The concentration of sago flour to taro-mung bean composite flour on the quality of non-gluten biscuits

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Wellcome to The ICGAB 2020 on 25 August 2020 in Malang, Indonesia

About the Conference

Global industrial expansion to foster economic growth entails severe damaging impacts on the environment, commonly derived from multiple sources including natural resource exploitation, fossil fuel use, greenhouse gas emissions, and deforestation. Thus, developing a resource efficient, climate-friendly technology, and low carbon economy have risen as the worldwide's demands and ambitions by 2050. With the estimation of the current global bioeconomy market worth at US$2.7 trillion, and a growing population of 2-3 billion people in the next 40 years accounted for increasing global food demand by 70%, green agro-industry is expected to play a substantial role. The creation of bioeconomy through the expansion of green agro-industry thus can create sustainable jobs/industries contributed to overall economic growth for sustainable development, whilst maintaining natural resourses/biodiversity, mitigating climate change, and increasing opportunities in the agricultural sectors.

Indonesia, as a major supplier of several agricultural products worldwide, is also globally known as one of the main agroindustry countries. With a rapidly growing interest on green agro-industry and potential optimisation for food security and bio-based products with green supply chain and eco-standardisation, it is important to accelerate the innovation and adoption of more sustainable and renewable resources/biomass, bioenergy, process, and technology, with fewer environmental impacts, less amounts of waste and carbon footprint. Yet, the transition toward a global and circular bioeconomy through green agro-industry is far more than the complex of the progression and innovations in research and technology, technical performances, sustainable biomass procurement and valorisation, policy-making, societal and multidisplinary rethinking process. A call for disemminating knowledge, sharing of the success stories, and encouraging international collaboration of interdisciplinary stakeholders, is therefore essential to foster competitive green agro-industrial development and tackle associated challenges in the developing world.

This conference is intended to inform and communicate to wider stakeholders aiming to increase awareness on the sustainable development in the circular bioeconomy context. This event will also provide a platform where local and international academia or researchers, policy makers, industry leaders, and other stakeholders to translate technology, exchange ideas, provide feedbacks, and help in developing guidelines for shaping a worldwide green economy.

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Emerging Technology and Integrated Information System for Sustainable Agroindustry

In the digitalisation era, nessities such as technology, innovation and information system are becoming critical for shifting agroindustries from conventional practices to be more sustainable. Furthermore, creation of bioeconomy has hugely highlighted and demanded in the global world. thefore Indonesia needs to strive and adapt by harnessing the emerging technology as well as integrated information system to address the chalanges of IoT as well as environmental problems in agroindustry. Such approaches may create opportunities forexpand sustainable agroindustry as well as to achieve sustainable development.

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This conference is aimed to communicate and disseminate research experiences, technology innovation, research and technology advances, as well as case studies related to sustainable agroindustry. This event provides a scientific platform enabling both local and international academia, researchers, policymakers, industry leaders, professionals, and other stakeholders to build networks, share ideas, and create research collaboration. ICGAB 2020 is hopefully offering all participants to engage with the practices and/or implementation of advance technology and information system to further develop green economy in Indonesia through creation of sustainable agroindustry.

Since 2017, ICGAB has been successfully attracting more than 300 participants from different countries. This year we are proudly inviting participants to attend and participate in the 4th ICGAB on 25 August 2020 at Online System. ICGAB 2020 is organised by Faculty of Agricultural Technology, Universitas Brawijaya in collaboration with MSAE (Malaysian Society of Agriculture and Food Engineers) and AUCFA (ASEAN Universities Consortium on Food and Agro-based Engineering & Technology).

We are also partnered with IOP Publisher to publish selected manuscripts in the IOP Conference Series: Earth and Environmental Science. Non-selected papers will be published in our electronic ICGAB proceeding with registered ISBN or recommended to be published in our International Journal "Advances in Food Science, Sustainable Agriculture and Agroindustrial Engineering (AFSSAAE)'.

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Please note that due the Covid-19 pandemic issue all over the world, ICGAB 2020 will be held as an **ONLINE CONFERENCE (REMOTE PRESENTATION) THROUGH VIDEO MEETING**

Detailed information regarding the online conference implementation will be informed further.

