PP-54

Antibacterial Activity of Aromatic Plants Oils From East Kalimantan

Laboratory of Forest Products Chemistry
Forestry Faculty, Mulawarman University, Samarinda, East Kalimantan

AGMI SINTA PUTRI, HARLINDA KUSPRADINI*, and EDI SUKATON
*Coresponding author : hkuspradini@fahutan.unmul.ac.id

INTRODUCTION

The forest of Kalimantan has immense biodiversity. One of its potential is Non-Wood Forest Products which has many benefits and has not been well-documented and optimally. The potential of kinds of medicinal and aromatic plants have not been explored. Aromatic plants have been used in traditional medicine as well as to preserve the food, traditionally. Their properties are due to secondary metabolites produced by the plants that were essential oils. Essential oil is one of the natural ingredients that can be used to treat bacterial infections. According to the Kurniawati's research (1998) concern essential oils directed to used it as antimicrobial of disease which caused by bacterial and fungi. Essential oils from several plants were able to control the growth of microorganisms caused skin infections, dental caries, and food spoilage. Essential oils have stood out as a promising source of bioactive molecules with potential application in the management of dental caries. Several oral products have incorporated essential oil-derived antimicrobials such as eucalyptus, lavandula and rosmarinus[1]. Essential oils such as calamus, citronella, clove, eucalyptus, lemongrass, lime, cananga, piper have been traditionally used by people for various purposes in different parts of the world. Eventhough there are a number studies on antimicrobial activity of these plant species in Indonesia, studies on the essential oils of different species from specific part of plant in East Kalimantan have not been extensively conducted. The purpose of this study was to compare the antibacterial activity of the essential oil derived plants locally available in East Kalimantan against oral bacteria and to search for the most effective essential oil from these plants.

MATERIALS AND METHODS

MATERIALS

Materials that used in this research were portable balance, erlenmeyer, aluminum foil, vial bottle, refinery, separator flask, digital balance, beaker glass, refractrometer, hot plate, micropipette, yellow tip, cotton swab, cork borer, inoculation needle, autoclave, laminar air flow cabinet, petridish, incubator, natrium chloride, nutrient agar, chlorhexidine, acetone, distilled water.

METHODS

The essential oils obtained by steam distillation method, include collecting the sample, drying, cutting, preparing the sample, calculation of moisture factor, distillation with steam system, filtration or separation of water and oil.

The refractive indexes measuring use hand refractometer.

The antibacterial assay using agar diffusion method replicates the experimental unit consisted of 2 times, which include sterilization process, making the nutrient agar medium, making the antibacterial suspensions, and antibacterial test.

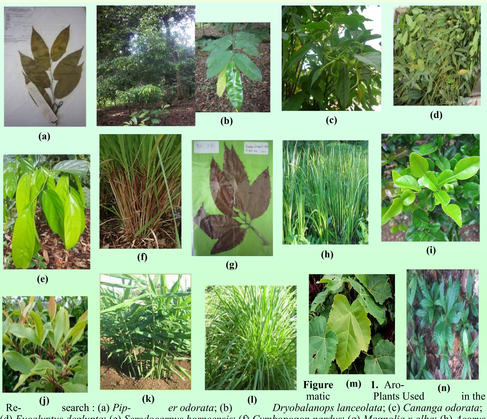

Figure 1. Aromatic Plants Used in the Research : (a) *Piper odorata*; (b) *Dryobalanops lanceolata*; (c) *Cananga odorata*; (d) *Eucalyptus deglupta*; (e) *Scrodocarpus borneensis*; (f) *Cymbopogon nardus*; (g) *Magnolia x alba*; (h) *Acorus calamus*; (i) *Citrus hystrix*; (j) *Syzygium aromaticum*; (k) *Zingiber cassumunar*; (l) *Cymbopogon citratus*; (m) *Macaranga gigantea*; (n) *Syzygium* sp.

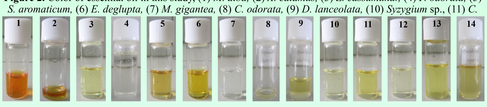

Figure 2. Color of essential oil in this study, (1) *M. alba*, (2) *A. calamus*, (3) *Z. cassumunar*, (4) *P. odorata*, (5) *S. aromaticum*, (6) *E. deglupta*, (7) *M. gigantea*, (8) *C. odorata*, (9) *D. lanceolata*, (10) *Syzygium* sp., (11) *C. histrix*, (12) *C. nardus*, (13) *C. citratus*, (14) *S. borneensis*

CONCLUSION

All tested oils have been investigated for their antibacterial activities. This study proved that the essential oils from leaves of aromatic plants have potential to inhibited the growth of *S. mutans* and *S. sobrinus*. the leaf oil from *Cymbopogon citratus* has the highest activity against *S. sobrinus*. The *Scorodocarpus borneensis* oil showed the best antibacterial activity against *S. mutans*.

