Call for Abstracts and Papers

The committee invite scientists from all over the world to present their papers in this conference.
The papers will be categorized :
1. Agrobiodiversity and Agroforestry
2. Food Security and Safety (including Halal Foods)
3. Food Technology
4. Human Health and Nutrition
5. Traditional Food and Knowledge

The accepted papers will be presented as oral or poster presentation, and will be published in a proceeding.

Abstract Guidelines

Abstract is written in English, MS Word format typed with Times New Roman (font 12), one space, maximum 250 words. The abstract contains the following informations: the title, author's name, affiliation and e-mail address of the correspondence author. Send the abstract (attached) via e-mail to: **icbfsh@ugm.ac.id**
with subject: Biodiversity 2016 Abstract - [Author'sname].

Deadline of abstract submission is **21 October 2016**. The accepted abstract will be announced by the end of October 2016.

Important Dates

Abstract deadline : 21 October 2016
Notification of abstract acceptance: 26 October 2016
Payment deadline : 31 October 2016
Full paper deadline : 4 November 2016

List of Speakers

No	Speaker
1	Dr. Danny Hunter (Bioversity International)
2	Prof.Dr. Gerry Bodeker (Chair Global Initiative for Traditional Systems of Health, Oxford, UK, & Adjunct Professor of Epidemiology, Columbia University, New York, USA)
3	Dr. Unnikrishnan Payyappallimana (Research Coordinator in the ESD Programme at the United Nations University IAS)
4	Dr. Bambang Dahono Adji (Ministry of Environment and Forestry - Republic of Indonesia)
5	Prof.Dr. Eni Harmayani, (CFNS and Faculty of Agricultural Technology - UGM)
6	Prof.Dr. Murdijati Gardjito (CFNS - UGM)
7	Prof.Dr. Mohammad Na'iem (Faculty of Forestry UGM)
8	Prof.Dr. Laksono Trisnantoro (Faculty of Medicine UGM)
9	Prof.Dr. Subagus Wahyuono (Faculty of Pharmacy UGM)
10	Dr. Gunadi – Director of PT Pagilaran UGM

Further information

Further information about the conference, can contact the secretariat of the committee, with the following personnel:
Prasetya Kurniawan (+6281294854455)
Puspita Mardika Sari (+6285292320430)

website: **rce.ugm.ac.id**
email: **icbfsh@ugm.ac.id**

1st International Conference on Biodiversity, Food Security, and Health

22 - 23 November 2016
Universitas Gadjah Mada
Yogyakarta, Indonesia

Organized by:
Center for Food and Nutrition Studies (CFNS)
Universitas Gadjah Mada

in collaboration with
Faculty of Agricultural Technology
Faculty of Agriculture
Faculty of Biology
Faculty of Animal Science
Faculty of Veterinary Medicine
Faculty of Forestry
Faculty of Medicine
Faculty of Pharmacy
Center for Biotechnology Studies
Department of Food & Agricultural Product Technology
Regional Centres of Expertise (RCE) Yogyakarta
The Indonesian Association of Food Technologists

in conjunction with
10th Global Conference of Regional Centres of Expertise

Supported by
Biodiversity for Food and Nutrition - Bioversity International

Background

Biodiversity plays a crucial role in food security and human nutrition through its influence on world food production, as it ensures the sustainable productivity of soils and provides the genetic resources for all crops, livestock, and marine species harvested for food. Food is an important basic need which should be sustainably provided in the future for human health and wellness.

Agrobiodiversity within food system not only provides a wide and varied range of nutrient-rich foods and dietary components with important health properties, but also a resource that is locally available. It is the basis of dietary diversity and the preferred choice for nutrition and health. Furthermore, agrobiodiversity related to communities' food culture, traditions and practices therefore it reinforces the cultural and social determinants of wise food choices by individuals which is fundamental to a good health of population.

There is growing concern about the health consequences of biodiversity loss and change. Biodiversity changes affect the functioning of life sustaining ecosystem. With the increasing population of the world in the future, the link between biodiversity, food security and sustainability to support health and well being need to be addressed, therefore it is important to conduct this international conference.

Objectives

- To improve awareness of the importance of biodiversity related to many aspects including food security, nutrition, health, climate change, and sustainable development.
- To communicate biodiversity conservation to a larger audience to enable biodiversity mainstreaming using traditional knowledge in food and health.
- To expand private-government-public-people partnership for biodiversity conservation related to food and health and to strengthen synergy among different sectors.
- To establish strategy and concept of agrobiodiversity development to improve food security and health.

Participants

The conference can be attended from the:

- Academia and Researcher
- Government and Non government institution/ organization
- Industry
- Professional organization
- Public and community

Time and Venue

The seminar will be held on:

Day 1 : **Tuesday, 22 November 2016**
Time : 08.00 - 17.00 local time
Venue : Grha Sabha Pramana (GSP) 2nd Floor Auditorium, Universitas Gadjah Mada

Day 2 : **Wednesday, 23 November 2016**
Time : 08.00 - 16.00 local time
Venue : University Club (UC) Hotel Universitas Gadjah Mada

Registration and Payment

Send the registration form by email to :
icbfsh@ugm.ac.id

Payment should be made by bank transfer (**deadline 31 October 2016**):
Bank BNI UGM Branch, Bulaksumur, Yogyakarta, Indonesia
Account No : **0448693358**
Account Name : Alia Fajarwati
Swift Code BNINIDJAUGM

Classification	Domestic Participant	International Participant
Early bird - until 30 Sept 2016	IDR 750,000	USD 200
After 30 Sept 2016	IDR 900,000	USD 300
RCE Member and/or Students	IDR 500,000 (early bird)	USD 100 (early bird)
	IDR 550,000 (after 30 September)	USD 150 (after 30 September)

Registration Form

International Conference on Biodiversity, Food Security, and Health
Yogyakarta, Indonesia, 22-23 November 2016

Full Name: _____

Status: ☐ Domestic participant ☐ International participant ☐ RCE Member ☐ Student

