PROCEEDINGS

2015 3rd International Conference on Adaptive and Intelligent Agroindustry (ICAIA)

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August 3rd - 4th, 2015
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Welcome Message from The General Chairs of ICAIA 2015

On behalf of the organizing committee, it is our pleasure to welcome you to International Conference on Adaptive and Intelligent Agroindustry, Bogor, Indonesia. This is the 3rd conference on the topic that is held by the Department of Agroindustrial Technology, Bogor Agricultural University, Indonesia.

The conference is expected to provide excellent opportunity to meet experts, to exchange information, and to strengthen the collaboration among researchers, engineers, and scholars from academia, government, and industry. In addition, the conference committee invited five renowned keynote speakers, i.e. Prof Irawadi from Bogor Agricultural University; Prof Kenneth De Jong from George Mason University, USA; Dr Yandra Arkeman from Bogor Agricultural University; and Dr Guillermo Baigorria from University of Nebraska-Lincoln, USA.

The conference committee also invited Prof Noel Lindsay from University of Adelaide, Australia; Kiyotada Hayashi from National Agricultural Research Center-Tsukuba, Japan; Prof Margareth Gfrerer from Islamic State University of Jakarta, Indonesia; Dr Barry Elsey from University of Adelaide, Australia; Dr Gajendran Kandasamy from Melbourne University, Autralia; and Imperial College London-British, Prof Allan O'Connor from University of Adelaide, Australia; Dr Wisnu Ananta Kusuma from Bogor Agricultural University ,Indonesia; and Dr Frank Neumann from University of Adelaide, Australia, as invited speakers.

This conference was organized by Department of Agroindustrial Technology, Bogor Agricultural University and Asosiasi Agroindustri Indonesia, and technically sponsored by IEEE Indonesia Section. Furthermore, it was supported by Departement of Computer Science, Bogor Agricultural University; Surfactant amd Bionegergy Research Center; PT Bogor Life Science and Technology; Indonesian Ministry of Industry; PT Pachira Distrinusa; and PT Kelola Mina Laut.

I would like to take this opportunity to express my deep appreciation to the conference's committee members for their hard work and contribution throughout this conference. I would like to thank authors, reviewers, speakers, and session chairs for their support to participate in the Conference. Lastly, I would like to welcome you to join ICAIA 2015 and wish you all an enjoyable stay in Bogor.

Sincerely,
Dr Yandra Arkeman
General Chairs, ICAIA 2015

WELCOMING ADDRESS

Prof. Dr. Ir. Nastiti Siswi Indrasti
Head of Agroindustrial Technology Department
Faculty of Agricultural Engineering and Technology
Bogor Agricultural University

on

3rd International Conference on Adaptive and Intelligence Agroindustry (3rd ICAIA)

Bogor, August, 3 – 4, 2015

Assalamu'alaikum Warohmatullahi Wabarokatuh
In the name of Allah, the beneficent and the merciful,

Distinguish Guest, Ladies and Gentlemen
Let me first thank you all for accepting the invitation to participate in this 3rd International Conference on Adaptive and Intelligence Agroindustry (ICAIA). In particular I would like to thank Rector of IPB (Institut Pertanian Bogor/Bogor Agricultural University) Prof. Herry Suhardiyanto for supporting this event as part of the series academic event in celebrating the 52nd Anniversary of Bogor Agricultural University.

We are certainly proud to have been able to assemble this event in IPB, Bogor. The range of participants and audience at this conference is precisely something I would like to stress. Participants who followed the event more than 150 people, coming from various countries including the USA, Australia, Japan, Vietnam, Philippine, Germany and Indonesia. The main goal of the conference is to provide an effective forum for distinguished speakers, academicians, professional and practitioners coming from universities, research institutions, government agencies and industries to share or exchange their ideas, experience and recent progress in Adaptive and Intelligent Agroindustry.