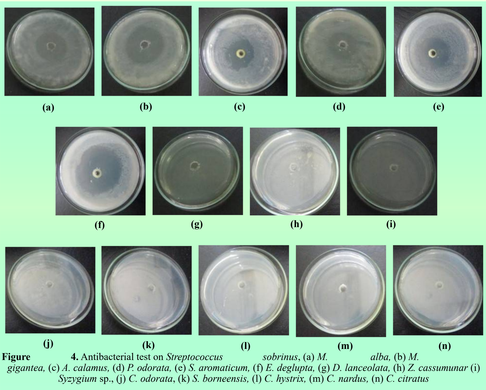

Figure 4. Antibacterial test on *Streptococcus sobrinus*, (a) *M. alba*, (b) *M. gigantea*, (c) *A. calamus*, (d) *P. odorata*, (e) *S. aromaticum*, (f) *E. deglupta*, (g) *D. lanceolata*, (h) *Z. cassumunar* (i) *Syzygium* sp., (j) *C. odorata*, (k) *S. borneensis*, (l) *C. hystrix*, (m) *C. nardus*, (n) *C. citratus*

ACKNOWLEDGEMENT

Very much thankfull to Ministry of Research, Technology and Higher Education, Republic of Indonesia, Mrs. Harlinda Kuspradini and members of Laboratory of Forest Products Chemistry

REFERENCES

[1]Allaker RP, Douglas CWI. Novel anti-microbial therapies for dental plaque-related diseases. International Journal of Antimicrobial Agents, 2009; 33(1): 8–13.

[2]M. Munazir, R. Qureshi, M. Arshad and M. Gulfraz. *Antibacterial Activity of Root and Fruit Extracts of Leptadenia pyrotechnica (Asclepiadaceae) from Pakistan.* Pakistan Journal of Botany, 44(4), 2012, 1210.

[2]http://www.sciencebuddies.org/science-fairprojects/project_ideas/icroBio_p014.shtml#background.

RESULTS AND DISCUSSION

Table 1. The plant species, family, yield oil and refractive index

No.	Plant species	Family	Yield (%)	Colour	Refractive index
1	*Magnolia x alba*	Magnoliaceae	0.28	Orange	1.344
2	*Acorus calamus*	Acoraceae	0.35	Brownish Yellow	1.482
3	*Zingiber cassumunar*	Zingiberaceae	0.25	Yellow	1.500
4	*Piper odorata*	Piperaceae	0.06	Colorless	1.492
5	*Syzigium aromaticum*	Myrtaceae	0.22	Yellow	1.459
6	*Eucalyptus deglupta*	Myrtaceae	0.40	Yellow	1.485
7	*Macaranga gigantea*	Euphorbiaceae	0.34	Colorless	1.369
8	*Cananga odorata*	Annonaceae	0.04	Pale Yellow	1.496
9	*Dryobalanops lanceolata*	Dipterocarpaceae	0.12	Yellow	1.340
10	*Syzygium* sp.	Myrtaceae	1.54	Pale Yellow	1.485
11	*Citrus hystrix*	Rutaceae	1.26	Yellow	1.452
12	*Cymbopogon nardus*	Poaceae	0.26	Pale Yellow	1.367
13	*Cymbopogon citratus*	Poaceae	0.46	Yellow	1.385
14	*Scrodocarpus borneensis* Becc.	Olacaceae	0.39	Yellow	1.435

The yields of essential oils varied with plant species. The steam distillation yielded clear and yellowish essential oils (showed in Figure 2.) Refractive indexes of oil were found to be in the range 1.340 to 1.500. The result of the yields and refractive indexes are presented in Table 1. *Syzigium* sp. appears to be richer in oil (1.54 %) than the other plant species, while *C. odorata* was poorer (0.04%).

The zone of inhibition for each sample was observed, measured, and expressed in mm. From this the Activity Index (AI) and Precent Inhibition (PI) were calculated for all essential oils using the following formula (Refer Table 2)[2].

$$\text{A.I} = \frac{\text{Mean zone of inhibition of each solvent extract}}{\text{Zone of inhibition obtained for standard}}$$