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IMPORTANT DATES

Name	Date	Deadline Extension
Abstract Submission	1 May 2020	14 July 2020
Abstract Acceptance	4 July 2020	16 July 2020
Manuscript (Full paper)	5 July 2020	10 August 2020
Registration Deadline		**15 August 2020**
Conference Day	**25 August 2020**	

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The conference invites contributions on the following topics but not limited to:

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The concentration of sago flour to taro-mung bean composite flour on the quality of non-gluten biscuits

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Abstract. The utilization of local raw materials, such as taro, avoids the gluten content usually found in wheat flour and creates innovation in the product development of biscuits. Taro has low protein content, thus requires the addition of other ingredients to meet the quality of the biscuits. The material used as a source of protein is mung bean flour. Besides, sago flour was used to improve the texture for being softer and crisp. The addition of sago flour also functions as an adhesive to replace the gluten found in wheat flour. This study aimed to determine the concentration of sago flour in biscuits of taro-mung bean composite flour that meet the quality standards of biscuits. The concentration of sago flour to taro-mung bean composite flour consists of four levels (0%, 20%, 40%, and 60%). The results showed that the selected treatment was the concentration of sago flour of 60%, with a total expected value of 6.10. Characteristics of the selected product include water content of 1.78%, carbohydrates of 63.55%, protein of 3.15%, fat of 29.86%, ash of 1.61%, the acceptance level of taste of 73.3%, color of 96.7%, and aroma of 90.0%.

1. Introduction

Non-gluten biscuits are a necessity for people who have celiac diseases or those who have a gluten intolerance. Innovation in developing non-gluten biscuits can be done by utilizing local resources, including taro, mung beans, and sago. Taro tubers could also be used for making chips and flour. In the form of flour, taro can be more flexible in its processing and better shelf life. Likewise, while sago on the market, green beans are already in the form of flour that is ready to use [1, 2].

Research conducted by Puspitasari et al. [3] showed that composite flour with cowpea based on selected formulations could be processed into biscuits. Taro flour is prepared from taro, which is treated to reduce the itching that usually arises due to oxalate content. Research conducted previously by Nurani and Yuwono [4] has used *kimpul* flour as a raw material for cookies.

The addition of mung bean flour can increase the low protein content in taro flour. In addition to giving bioactive peptides and essential amino acids source, pulse proteins have functional properties, for instance, fat binding, water retention, foaming, and gelation, which increase their conceivable use in a large collection of food things [5]. For these reasons, legumes are ideal supplements for cereals in vegetarian diets with increased attention and concentration as functional ingredients. Among legumes, mung bean (*Vigna radiata L. Wilczek*) is a magnificent source of 23.25% protein [6]. It is one of the protein source plants of the least expensive and most productive [7]. Moreover, mung beans are rich in essential fatty acids, antioxidants, and minerals [8–10].

Adding sago flour will improve the texture and crispness of the resulting biscuits. The replacement of wheat flour with sago starch in the traditional formulation of cookies has been considered. It is reported that sago flour could submerge wheat flour to a degree of 40 percent in creating treats that discover great shopper acknowledgment in Southern Thailand. Nonetheless, purchaser acknowledgment of treats declined significantly when sago starch in the treat definition expanded past 40%, inferable from helpless appearance and a crumbly texture [11]. Sago can also be used as a raw material for the food industry. It can, among others, be processed into foods such as bagel (traditional cake), pearl sago, dry cakes, noodles, biscuits, crackers, *laksa* (fine noodles similar to vermicelli), and bio-ethanol [12]. This research aimed to determine the concentration of sago flour in biscuits of taro-mung bean composite flour.

2. Methods

This examination utilized a Randomized Block Design (RBD) with a single factor, namely the concentration of sago flour to taro-mung bean composite flour with four levels, and repeated three times. In a preliminary study, the fraction of taro flour and mung bean flour used as initial composite flour was 50:50. Then, in the real experiment, sago flour according to treatment with a percentage: 0%; 20%; 40%; and 60% were added.

2.1. Observation parameters

Chemical parameters tested were water content, carbohydrate content, ash content, protein content, and fat content. The organoleptic parameters tested were taste, color, and aroma.

2.2. Data analysis

The analysis of variance does chemical test data processing. In the event that there is a distinction, the Duncan test was done with a 95% confidence level, and organoleptic analyzed using the Friedman Test method.