Institution: _____

_____

Address: _____

_____

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Phone/Fax: _____

Mobile phone: _____

*E-mail:

Registered as
☐ Oral presenter ☐ Poster presenter ☐ Non-presenter

Title of the paper (for presenter): _____

_____

_____

The paper category desired:
☐ Agrobiodiversity / Agroforestry
☐ Food Security and Safety (Food Policy)
☐ Food Technology
☐ Human Health and Nutrition
☐ Traditional Food and Knowledge

Payment:
☐ Cash
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*** Please attached the proof of transfer when submitting this form

1st International Conference on Biodiversity, Food Security, and Health

Gadjah Mada University, 22-23 November 2016

www.rce.ugm.ac.id email: icbfsh@ugm.ac.id

Yogyakarta, 26 October 2016

No : COM-ICBFSH/PSPG-UGM/X/016/2016
Subject: Letter of Acceptance

Mr. Karseno
Department of Agriculture Technology
Jenderal Soedirman University

Dear Mr. Karseno
It is pleasure to inform you that your paper entitled.

The Effect of Green Betel Leaf Extract, Mangosteen Rind Extract, and Lime Solution Addition as Natural Preservative on Coconut Sugar Quality

Paper ID: OFT-05, written by Karseno and Retno Setyawati has been accepted to be presented in **oral presentation** in the 1st International Conference on Biodiversity, Food Security and Health (ICBFSH 2016). The conference will be held in Yogyakarta, Indonesia on November 22-23, 2016. The committee would like to express our sincere welcome to you.

Further information will be sent by email, also please check our website (rce.ugm.ac.id/seminar) for update. If you have any question, please feel free to contact us. Thank you for your participation in this conference. We look forward to seeing you in the ICBFSH 2016.

Sincerely yours,

Dr. Lily Arsanti Lestari, STP., MP
Chairperson of ICBFSH 2016
email : icbfsh@ugm.ac.id

PROCEEDING

1st INTERNATIONAL CONFERENCE ON BIODIVERSITY, FOOD SECURITY AND HEALTH

22-23 November 2016
Gadjah Mada University, Yogyakarta

Editor:
Umar Santoso
Eni Harmayani
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Center for Food and Nutrition Studies
Gadjah Mada University

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Indonesia
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2017

PROCEEDING: 1ST INTERNATIONAL CONFERENCE ON BIODIVERSITY, FOOD SECURITY AND HEALTH 22–23 NOVEMBER 2016

EDITORS:
Umar Santoso – Professor of Food Science and Technology
Faculty of Agricultural Technology Gadjah Mada University/Center for Food and Nutrition Studies Gadjah Mada University
Eni Harmayani – Professor of Food Science and Technology
Faculty of Agricultural Technology Gadjah Mada University
Lily Arsanti Lestari – Doctor of Health and Medical Science
Faculty of Medicine Gadjah Mada University
Nurliyani – Professor of Animal Product Technology
Faculty of Animal Science Gadjah Mada University
Unnikrishnan Payyappallimana – Senior Researcher in Ethnobotany
ProSPER.Net United Nations University IAS
Gerard Christopher Bodeker – Professor in Traditional Medicine and Public Health
Global Initiative for Traditional Systems of Health, Oxford, UK, & Columbia University, New York, USA

Editing staff:
M. Prasetya Kurniawan, Puspita Mardika Sari, Zaki Utama,
Th. Tri Susanti Nugraheni, Kartika Wulan Sari, Ryan Salfarino

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Gringgo

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Jl. Teknika Utara, Barek, Sleman
Yogyakarta 55281
cfns@ugm.ac.id | www.cfns.ugm.ac.id

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PREFACE FROM ORGANIZING COMMITTEE

The 1st International Conference on Biodiversity, Food Security, and Health took place at the Grha Sabha Pramana and University Club Hotel, Gadjah Mada University from Tuesday to Wednesday, 22 to 23 November 2016, and was attended by approximately 125 participants coming from Indonesia, Malaysia, Vietnam, India, Nigeria, Philiphine, Thailand, as well as other countries. This conference was organized by Center for Food and Nutrition Studies in collaboration with Faculty of Agricultural Technology UGM. This conference was also in conjunction with the 10th Global Conference of Regional Centres of Expertise.

The conference was opened by Prof. Dr. Suratman, MS., Vice Rector for Research and Community Services UGM and Prof. Dr. Ir. Umar Santoso, M.Sc., the Head of Center for Food and Nutrition Studies UGM. The keynote speaker for this conference was Dr. Drs. Sugeng Priyanto, M.Si. from Ministry of Environment and Forestry Indonesia. The invited speakers of this conference were Prof. Gerard Christopher Bodeker from Global Initiative For Traditional Systems (GIFTS) of Health, Oxford, UK, Dr. Unnikrishnan Payyappallimana from UNU-IAS, Prof. Dr. Ir. Eni Harmayani, M.Sc. (UGM), Prof. Dr. Ir. Murdijati Gardjito, MS. (UGM), Prof. Mohammad Na'iem (UGM), Prof. Subagus Wahyuono (UGM), and Dr. Ir. Arman Wijanarko, M.Sc. from PT. Pagilaran (tea plantation and industry).

There were 85 oral presentation and 16 poster presentation which were divided into 4 sub-theme namely Agrobiodiversity and Agroforestry; Food Security and Safety; Food Technology; and Human Health and Nutrition. Several papers were included in this proceeding while others will be published in the Indonesian Food and Nutrition Progress Journal. The success of the 1st ICBFSH can be attributed to the efforts of the Steering Committee, chaired by Prof. Dr. Ir. Eni Harmayani, M.Sc.; the Organizing Committee, chaired by Dr. Lily Arsanti Lestari; and our sponsor Publisher and Publication Board UGM and PT Tiga Pilar Sejahtera. Hopefully this

proceeding can give more information of biodiversity to the academician, researcher, institution, and also to the community.