The 2015 3rd International Conference on Adaptive and Intelligent Agro-industry (ICAIA) is the third forum for the presentation of new advances and research results on various topics in all aspects of innovative agro-industry that highlights the development and improvement for today and tomorrow's global need for food, energy, water and medicine. The aim of the conference is to stimulate interaction and cohesiveness among researchers in the vast areas of innovative agro-industry. Innovative Agro-industry has the ability to adapt intelligently to future global challenges, i.e. food, energy, water, and medical. Global challenges needs a new breed of Agroindustry which could produce innovative products to fulfill the needs through advanced processing technology, production systems and business strategy supported by cutting-edge information and communication technology.

The topic for this event is "Empowering Innovative Agroindustry for Natural Resources, Bioenergy and Food Sovereignty". The topics clustered into four main parts:
Track 1 : Innovative Agroindustrial and Business System Engineering

Track 2 : Frontier Approaches in Process and Bioprocess Engineering
Track 3 : Frontier Approaches in Industrial Environmental Engineering
Track 4 : Intelligent Information and Communication Technology for Adaptive Agroindustry of the Future

This event also hosts four (4) workshops: (1) Strategies for Agroindustry Development (2) LCA for Agroindustry (3) Innovation and Technopreneurship for Agroindustry and (4) Agroindustry Informatics.

Distinguish Guest, Ladies and Gentlement,
Agroindustry transforms agricultural commodities into high value-added products. Agroindustry is industry that process agricultural products to increase their value added significantly by using technology and by considering environmental aspect and sustainability. However, with changing global demand and technology advancement, innovative agroindustry is needed in order to be competitive as well as sustainable. The challenge of future agroindustry is not merely efficiency and productivity anymore, but also the challenge to appropriately apply frontier technology as well as meeting future global demands.

Agroindustry needs to deal with the application of advance technologies and cope future global issues. Current global issues which arise and expected to exist in the future are food sovereignty, renewable energy, sustainable water management and pharmacy. The ability of agro-industry to respond the future global issues and the undoubtedly substantial increase in demand in future decades will be highly dependent on the increased application of existing technologies as well as the exploitation of new and innovative technologies.

The emergence of high technology could be applied in the agro-industry are: nanotechnology, biotechnology, bioinformatics, food processing, food packaging-waste, state-of-the-art computation and many others. The aforementioned high-technology along with computation technology could greatly advance agro-industry from a traditional system into a smart-intelligent and innovative technology. Therefore, in the new millennia, adaptive-intelligent and innovative agro-industry will contribute to solutions to global problems and brings agriculture into perfection.

Hope this conference will also discuss this issue in more detail as it is an important matter for all of us. We should no more think just how to produce high value product but it is also necessarily important how to keep our live in good quality by understanding following old saying… “You do not live at once. You only die once and live every day”.

I do not to take up any more of your time with these opening remarks. Let me simply thank you once again for sharing your thoughts with us. Here’s wishing every success for the conference. May Allah bless all of us.

Thank you for your kind attention,
Wassalamu’alaikum Warohmatullahi Wabarokatuh

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AGENDA

Time	Activities
Monday, August 3rd 2015	
08.00 - 09.00	Registration
09.00 - 10.00	Opening Ceremony • Welcoming Address: Prof. Nastiti Siswi Indrasti (Head of DAT, Fateta, IPB) • Welcoming Speech Head of Bogor Regency • Conference Opening: Prof. Herry Suhardiyanto (Rector of IPB) • Opening Speech and Conference Opening : Minister of Industry Indonesia * • Launching Expose International program DAT
10.00 – 10.05	*Photo Session*
10.05 - 10.15	*Coffee break*
10.15 - 10.45 10. 45 - 11.30 11.30 – 12.00 12.00 – 12.30	Keynote Speech : 1. Prof Irawadi (Bogor Agricultural University, Indonesia) 2. Prof. Kenneth De Jong (George Mason University, USA) 3. Dr. Yandra Arkeman (Bogor Agricultural University, Indonesia) 4. Dr. Guillermo Baigorria (University of Nebraska, Lincoln, USA)
12.30 – 13.30	Lunch break
13.30 – 13.50 13.50 – 14.10 14.10 – 14.30 14.30 – 14.50 14.50 – 15.10 15.10 – 15.45	Plenary Session 1 : Prof. Noel Lindsay (University of Adelaide, Australia) Dr. Kiyotada Hayashi (National Agricultural Research Center, Tsukuba, Japan) Prof. Margareth Gfrerer (Islamic State University of Jakarta, Indonesia) Dr. Barry Elsey (University of Adelaide, Australia) Ir. M. Novi Saputra (Marketing Director KML Food Group) *Discussion*
15.30 – 15.45	*Coffee break*
15.45 – 18.00	Parallel session A, B and C
18.00 – 21.00	Welcome Dinner