2.3. Alternative selection

To determine the best treatment for the concentration of sago flour in taro-mung bean composite flour for biscuits in different formulations, an alternative selection was made. The definition of expected value is to choose a choice that has the greatest pay-off or least expense. For biscuit products, the parameters tested were water content, ash content, protein content, fat content, and taste, color, and aroma. The selection of alternatives was made in order to choose the greatest treatment from several present treatments. Decision making is a method of choosing the greatest treatment systematically. Determination of the importance of each factor carried out by the Analytical Hierarchy Process (AHP) test. Based on the Expectation Value method, as for defining the option of the greatest treatment.

3. Results

3.1. Chemical content

The results of the variance analysis presented that the percentage of sago flour to taro-mung bean composite flour was significantly different in water content, carbohydrate content, protein content, fat content, and ash content. Table 1 shows that the biscuit's water content with various sago flour addition was significantly different. The more proportion of sago flour that was added, the water content of biscuits will decrease. Water content is related to protein content; the more protein the more water content, and vice versa. In this study, the more sago flour was added, the less protein content.

The higher the extent of added sago flour, the carbohydrate content increases. The sago flour carbohydrate content has a higher amount than the composite of taro-mung bean flour. Sago flour has a carbohydrate content of 84.7%, while mung bean flour has a carbohydrate content of 72.86%, and taro

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flour has a carbohydrate of 71.56%. The statistical analysis result showed that there is a real association between treatments of carbohydrate content created. The more significant level of starch and the expansion in sago flour focuses are suspected on the grounds that sago flour contains higher sugar levels than sugar content in the composite flour of mung beans. As indicated by Baka et al. [12], sago contains a starch substance of 87.55%. The calculation of carbohydrate content in taro-mung bean-sago composite biscuits was finished by the distinction technique.

Table 1. Analysis of variance results chemical content of biscuits.

Treatment (% sago flour)	Water Content (%)	Carbohydrate Content (%)	Protein Content (%)	Fat Content (%)	Ash Content (%)
0	3.07 ± 0.04 d	58.27 ± 0.14 c	7.20 ± 0.02 a	29.10 ± 0.02 d	2.53 ± 0.05 d
20	2.61 ± 0.02 c	60.07 ± 0.07 b	5.62 ± 0.04 b	29.59 ± 0.03 c	2.23 ± 0.04 c
40	2.17 ± 0.03 b	60.17 ± 0.05 b	4.59 ± 0.05 c	29.86 ± 0.03 b	2.92 ± 0.03 b
60	1.78 ± 0.04 a	63.55 ± 0.11 a	3.15 ± 0.03 d	31.28 ± 0.03 a	1.61 ± 0.02 a

The greater quantity of added sago flour, the protein content decreases. The protein substance of sago flour has a lower amount compared to the composite of taro-mung bean flour. Sago flour has a protein content of 0.7%, while mung bean flour has a protein content of 19.09%, and taro flour has a protein of 6.43%. The higher the fraction of added sago flour resulted in a decrease of the protein level. These were supported by Tidore et al. [13], which shows the more starch flour is added, the lower the protein content. When the test is done, the greater the amount of sago flour added, the lower the amount of composite flour containing mung bean flour with high protein content, such that the protein content diminished. These were upheld by the finding of Man *et al.* [14]. The taro-mung bean-sago biscuits protein content is still below the Indonesian national standard (SNI) needed for biscuits (SNI 01-2973-1992), which contains at least 9% protein content.

The greater the percentage of added sago flour, the greater the fat substance increment. Fat assumes a critical function in the shelf life of food. Such moderately high-fat substances could be unwanted in heated food items since fat can advance rancidity in food, prompting the improvement of a horrendous and putrid compound. Fat is an energy source for biscuits [15]. This high-fat content was contributed by egg yolk as one of the biscuits' essential ingredients. The statistical analysis result indicated that there were substantial differences among treatments. The real difference was thought to be due to the difference in the percentage of sago flour added, which affects the fat substance difference. The greater the percentage of sago flour, the less proportion of taro-mung bean flour, the higher the fat substance of biscuits. These are supported by research results [16]. Mung beans have lesser oil content than wheat, which added to the diminishing fat substance of the cookies.

The more prominent the extent of added sago flour, the ash level decreases. Increasing the percentage of sago flour certainly reduces the proportion of mung beans, indicating a decrease in ash content. These upheld by the aftereffects of examination by Tidore et al. [13] shows that more starch flour was added, the ash content decreases as well as a decrease in ash content if the proportion of green beans decreases in the study [16]. There was thought to be caused by the addition of different levels of ash in the constituent materials. According to Puspitasari *et al.* [3], the composite ash powder of cowpea flour of 4.18%, and the ash substance of sago flour of 0.6%, so that with the expanding extent of sago flour, the subsequent ash substance of biscuits tends to be lower.