Chairperson of the Organizing Committee

Dr. Lily Arsanti Lestari

PREFACE FROM EDITOR

About three years past - in July 2014, the UN General Assembly's Open Working Group (OWG) on Sustainable Development Goals (SDGs) forwarded a proposal for the SDGs to the Assembly. The proposal contained 17 goals covering a broad range of sustainable development issues, one of the issue is **Life on Land**, *i.e.*, to protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt **biodiversity loss**.

Biodiversity is variety and variability of life on Earth. The number and variety of plants, animals and other organisms that exist is known as biodiversity. It is an essential component of nature and it ensures the survival of human by providing food, medicines, fuel, shelter, and other resources to mankind. If the biodiversity is lost then our life is threatened. Biodiversity's relevance to human health is becoming a global issue, as scientific evidence builds on the global health implications of biodiversity loss.

Biodiversity plays an important on the sustainable productivity of soils and provides the genetic resources for all crops, livestock, and marine species harvested for food, thus biodiversity directly influence on food security. By definition, **food security** is an existence *"when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life"* (WFS, 1996*)*. Food security is threatened by biodiversity loss because the production and availability of food depend on plant, animal and other organism life. Biodiversity and **health** are linked at many levels; the ecosystem, with food production as an ecosystem service; the species in the ecosystem and the genetic diversity within species. Nutritional composition between foods and among varieties/cultivars/breeds of the same food can differ significantly, affecting micronutrient availability in the diet. Healthy local diets, with adequate average levels of nutrients intake, requires maintenance of high biodiversity levels. Biodiversity provides critical support for drug discovery and the availability of medicinal resources.

Based on the importance of three keywords mentioned above, *Center for Food and Nutrition Studies (CFNS) UGM* in collaboration with *Faculty of Agricultural Technology UGM* held the ***1th International Conference on Biodiversity, Food Security and Health*** in 22-23 November 2016, this event was in conjunction with the *10th Global RCE Conference* held in Yogyakarta, Indonesia. The objectives are to improve awareness of the importance of biodiversity related to many aspects, and to contribute in making strategy to conserve biodiversity while improving food security and health, and to disseminate results of relevant research and development related with the topic of Conference.

This Proceeding contained papers and abstracts of papers that have been presented in oral or poster presentation in this Conference, but not all, some authors requested not to include their papers in the Proceeding for some rational reasons. There are 7 abstracts from the invited speakers and 35 original research papers in this Proceeding. The titles of the abstracts are **Traditional medicine and medicinal plant biodiversity** (by Prof. Gerard Bodeker), **Rehabilitation of degraded forest to support food and wood security program in Indonesia** (Prof. Mohammad Na'iem), **Searching bioctive compounds from Indonesia medicinal plants** (Prof Subagus Wahyuono), **Ethnobotany, Community Health & Nutrition - Policy-Practice Linkages** (Dr. Unnikrishnan Payyappallimana), **Traditional Food Conservation to Support Biodiversity and Sustainable Food and Nutrition Security** (Prof. Eni Harmayani), **Agrobiodiversity Concept, Its Relevance in Farmers Family Welfare** (Prof. Murdijati Gardjito), and **Biodiversity in Tropical Climate Tea Management System in Indonesia** (Dr. Arman Wijanarko).

The original research papers are divided into 4 sections, *i.e*, Section I : Agrobiodiversity and Agroforestry (AA), Section II : Food Security and Safety (FS), Section III: Food Technolgy (FT), and Section IV: Human Nutrition and Health (HN). In the Section I we can find papers related to agrobiodiversity or agroforestry aspects such as Conflicting or Combinative – Human and Natural Values at Kathotiya, Central India; Biodiversity Assesment of Mangrove in Pasuruan District, East Java; Traditional Red Rice Grain Characteristics Still Cultivated In Regencies of South Sulawesi, and so on. In the Section II we can read papers including Chemical, Biological Activity and Heavy Metal Content

of Sea Cucumbers from Karimunjawa and Lampung's Marine, Indonesia; Pathogenic Bacteria Contamination of Loin Bali Cattle That Slaughter at Modern and Traditional System; Promoting Sustainable Agriculture in Pekalongan, Indonesia: Coastal Farmers Choices; and so forth. Papers with aspect of food technology in the Section III included Exterior and Interior Egg Quality of Muscovy Duck (*Cairinamoschata*) Reared Traditionally in Yogyakarta; Copigmentation of Anthocyanin Extract of Java Prune (*Kopsiapruniformis*) Fruit with Quercetin to Increase the Colour Stability; Effect of Autoclaving-cooling Cycle on Resistant Starch Content and Functional Properties of Gayam(*Inocarfusfagifer* Forst.) Flour; Biofilm-forming Ability and Resistance to Disinfectants of Samples Collected from Seafood Processing Plants; and so on. Papers in the Section IV including Protective Effect of Tropical Fruit Juice on Histopathological Image of Rats Lung Exposed to Cigarette Smoke; Antioxidant Activity of the EthanolicExtracs of Peel and Flesh of *Coleus tuberosus;* and The Effectiveness of Various Salacca Vinegar as Therapeutic Agent for Management of Hyperglycemia and Dislipidemia on Diabetic Rats.

In conjuction with the Conference we held a round table discussion (RTD) that discuss a concept of strategy to conserve Biodiversity while improving food security and health especially in Indonesia; the conclusion of the RTD is in the last section of this Proceeding. We do hope that this Proceeding can be used as a scientific document and may have contribution to enrich the knowlegde and development of biodiversity especially that related with food securiy and health, and also may provide inspiration for further research in related topics.

Finally, the Editors would like to express deep gratitude to all invited speakers and contributors for their valuable contribution of papers and all participants of the Conference. Special thank is also expressed to all peer reviewers and editing staff for their hardwork that made this Proceeding could be realized.