Time	Activities
Tuesday, August 4rd 2015	
08.30 – 09.00	Registration
09.00 – 09.20 09.20 – 09.40 09.40 – 10.00 10.00 – 10.20 10.20 – 10.45	Plenary Session 2 : Dr. Gajendran Kandasamy (PhD in Physic, Melbourne University ; PhD in Innovation Imperial Collage, London) Prof. Allan O'Connor (University of Adelaide, Australia) Dr. Eng. Wisnu Ananta Kusuma, ST, MT (Bogor Agricultural University, Indonesia) Dr. Frank Neumann (University of Adelaide, Australia) *Discussion*
10.45 – 13.00	Parallel Session A, B and C
13.00 – 14.00	Lunch break
14.00 – 15.30	Parallel Workshop • Strategies for Agroindustry Development • LCA for Agroindustry • Innovation and Technopreneurship for Agroindustry • Agroindustrial Informatics
15.30 – 15.45	Coffee Break
15.45 – 16.15	Closing remark

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ABSTRACTS OF INVITED SPEAKERS

 ISBN : 978-1-4673-7404-0

In Vitro Potential of Antibacterial Marine Microalgae Extract *Chaetoceros gracilis* toward *Staphylococcus epidermidis* Bacteria

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***Abstract*— Acne is common skin disease which can be found in society. Antibiotic was a treatment that always used to be solved this disease. Utilization of antibiotic has been facing a problem. Resistance of bacteria toward antibiotic has become one problem in acne treatment. Antibiotic resistance can be prevented through using new antibiotic compound. Marine microalgae *Chaetoceros gracilis* can be used as new antibiotic resources in acne treatment. The aim of this research was to determine in vitro antibacterial activity of C. gracilis toward *Staphylococcus epidermidis* bacteria. Antibacterial activity was tested by inhibition index and cell membrane leakage. Cultivation of marine microalgae biomass produced yield was 0.12 g/L. Yield of microalgae *C. gracilis* extract which obtained was 47.40%. Extract capable inhibited the growth of *S. epidermidis* based on the highest antibacterial activity. Minimum inhibitory concentration (MIC) value of extract was 0.4 mg/mL and have caused the cell membrane leakage. The leakage of genetic material was more higher than protein in bacteria cell membrane. Active compounds contained in extract were alkaloid and steroid.**

Key words: antibiotic resistance, *C. gracilis* extract, *S. epidermidis*, inhibition index, MIC

I. INTRODUCTION

Acne is one skin disease which can be found easily in society. Clinical diagnose of acne is more easy than prevent. One of cause acne is infection of bacteria such as *Propionibacterium acnes* and *Staphylococcus epidermidis*. Antibiotic and chemical compound is common treatment which always using to solve acne [1]. Utilization antibiotic and chemical compound in acne has make some problems such as side effect (irritation, dry skin and painful), infection of upper respiratory tract and increasing bacteria resistance [2][3]. Current research show that occurred increasing of skin bacteria resistance. In South Korea, occurred increasing of acne bacteria from isolation 100 acne patient. Resistance of *P. acnes* increasing about 36.7% and *S. epidermidis* about 69.4%. The highest resistance toward antibiotic is shown by *S. epidermidis* [4]. This result show that *S. epidermidis* has high resistance to antibiotics and also become common acne bacteria in human skin [5].

