potential Anti-Cancer Lead Compound *from Artocarpus odoratissimus*, *Letters in Organic Chemistry*, Vol.7 (3), 240-244, Bentham Science Publishers.
25. Erwin, 2014, Phytochemical and bioactivity screening of extracts and isolates from *Terap* Leaves (*Artocarpus odoratissimus* Blanco), *Proceedings of Seminar of Chemistry*, Samarinda, 89-92.