May 2017

Umar Santoso - Chief Editor

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FT-03

THE EFFECT OF GREEN BETEL LEAF EXTRACT, MANGOSTEEN RIND EXTRACT, AND LIME SOLUTION ADDITION AS NATURAL PRESERVATIVE ON COCONUT SUGAR QUALITY

Karseno* and Retno Setyawati
Food Science and Technology Study Program, Department of Agricultural Technology, Jenderal Soedirman University, Purwokerto
E-mail: karsenounsoed@gmail.com*

Abstract

Coconut sap is raw material of coconut sugar that easily damage due to microbial activity. This damage can be prevented by using a natural preservative, called *laru*. *Laru* divided into two types, that are natural and synthetic *laru*. This research was using natural *laru* that made by mixture of green betel leaf extract, mangosteen rind extract, and lime solution. The aim of this research were to determine the percentage of mixture of green betel extract and mangosteen rind extract toward total natural *laru*, the amount of addition of natural *laru*, and the effect of the combination between the percentage of mixture of green betel leaf extract and mangosteen rind extract toward natural *laru* total by the amount of addition of natural *laru* which produce the best quality of coconut sugar. This research was used Completely Randomized Design Experimental that consist of 8 treatments combination with three times replications. The factor tested in this research were the precentage of mixture of green betel extract and mangosteen rind extract (1:1) toward total natural *laru* (v/v) that were 0; 10; 30; and 50%, and the amount of natural *laru* addition into ± 1 liter sap that were 5 and 10 ml. The observed variables were reducing sugar, water content, sucrose, texture, ash content, and total unsoluble solid. The combination of green betel extract and mangosteen rind extract toward total natural *laru* 30% with 5ml/liter addition of natural *laru* into sap resulted the best quality of coconut sugar. This coconut sugar has characteristics of reducing sugar is 4.09% db, total sucrose is 87.5% db, water content is 9.97% wb, texture is 0.12 mm.dt/g, total unsoluble solid is 1.16%, ash content is 2.65% db, brown in colour (score 2.73), sweet in taste (score 2.68), and overall preference was accepted (score 3.07), respectively and quality of the product was met to Indonesian Nasional Standard for coconut sugar.

Keywords: Coconut sugar, coconut sap, green betel, mangosteen rind, liquid natural preservation.

1. INTRODUCTION

Sap is liquid which comes out by cutting palm tree flowers such as arenga, coconut, borasus, and nipha. Coconut sap was easly fermented by microbial activity such as by *Saccharomyces cerevisae* that convert of sucrose to reducing sugars (Goutara and Wijandi, 1980 *in* Marsigit, 2005) and lead to decreased the quality of coconut sugar. To prevent the fermentation occurred, it can be done by adding a preservative (called *laru*), either synthetic or natural *laru*.

The synthetic *laru* that used by farmer (local term: *penderes*) is natrium metabisulfit ($Na_2S_2O_5$). In the other hand, natural *laru* that used by *penderes* usually is a mixture of lime solution with mangosteen rind or dried jackfruit wood bark. Other natural materials also have been used to improve the quality of coconut sugar. Marsigit (2005) reported that the castor bean and candlenut seeds can improve the quality of coconut sap and coconut sugar quality in Bengkulu. Yasni *et al*. (1997) reported that the kusambi bark juice can inhibit the sap damage. The other natural ingredients that can be used as preservative is green betel leaf. Asriningtias (2011) and Adisti (2012) reported on their research that green betel leaf that mixed with lime can be used as a natural preservative for coconut sap and able to produce good quality of coconut sugar.

The *penderes* generally use natural *laru* in liquid form. However, the production method, concentration, and the amount of natural *laru* addition has not been standardized, consequently the quality of coconut sugar was vary even from the same *penderes*. The mixture of green betel leaf extract and mangosteen rind with lime solution is an innovation to be used as a natural preservative coconut sap. The using percentage of natural *laru* of green betel extract and mangosteen rind extcract with lime solution has not been standardized. Therefore, research on natural *laru* formulation with mixing green betel extract and mangosteen rind extract with a lime solution toward the quality of coconut sugar is needed.

The purpose of this study were: 1) to determine the percentage of green betel leaf and mangosteen rind extract toward total natural *laru* that produce the best quality of coconut sugar, 2) to determine the amount addition of natural *laru* that produce the best coconut sugar, and 3) to determine the effect of combination treatment between the percentage of green betel

leaf and mangosteen rind extract toward total natural *laru* and the amount addition of natural *laru* that produce the best quality of coconut sugar.

2. MATERIAL AND METHODS

2.1. Materials

Coconut sap, mangosteen rind, jackfruit bark, and lime were purchased from local market in Banyumas regency. All chemical reagents were purchased from Sigma and Merck, except when stated in the text.

2.2. Preparation of *laru*

Mangosteen rind and green betel leaf were dried on cabinet dryer at 60ºC, subsequently crushed into small size and extracted with warm water, filtered to get a filtrate. Mangosteen peel extract and green betel leaf extract (1:1 v/v) then mixture with 10% lime solution in the concentration of 0, 10, 30, and 50%, then homogenized.

2.3. Production of coconut sugar

A 5 ml and 10 mL of *laru* concentration were put into container sap before taping. After 10-12 hour, the sap then collected, filtered and heated until it solidified. Solidified sugar then evaluated for physical, chemical and sensory characteristics.

2.4. Statistical analysis

Randomized Block Design method was used in this research. All physical and chemical parameters were conducted in triplicate. Data was analyzed with F test. Differences were considered significant at $p<0.05$, and if the data show significantly different, then continued with *Duncan's Multiple Range Test,* 5% level. Sensory parameter were analyzed with Friedman test, and if the data show significantly different, then continued with comparative double test, 5% level.

3. RESULTS AND DISCUSSION

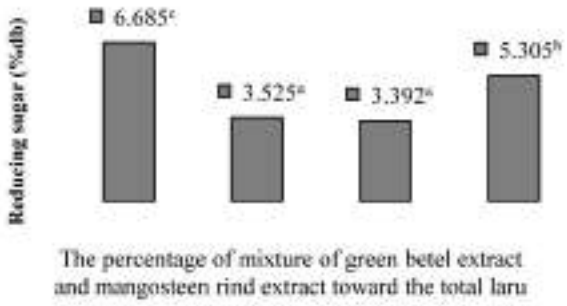
3.1. Reducing sugar

The average of reducing sugar in the effect of percentage of green betel leaf extract and mangosteen rind extract toward the total natural *laru* was

presented in Figure 1. The results showed that treatment of lime *laru* only has high reducing sugar. One of the factor that affect of reducing sugar in the coconut sugar is pH of sap. Data average of sap pH treated by 0, 10, 30 and 50%, were 5.33; 7.5; 7.33; and 5.5, respectively. The high of reducing sugar in the treatment 0% *laru* because of the low pH of coconut sap.