Prevention acne bacteria resistance can be solved by using alternative bioactive compound such as microalgae. Microalgae is a potential antibacterial resource which can be used as a solution to solve acne problem. Some microalgae has antimicrobial activity, one of that is *Chaetoceros* spp. *C. muelleri* which is extracted by supercritical fluid extraction (SFE) can damage and kill cell membrane *E. coli* ATCC 11775 and *S. aureus* ATCC 25293 [6]. Except that, *C. gracilis* also show antibacterial activity toward *Vibrio harveyi*. *Listeria monocytogenes* ATCC feld stem and *Bacillus cereus* ATCC 13901 [7]. Those results show potential marine microalgae *C. gracilis* as a new alternative resource in bioactive.

Measurement an anti-acne active compounds carried through several stages consist of antibacterial activity, anti-oxidant and anti-inflammatory. The first stage of anti-acne was checked by measured of antibacterial spectrum. Antibacterial activity was tested by inhibition and cell membrane leakage. Antibacterial compound of *C. gracilis* can be obtained via ultrasound-assisted extraction (UAE). Combination with UAE aimed to damage cell wall of *C. gracilis* which contained silica. Utilization of *C. gracilis* extract using UAE to inhibit *S. epidermidis* growth has never been done before. In addition, mechanism of cell membrane leakage *S. epidermidis* by using *C. gracilis* extract is not clear. Measurement of bacteria cell membrane leakage will describe the

process of bacterial cell membrane damage from *C. gracili*s extract and its potential in pharmacy sector.

II. MATERIALS AND METHODS

A. Sample preparation

Pure cultures of *C. gracilis* were scaled up from 2 L to 50 L in medium aquarium supplied with aeration and illumination. Vitamins, trace metals, Na_2EDTA, Na_2HPO_4, F medium and $Na_2SiO_2.5H_2O$ were used as fertilizers. At the logarithmic phase, microalgae cell were harvested by filtration. The harvested microalgae were stored in jar bottle and refrigerated to maintain freshness during one day. Drying of microalgae cell used freeze drying with temperature about -82 ^oC and pressure on 0,001 bar. The biomass powder was kept in 4 ^oC refrigerator until extraction.

B. Ultrasound-Assisted Extraction (UAE)

In the current work, ultrasound-assisted extraction (UAE) was applied for extraction of biomass. The ultrasound extraction was carried out under the following experimental condition: time (15 min), solid to solvent ratio (1:10 g/mL), amplitude 100% and sonication power (20 KHz). After sonication done followed by stirring using magnetic stirrer during 24 hour at room temperature 30 ^oC. The extracts were filtered and the solvent was removed using rotary evaporator. Ethanol was used as the solvent and extraction was performed in duplicate.

C. Antimicrobial activity

Antimicrobial activity was checked by disc diffusion method. The cultures were grown in nutrient broth and incubated at 37 ^oC for 24 h. After incubation period is over, the OD of the culture was adjusted to 0.5-0.8 with sterile nutrient broth. Mueller-Hinton agar medium mixed with bacteria culture then poured into sterile petri plates and allowed to solidify. The disc (6 mm diameter) impregnated with some concentration 0.5, 1 and 2 mg/mL were placed on the surface of petri plates. The plates then were incubated at 37 ^oC for 24 h. after incubation period the zone of inhibition was measured.

D. Minimum inhibitory control (MIC)

Minimum inhibition concentration (MIC) were used by dilution method. Nutrient broth was used about 5 mL and extract has some concentrations 0.1, 0.2, 0.3, 0.4 and 0.5 mg/mL respectively and control, then added with bacteria culture about 5 µL. Medium and inoculum (tested microorganism) were used as positive control meanwhile medium and extract used as negative control. Sample were incubated at 37 ^oC and 24 h. MIC were determined by optical density value. OD was measured with wavelength 600 nm at 18 h and 24 h. The MIC was defined as the lowest concentration of the compound to inhibit growth of microorganism by OD value.