Table 2. Antibacterial activity of pure essential oils against *S. mutans*

Sample	Inhibition Zone (mm)		Activity Index
	Sample	Control positive*)	
Magnolia x alba	10.50 ± 0.28		0.63 ± 0.02
Acorus calamus	14.65 ± 0.49		0.88 ± 0.03
Zingiber cassumunar	18.65 ± 6.15		1.12 ± 0.37
Piper odorata	20.85 ± 5.87		1.25 ± 0.35
Syzigium aromaticum	22.15 ± 1.20		1.33 ± 0.07
Eucalyptus deglupta	23.35 ± 0.49		1.40 ± 0.03
Macaranga gigantea	23.65 ± 0.92	16.70 ± 11.81	1.42 ± 0.06
Cananga odorata	43.50 ± 9.19		2.60 ± 0.55
Dryobalanops lanceolata	43.65 ± 3.32		2.61 ± 0.20
Syzygium sp.	50.85 ± 1.20		3.04 ± 0.07
Citrus hystrix	51.70 ± 0.00		3.10 ± 0.00
Cymbopogon nardus	52.15 ± 0.21		3.12 ± 0.01
Cymbopogon citratus	52.85 ± 1.63		3.16 ± 0.10
Scrodocarpus borneensis Becc.	53.65 ± 0.92		3.21 ± 0.06

*Control positive in this study was Chlorhexidine (10µg/ml)

This result (Table 2) suggested that the volatile oil of *C. odorata, D. lanceolata, Syzygium sp., C. hystrix, C. nardus, C. citratus, S. borneensis* Becc remarkably exhibited broad spectrum of activity, and *Z. purpureum, P. odorata, S. aromaticum, E. deglupta, M. gigantea* showed moderate activity, while *M. alba* and *A. calamus* showed lowest activity against *S. mutans*.

Table 3. Antibacterial activity of pure essential oils against *S. sobrinus*

Sample	Inhibition Zone (mm)		Activity Index
	Sample	Control positive*)	
Magnolia x alba	11.65 ± 0.49		0.66 ± 0.03
Macaranga gigantea	13.50 ± 0.71		0.76 ± 0.04
Acorus calamus	17.80 ± 2.12		1.01 ± 0.12
Piper odorata	18.35 ± 0.92		1.04 ± 0.05
Syzigium aromaticum	20.00 ± 0.00		1.13 ± 0.00
Eucalyptus deglupta	34.50 ± 0.28		1.95 ± 0.02
Dryobalanops lanceolata	43.80 ± 2.12		2.47 ± 0.12
Zingiber cassumunar	47.65 ± 7.57	17.70 ± 0.00	2.69 ± 0.43
Syzygium sp.	50.00 ± 0.00		2.82 ± 0.00
Cananga odorata	51.30 ± 2.83		2.90 ± 0.16
Scrodocarpus borneensis Becc.	51.65 ± 0.92		2.92 ± 0.05
Citrus hystrix	52.35 ± 0.49		2.96 ± 0.03
Cymbopogon nardus	52.50 ± 0.28		2.97 ± 0.02
Cymbopogon citratus	53.15 ± 0.21		3.00 ± 0.01

*Control positive in this study was Chlorhexidine (10µg/ml)

Table 3 showed that the volatile oil of *C. odorata, D. lanceolata, Syzygium sp., C. hystrix, C. nardus, C. citratus, S. borneensis* Becc. remarkably exhibited broad spectrum of activity, and *Z. purpureum, P. odorata, S. aromaticum, E. deglupta, A. calamus* showed moderate activity, while *M. alba* and *M. gigantea* showed lowest activity against *S. sobrinus.*

Following table shows values to evaluate the bacteria response to each compound.

Table 4. Values to Evaluate the Microbials Response to Each Compound[3]

	Diameter of zone of inhibition (mm)
Resistant	10 or less
Intermediate	11-15
Susceptible	16 or more

Scorodocarpus oil showed the best activity against *S. mutans* (53.65 ± 0.92 mm) while *Cymbopogon citratus* showed the highest activity against *S. sobrinus* (53.15 ± 0.21 mm) and both of them are susceptible. Only *M. alba* that intermediate to *S. mutans* and *S. sobrinus.*

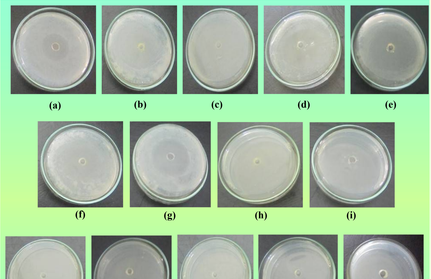

Figure 3. Antibacterial test on *Streptococcus mutans*, (a) *M. alba*, (b) *A. calamus*, (c) *Z. cassumunar*, (d) *P. odorata*, (e) *S. aromaticum*, (f) *E. deglupta*, (g) *M. gigantea*, (h) *C. odorata*, (i) *D. lanceolata*, (j) *Syzygium* sp., (k) *C. histrix*, (l) *C. nardus*, (m) *C. citratus*, (n) *S. borneensis*

ISNM 2017
International Symposium on Natural Medicines
(http://isnm.ipb.ac.id)
IPB International Convention Center, Bogor, Indonesia August 24-25, 2017
Forest Chemistree