Sap that treated by lime only has a low pH, because lime only was not able to prevent microbial contamination, so the hydrolysis of sucrose was occured that produce sugar reducing and acids. During the hydrolysis of sucrose by yeast, it will produce ethanol and organic acids such as acetic acid, lactic acid, malic acid and tartaric acid and the pH sap was decrease (Safari, 1995).

Treatment of the amount of addition of natural *laru* 5 mL and 10 mL resulted in reducing sugar of coconut sugar which were 3.87 and 3.64%, respectively. The interaction treatment did not significantly affect of reducing sugar in the coconut sugar. This condition might occurred as the affect of pH of sap from each treatment were not significantly different.



Note: Figures followed by the same letter show no significant difference in DMRT 5%

Figure 1. The average of reducing sugar of coconut sugar in the variation concentration of green betel extract and mangosteen rind extract toward the total natural *laru*.

3.2. Water content

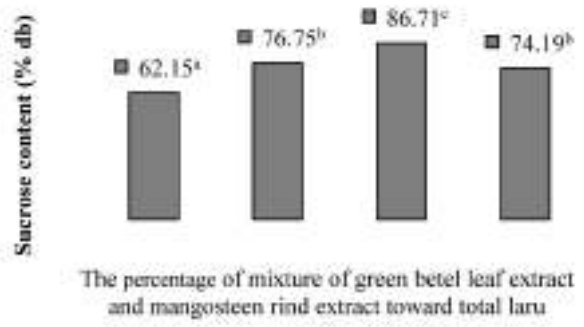
The results of variance analysis showed that the percentage of mixture of green betel leaf extract and mangosteen rind extract on the total natural *laru*, the amount of addition of natural *laru*, and the interaction of both treatment gave no significant effect on water content of coconut sugar. The percentage of mixture of green betel leaf extract and extract of mangosteen rind on the total natural *laru* that were 0, 10, 30, and 50% produced coconut

sugar with water content were 11.59; 12.07; 10.73; and 10.91%, respectively, while the variation of the amount of addition of natural *laru* 5 mL and 10 mL produced coconut sugar with water content were 11.27% and 11.38%.

Based on these data, there was a tendency of higher percentage of mixture of extracts on total *laru* and the number of addition of *laru* produce low of water content of coconut sugar. It was agreed when compared to the data of reducing sugar which was also lower. Reducing sugar affects the water content in coconut sugar because sugar reduction will absorb more water than sucrose. Kusnandar (2010) stated that the hygroscopic properties of a reducing sugar caused by the presence of polyhydroxy group capability of hydrogen bonds with water. The water content of palm sugar base on SNI is a maximum of 10%. From the data of the water content, coconut sugar that met to SNI was A3M1 only that is 9.97%.

3.3. Sucrose content

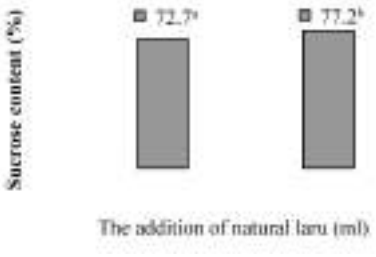
The results of variance analysis showed that the percentage of mixture of green betel extract and mangosteen rind extract toward the total natural *laru*, the amount of addition of natural *laru*, and the interaction of both treatment gave significant effect on sucrose level of coconut sugar. Sucrose level obtained from treatment of percentage mixture of green betel extract and extract of mangosteen rind toward the total natural *laru* are presented in Figure 2.



Note: Figures followed by the same letter show no significant difference in DMRT 5%

Figure 2. The average of sucrose content of coconut sugar in the percentage of green betel extract and mangosteen rind extract toward the total natural *laru*.

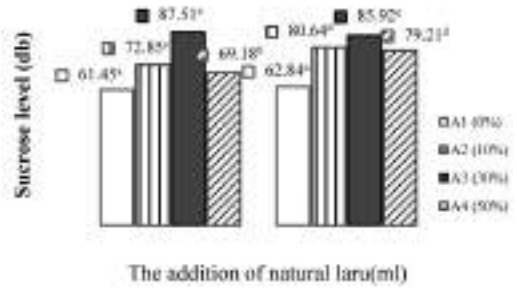
The results showed that the higher of percentage of mixture of green betel extract and extract of mangosteen rind of the total natural *laru* lead to the higher amount of the sucrose level. Sucrose levels associated with reducing sugar content and pH of sap. Higher of sucrose indicates that reducing sugar is low. Sucrose data at variation percentage of mixture of green betel extract and mangosteen rind extract toward the total natural *laru* is related with the pH and reducing sugar. The highest sucrose content of coconut sugar resulted by the treatment of the percentage mixture of green betel extract and extract of mangosteen rind toward total natural *laru* by 30%. Green betel leaf extract contains kavikol components as the main chemical component of essential oil of green betel leaf that responsible to the distinctive smell of the green betel and antibacterial, that is 5 times stronger than ordinary phenol (Heyne, 1987). According to Walker (2007) in Anastasia (2010), mangosteen rind contains xanthones which already proven used as an antioxidant, anti-inflammatory, antimalaria and antimicrobial. In the other hand, lime will release OH- ions that will bind to the H^+ ions in the sap, thus will reduce the number of H^+ ions that can affect the lower pH of sap, so that microbial growth can be inhibited. Sucrose level obtained from treatment of the amount of addition of natural *laru* was presented in Figure 3.