E. Analyze of cell membrane leakage

The culture about 10 mL was centrifuged for 20 min at 3500 rpm followed by washed with phosphate buffer saline pH 7.0 duplicate then re-suspended pellet by 0.1 M phosphate buffer saline pH 7.0 about 8 mL and also added extract concentration 1 and 2 MIC. Sample followed by incubated in rotary shaker 150 rpm at 37 ^oC for 24 h. After incubation, bacteria suspension was centrifuged for 20 min at 3500 rpm. Supernatant and pellet were filtered by Whatmann 0.42 µm. The absorbance of the supernatant obtained was measured using a UV-visible spectrophotometer at 260 nm and 280 nm to analyze the nitrogen content of nucleic acids and protein, respectively.

F. Phytochemicals screening

Phytochemicals screening were tested refers to analyze active compounds in extract. In this work, active compounds were tested consist of alkaloid, flavonoid, phenol, steroid, tannin and saponin.

III. RESULTS AND DISCUSSION

A. Biomass and extract *C. gracilis*

In this research, biomass was cultivated at 50 L in medium aquarium. Wet biomass was obtained 59.74 g then followed by drying. Freeze drying used as method to dry wet biomass to save bioactive compound such as sterol and unsaturated fatty acid. These component was sensitive to heat process. Dry biomass obtained 5.96 g and yield 0.12 g/L. This result show that yield of cultivation process was small. One factor contributed to yield of cultivation added of CO_2 at cultivation process. In this study, there was no added of CO_2 while cultivation. CO_2 sources was only came from aeration so that biomass obtained only in small capacity.

Dry biomass was extracted by UAE combination with stirring. Crude extract of *C. gracilis* was obtained has green brown color, sticky and paste appearance. Green brown color was expected from chlorophyll and carotenoid pigment. Yield of extract was obtained about 47.40%. This result show that extraction process have the impact to yield. Sonication makes cell wall of *C. gracilis* damage and active compound from cell wall come out to solvent [8]. Moreover, stirring also increased damage of microalgae cell wall and mass transfer and interaction between solvent and material occurred. This process caused some active compound was still left in cell

wall come out and dissolved with solvent. Crushed solvent and cell component will powerful caused by particles pounding by stirring [9].

B. Antibacterial activity

The results obtained from the present study concerning the antibacterial effects of algal extracts against *S. epidermidis* were recorded in Table (1). It was concluded that the diameter of inhibition zone depend on difference of concentration extract. Concentration 2 mg/mL was the highest spectrum of antibacterial activity.

Table 1. Inhibition *S. epidermidis* bacteria

Test	Zone inhibition (mm)	Inhibition index
Ethanol	0.00	0.00
Clindamycin	26.50	4.42
Extract 0.5 $^{mg}/_{mL}$	4.25	0.71
Extract 1 $^{mg}/_{mL}$	6.50	1.08
Extract 2 $^{mg}/_{mL}$	9.50	1.58

According to inhibition index, this concentration has strong capability to inhibit growth of *S. epidermidis*. Capability of inhibition *C. gracilis* extract was more smaller than *Aquilaria crassana* leave extract. Inhibition zone diameter of *A. crassana* leave extract in 2 mg/mL was 12 mm and higher than *C. gacilis* extract 9.5 mm [10]. In other that, capability of *C. gracilis* extract also more smaller than clindamycin because its purity. Clindamycin was an antibiotic compound lincosamide class which obtained from *Streptomyces lincolnensis* bacteria through purification process sot that clindamycin has strong antibacterial spectrum than *C. gracilis* extract [11].