3.2. Organoleptic parameters

The score of aroma, color, and taste of biscuits shown in Figure 1. The highest total score of taste parameters obtained by treatment sago flour 0%, 20%, and 40%. According to Winarno [17], taste is determined by taste and mouth stimulation. The texture and consistency of the material will also affect the taste caused by the content.

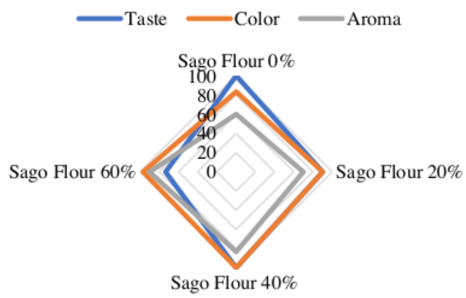

Figure 1. Result score of aroma, color, and taste of biscuits.

In the sago flour 60% treatment, there is the lowest score; this is possible because too much sago flour can make the texture of the biscuits more easily destroyed so that the panelists are less favored. The best score of the highest color parameter obtained by sago flour 40% treatment was 100%, while the lowest total score obtained by sago flour 0% treatment was 83.3. In the treatment of sago flour 0%, sago flour 20%, and sago flour 40%, the more the percentage of sago flour, the color of the biscuit will be more preferred. That was because the panelists liked the bright color of the biscuits. The more percentage of sago flour added, the more attractive the biscuit's color. The color of the biscuit is getting brighter due to the decreasing proportion of the composite of taro-mung bean flour, which can give the biscuit a dark color. In the treatment of sago flour 60%, the best score (3,4,5) from sago flour 40% decreased by 96.7%. It suspected that some panelists did not like the color of the biscuits that were too bright.

The best score of the highest aroma parameter obtained by sago flour 60% treatment was 90%, while the lowest best total score was obtained by sago flour 0% treatment by 60%. It suggests that the more the percentage of sago flour is added, the more biscuit aroma is preferred. That was presumably because of the more the percentage of sago flour, the unpleasant aroma of taro-mung bean composite flour.

3.3. Alternative selection

AHP is a decision making procedure for multi measures problems. The multi-criteria problem in AHP is easy in the form of a hierarchy containing three core components: decision-making goals, criteria of assessment, and valuation alternatives. The priority scale of each parameter is shown in Figure 2. A priority scale is used to determine the best alternative treatment.

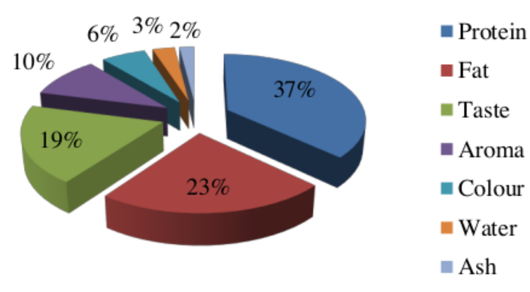

Figure 2. Priority scale of each parameter.

The best alternative is the treatment that has the highest expectation score. The results of the expected score for each treatment shown in the histogram presented in Figure 3. The highest expectation score founded in the treatment of sago flour of 60% with an expected score of 6.10.

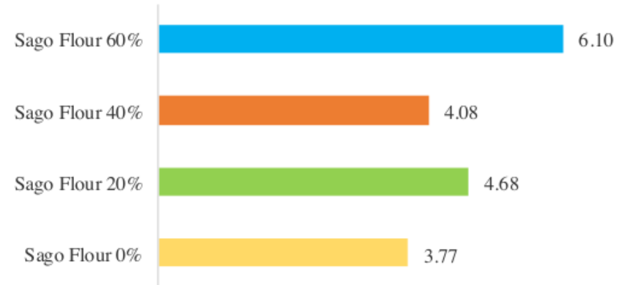

Figure 3. Total expectation value of biscuits.

4. Conclusions

Based on the study conducted, it determined that the treatment of concentration sago flour 60% is selected treatment with a total score of 6.10. Moisture content of 1.78% ± 0.04, carbohydrate content of 63.55% ± 0.11, protein content of 3.15% ± 0.03, fat content of 29.86% ± 0.03, ash content of 1.61% ± 0.02, taste level of 73.3%, color of 96.7%, and aroma of 90.0%.

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