Note: Figures followed by the same letter show no significant difference in DMRT 5%

Figure 3. The sucrose level of coconut sugar in different amount of natural *laru* addition

The results showed that the more number of addition of natural *laru* in the sap, lead to the higher levels of sucrose. This is because the greater number of additions *laru* means more amount of lime, green betel extract and extract of mangosteen rind which acts as a preservative, so that the damage in sap can be prevented. The sucrose level of coconut sugar on the various interactions of treatment are presented in Figure 4.



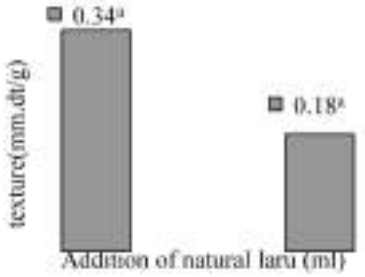
Note: Figures followed by the same letter show no significant difference in DMRT 5%

Figure 4. The sucrose level of coconut sugar at various interaction treatment.

The results showed that the precentage of mixture of green betel leaf extract and mangosteen rind extract with more amount of addition of natural *laru*, caused more increase levels of sucrose. This caused by more natural *laru* levels can inhibit the hydrolysis of sucrose in the sap. The treatments resulted high levels of sucrose in coconut sugar was the percentage of mixture of green betel leaf extract and mangosteen rind of the total natural *laru* by 30% with the addition of 5 mL/L.

3.4. Texture

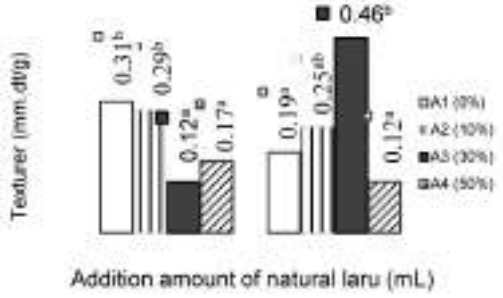
Results of variance analysis indicate that the treatment of percentage of mixture of green betel leaf extract and mangosteen rind extract on the total natural *laru* had no significant effect. While the treatment of amount addition of natural *laru* and the interaction of both treatment gave significant effect. Texture measurement of coconut sugar was done by using a penetrometer. The lower score of texture (mm.dtg) showed that the harder texture of coconut sugar. Scores texture of coconut sugar obtained from treatment of mixture percentage of green betel leaf extract and mangosteen rind extract to total *laru* natural from 0, 10, 30, and 50% were 0.25; 0.27; 0.38; and 0.14 (mm.dt/g), respectively. Texture of coconut sugar is associated with water content. The higher number of water content, so the texture would be not hard. Water content from each treatments was not significcantly different, so the the texture was not significantly different too. The average score of texture at variation of the amount of addition natural *laru* showed by Figure 5.



Note: Figures followed by the same letter show no significant difference in DMRT 5%

Figure 5. The average score of texture of coconut sugar at various amount of natural *laru* addition.

The results showed that coconut sugar with the addition of natural *laru* 10 mL/L sap tend to have a hard texture. This is because in *laru* addition as much 10 mL/L, lime solution and mixture of extracts percentage was also higher, so it can prevent sucrose hydrolysis come reducing sugar in sap. Lower level of reducing sugar causes lower hygroscopic characteristics of coconut sugar. So, the texture of sugar is harder (score of texture is low). Kusnandar (2010) stated that hygroscopic characteristic of reducing sugar caused by polyhidroxy group which able to make bond of hydrogen and water. The average score of coconut sugar texture at various treatment combinations showed by Figure 6.



Note: Figures followed by the same letter show no significant difference in DMRT 5%

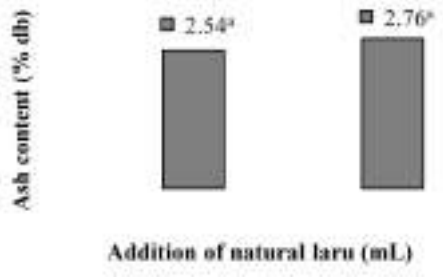
Figure 6. The average score of coconut sugar texture at various treatment combinations

The result showed that higher addition amount of natural *laru* and percentage of mixture of green betel leaf extract and mangosteen rind extract on total natural *laru*, the texture score of coconut sugar was decrease (harder). The higher addition amount of natural *laru* and percentage of green

betel leaf extract and mangosteen rind extract can help prevention of sucrose hydrolysis in sap, so the formation of reducing sugar can be prevented. The treatment that produce hard texture in coconut sugar is the percentage of mixture of green betel leaf and mangosteen rind extract on total natural *laru* by 30%, with amount addition 5 mL/L sap and percentage of mixture of green betel leaf extract and mangosteen rind extract on total natural *laru* by 50% with addition amount 10 mL/L of sap. Both treatment statistically was not significcantly different.

3.5. Ash content

The average score of ash content from treatment percentage of mixture of green betel leaf extract and mangosteen rind extract toward total natural *laru* 0, 10, 30, and 50% were 1.54; 1.61; 1.63; dan 1.82 %, respectively. Those score of ash content was unsignificantly different at each percentage, allegedly because the number of anorganic substances in natural *laru* is not different in each percentage. Ash is an inorganic substance waste products of combustion of an organic material (De Man, 1997). The average score of ash content at various addition amount of natural *laru* showed in Figure 7.

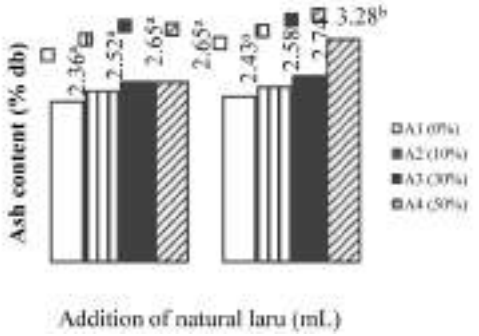


Note: Figures followed by the same letter show no significant difference in DMRT 5%

Figure 7. The ash content of coconut sugar at various addition amount of natural *laru*.