C. Minimum inhibitory concentration (MIC)

MIC value in this study was obtained from two different time, 18 h and 24 h. OD value was decreased with increasing of concentration (Table 2). This result was appropriate with basic theory that increasing antibiotic concentration will decrease bacteria growth. Inhibition extract showed by comparison of OD from control and sample. At 18 h, control value more higher than sample which means that bacteria growth was inhibited. OD value at 18 h became determined inhibition character of *C. gracilis* extract. OD value at 24 h increased higher than od value at 18 h. This result show that effectiveness extract was decreased but inhibition bacteria growth still occurred looked from value of OD control higher than sample.

Table 2. MIC *C. gracilis* extract

Test	OD 18 h	OD 24 h
Control	0.363	0.558
0.1 $^{mg}/_{mL}$	0.029	0.042
0.2 $^{mg}/_{mL}$	0.029	0.040
0.3 $^{mg}/_{mL}$	0.027	0.040
0.4 $^{mg}/_{mL}$	0.019	0.030
0.5 $^{mg}/_{mL}$	0.012	0.030

Increasing OD value show that *C. gracilis* extract only inhibited bacteria growth and can't killed bacteria, so that this extract has bacteriostatic character. MIC value in this study was obtained at extract concentration 0.4 mg/mL. From classification of MIC value which classified refers to [12] this concentration was categorized as medium spectrum of antibacterial activity.

D. Cell membrane leakage

The value of cell membrane leakage was analyzed by reading the absorbance value at a wavelength of 260 nm and 280 nm. Wavelength of 260 nm can detect the presence of purine compounds and pyrimidine, meanwhile the wavelength of 280 nm can detect the presence of tyrosine and tryptophan compound belongings to the proteins class [13]. Results showed absorbance reading absorbance 260 nm values higher than 280 nm (Figure 1). The high reading absorbance values shows that the genetic material of bacteria cell membrane of *S. epidermidis* was more dominant damage than protein.

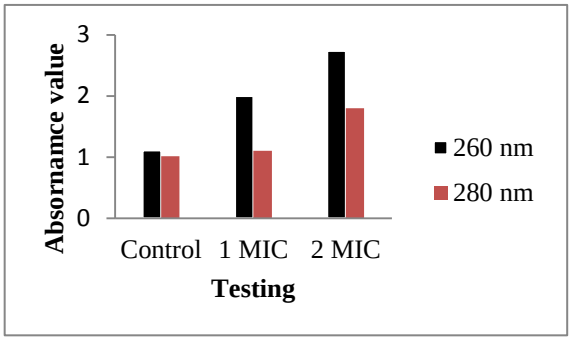

Fig. 1 Cell membrane leakage of *S. epidermidis*

Measurement absorbance of cell membrane leakage also showed changes value of leakage at each concentration. Changes in absorbance values of each treatment has a difference. High concentration was effected to cell membrane leakage become higher than less concentration. Change of absorbance values was resulted a breakdown of bacteria cell membrane. Bacteria cell membrane of *S. epidermidis* was damaged by *C. gracilis* extract effected to release of genetic material and proteins [14].

E. Phytochemical screening

Crude extract from *C. gracilis* which extracted by ethanol were contained alkaloid and steroid. Those compounds were secondary metabolite compound which has capability as antibacterial. Alkaloid was offend peptidoglycan component in cell membrane. Antibacterial character from steroid was offend translation which effected in disorder of transcription process [15]. This process have the impact to synthesis of bacteria protein. Steroid compound in this study was suggested as the main antibacterial compound. This result was analyzed from FTIR test of *C. calcitrans* extract [16].

IV. CONCLUSION

The present study has reported the screening phytochemical, antibacterial activity, MIC and cell membrane leakage from *C. gracilis* extract. Extract exhibited strong anti-bacterial activity toward *S. epidermidis* growth. Mechanism of action extract also was reported. Leakage of material genetic was higher than protein component in cell membrane. Antibacterial component in extract were suggested alkaloid and steroid. From this study, extract *C. gracilis* which could be useful in the treatment of acne disease.

ACKNOWLEDGEMENT

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