The results showed that the amount of addition of natural *laru* as much as 5 and 10 mL/L of sap was not gave significantly different levels of ash after a further test of DMRT at 5% level. However, the data showed that the addition of natural *laru* additon of 10 mL/L of sap had ash levels which tend to be higher than the number of addition of natural *laru* 5 mL/L of sap. This is because the more the addition of natural *laru* means the more amount of lime added to the sap. Lime is one type of macro mineral (inorganic)

(Kusnandar, 2010). The average score of ash content on a variety of coconut sugar interaction of treatment are presented in Figure 8.

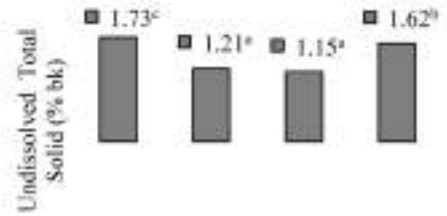


Note: Figures followed by the same letter show no significant difference in DMRT 5%
Figure 8. Ash content of coconut sugar at various interaction treatments.

Further test of DMRT 5% gave not significantly different of ash content. However, the data of research showed that more amount of variation of mixture of extracts toward total *laru* and the addition amount of natural *laru* tends to give increasing number of ash content. The highest ash content is coconut sugar that treated by 50% of mixture extracts toward total natural *laru* and the addition 10 mL/L of *laru* into sap. The higher amount of ash content is caused by more number of lime and extracts content, so the minerals content in sap is increasing too. Lime, green betel, and mangosteen rind containing minerals that can increase ash level in coconut sugar. Coconut sugar in this research has low ash content and belongs to conditions of SNI-01-3743-1995 that is maximally 2%.

3.6. Total undissolved solid

Result of variance analysis showed that the percentage mixture of green betel extract and mangosteen rind extract toward total natural *laru* was significantly different toward total undissolved solid. The average score of total not dissolved solid at treatments mixture precentage of 0, 10, 30, and 50% toward total natural *laru* are presented in Figure 9.



Note: Figures followed by the same letter show no significant difference in DMRT 5%

Figure 9. The mixture percentage of green betel extract and mangosteen rind extract

The result showed that the highest score of total undissolved solid is by percentage of extract 0% (*laru* only consist of lime). The high score of total undissolved solid at that treatment is might because just lime in that components which is lime is not dissolved material in water. Undissolved materials in coconut sugar also can be as wax, pectins, or chlorophyl which contain in sap (Firmansyah, 1992).

Treatment of addition amount of natural *laru* and interaction of both treatment was not significantly different in score of total undissolved solid. The average score of total undissolved solid in addition of 5 mL/L of sap and 10 mL/L of sap were 1.38 and 1.46 %db, respectively. While the average score of total not dissolved solid at treatments were 1.57; 1.88; 1.15; 1.26; 1.16; 1.13; 1.65 and 1.5 (%db). The score of total undissolved solid of coconut sugar in this research was high and were not belonged to SNI of palm sugar.

3.7. Colours

Result of Friedman test showed that the treatment combination of mixture percentage of green betel leaf extract and mangosteen rind extract toward total natural *laru* and addition amount of natural *laru* was significantly different (α = 5%) on color of coconut sugar. The average score of coconut sugar was about 2.2 – 3.44 which mean that it has brown – yellowish brown color. According to SNI-01-3743-1995, the color of coconut sugar are brownish yellow until brown. The obtained coconut sugar color at various treatment combination are presented in Figure 10.

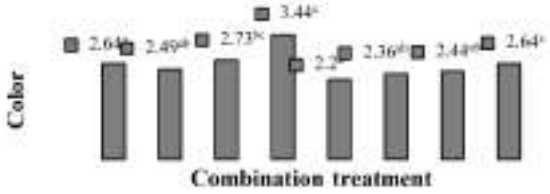


Figure 10. The color of coconut sugar at various treatment combination.

The result showed that there was an increasing of score at the increase of mixture percentage of extract and decreasing of addition amount of natural *laru*. The high score of color showed that more brownish-yellow, while the lower score of coconut sugar sign that the color is blackish-brown. The highest score of color is owned by A4M1 coconut sugar or coconut sugar with percentage of mixture of green betel extract and mangosteen rind extract toward total *laru* as much as 50%, with addition amount of natural *laru* 5 mL/L of sap. One of factor that influencing color of sugar is pH score. In treatment A4M1, pH of sap was 6 which indicates that were not belonged to high level of pH. If sap has too high of pH, so the color of coconut sugar would be blackish-brown. The high score of pH can be caused by excessive addition of lime, because lime is base material. According to Catrien *et al*. (2008), Maillard reaction occured better in base condition.

3.8. Bitter taste

Aroma and taste of coconut sugar is appear because of caramelization reaction. So that, the coconut sugar would be produce aroma and taste of caramel. Betel leaf has scent of aromatic and a little hot taste (Tampubolon, 1981). Chavicol as main chemical component at volatile oil is responsible scent and special taste of betel. While, the mangosteen rind contains high amount of tannin, so that it has astringent flavor. Giving natural *laru* of green betel and extract and mangosteen rind extract is feared to give astringent flavor in coconut sugar, which can cause the consumer does not like the sugar.

The result of Friedman test showed that the treatments combination of percentage mixture of green betel leaf extract and mangosteen rind extract toward total natural *laru* and addition amount of natural *laru* was not significcantly different toward the bitter taste in coconut sugar. Although the

adding of mixture precentage was high, this was not significantly different on bitter taste in coconut sugar. There are possibilty of compound of green betel extract and mangosteen rind extract which able to give bitter taste is already degradated by high temperature during coconut sugar processing.

3.9. Sweet taste

The result of *Friedman* test showed that the treatments combination of percentage mixture of green betel extract and mangosteen rind extract on total natural *laru* and addition amount of natural *laru* was not significantly different on the bitter taste in coconut sugar. The average score of sweet taste score was in range 2.6-3.2 (sweet-too sweet). Sweet score was tend to be high at coconut sugar with mixture percentage of green betel extract and mangosteen rind extract toward total natural *laru* are 0% with the addition amount of natural *laru* as much as 10 mL/L of sap. Poedjiadi (1994) *in* Adriani (2011) stated that fructose has sweeter taste than glucose, and also sweeter than sugar cane and sucrose.

3.10. Overall preference

The result of *Friedman* test showed that the combination treatment of mixture of green betel extract and mangosteen rind extract toward total natural *laru* and the addition amount of natural *laru* was significantly different (α 5%) on overall preference of coconut sugar. The average score of overall preference score of coconut sugar were in range 2.42 – 3.16 (acceptable). The overall preference score of coconut sugar at various treatment combination are presented in Figure 11.

The research result showed that the highest overall preference score is owned by A2 coconut sugar that is composed by mixture percentage of green betel and mangosteen rind toward total natural *laru* as much as 10%, with the addition amount of natural *laru* 10 ml/litre of sap and 50% with addition amount of natural *laru* 10 mL/L of sap. Both treatment statistically is not significantly different, so that the best treatment which more effective and efficient to produce coconut sugar with highest overall preference is A2M2. The high overall preference level of panelist is suitable with sensory characteristics, that are the color is yellowish-brown, no bitter taste, and high sweet taste level.

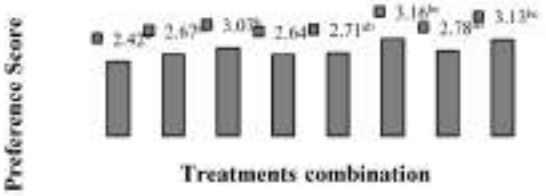


Figure 11. Overall preference score of coconut sugar at various treatment combinations.

The mixture of green betel extract and mangosteen rind extract with lime solution was an inovation of natural *laru* of coconut sap. The percentage and amount of addition of natural *laru* that has been equated is expected to give information to *penderes* for producing coconut sugar with better quality and appropriate according to SNI 01-3743-1995. Factor that had observed in the research were the percentage of mixture of green betel extract and mangosteen rind extract (1:1) on total natural *laru* (v/v) that were 10; 30; and 50%; and the addition amount of natural *laru* into ±1L of sap that were 5 mL and 10 mL. The treatments combination of mixture percentage of green betel extract and mangosteen rind extract on total natural *laru* with the addition amount of natural *laru*, which has been produced the best coconut sugar was 30% with 5 mL/L of sap. That sugar compared to standard of SNI 01-3743-1995. The comparison of characteristics of coconut sugar with SNI 01-3743-1995 are presented in Table 1.

Sucrose is main component of coconut sugar which it amount is expected high. Sucrose give sheet taste and help to form crystal in coconut sugar, so the sugar can be solidified. Sucrose content in A3M1 coconut sugar was quitely high and belongs to SNI 01-3743-1995, because there is possibility that the origin sap of A3M1 has not hydrolized too much. This case is supported by the data of pH of A3M1 sap, that is 6.67 and low reducing sugar level. That pH score still fill the condition of sap processing into coconut sugar. Muchtadi *et al* (2010) stated that sap that used to make coconut sugar has pH 5.5-7.0. The reducing sugar in A3M1 coconut sugar is associated with pH score. The pH of A3M1 coconut sugar is 6.67 that is belongs to good score. The addition of natural *laru* of mixture of green betel extract and mangosteen rind extract can defend the pH, so the early pH of sap was not too low.

Table 1. The comparison of characteristics of coconut sugar with SNI 01-3743-1995

Composition	A3M1	SNI
Sucrose (%wb)	86.29	Min. 77
Reducing sugar (%wb)	3.09	Max. 10
Water content (% wb)	9.97	Max. 10
Texture (mm dt/g)	0.12	Normal
Undissolved total solid	1.12	Max. 1
Ash content (%bb)	1.64	Max. 2
Sweet taste	Sweet	Normal, specific
Colour	Brown	Yellow until brownish

Water content is associated with texture and reducing sugar. The high amount of reducing sugar causes high amount of water content. It can be happened because the reducing sugar absorp more water in sucrose (Kusnandar, 2010). So that, in A3M1 it has low reducing sugar, and followed by the water content that low too. The water content of A3M1 is belong to criteria of SNI 01-3743-1995. The low water content of A3M1 make hard texture of A3M1, that is 0.12 mm.dt/g.

Ash content of A3M1 coconut sugar already fullfill the criteria of SNI, this happened because the natural *laru* used in liquid form, so it can reduce the ash content. Liquid natural *laru* are alleged easily mixed with sap so it will not make sediment of *laru*. Sweet taste of coconut sugar formed because of sucrose, glucose, and fructose. The coconut sugar has specific taste and aroma which influenced by organic acids in coconut sap (Sardjono, 1989 *in* Firmansyah, 1992). Colour of A3M1 coconut sugar is brown. The color of sugar is formed because of Maillard reaction. Maillard reaction is non enzymatic browning which happened because reaction of reducing sugar and free amine from amino acids or protein. According Meynier *et al*. (1995) in Ho *et al*. (2008), colour and aroma of food are influenced by pH. Mailard reaction is more intensive in base condition and high temperature (Catrien *et al*., 2008).

4. CONCLUSIONS

The percentage of mixture of green betel extract and mangosteen rind extract on total natural *laru* which produced the best quality of coconut sugar was 30%. The addition amount of natural *laru* into ±1L of sap which

produced the best quality of coconut sugar was 5 mL/L of sap. The treatment combination of mixture of green betel extract and mangosteen rind extract on total natural *laru* with addition amount of natural *laru* which produce the best quality of coconut sugar was 30% with 5 mL/L of sap. The coconut sugar had characteristics reducing sugar of 4.09% db, sucrose content of 87.50% db, water content of 9.97% wb, texture of 0.12 mm.dt/g , total undissolved solid of 1.16%, ash content of 2.65% db, colour score of 2.73 (brown), sweet score 2.68 (sweet), bitter taste score of 3.42 (slighlty bitter), and overall preference score of 3.07 (like).

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