

Characteristics of Nata De Taro from “Beneng” Taro Starch Waste with Addition of Various Types of Carbon and Isolated Soy Protein

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Abstract

The research aims to characterize nata of “Beneng” taro starch waste with addition of various types of carbon and several concentration of Isolated Soy Protein (ISP). The experimental design used was a complete randomized group design with ISP concentrations of 1%, 1.5%, and 2%. “Beneng” taro waste was heated, added with 2% vinegar, then treated with a carbon source of sucrose and glucose 5% and a nitrogen source from the ISP at concentrations of 1%, 1.5%, and 2% and fermented for 13 days. The results showed the combination of glucose with 1% ISP gave the best results and yield of 44.28%, 0.984 cm of thickness was not significantly different from the addition of ZA with a yield of 43.77%, thickness of 1.016 cm. Nata fiber content tends to be higher in the treatment with ZA addition compared to ISP, although it is not significantly different. The value of the white level is getting higher or the nata become brighter in the glucose treatment with ISP and significantly different from other treatments. The addition of ISP has the potential as an alternative for substitution of ZA and tends to increase the brightness of nata color.

Keywords: “Beneng” taro, fermentation, isolated soy protein, nata

INTRODUCTION

“Beneng” Taro has The Latin name of *Xanthosoma undipes K. Koch*, a local commodity in Pandeglang, Banten, which grows wild and has not been widely utilized. At the age of 2 years, this taro root weighs up to 30 kg, has 1.2 - 1.5 m in length, an outer diameter of 50 cm and turns yellow as its distinctive color, thus the local people give it name “Beneng” (besar (big) and koneng (yellow)). “Beneng” taro is a plant that lives in the forest area of Mount Karang Pandeglang and is often considered a wild plant. Its oxalate content is relatively high which can cause itching in the throat after it is consumed. Research conducted by Muttakin, Muharfiza, & Lestari (2015) revealed that the oxalate content of “Beneng” taro can be reduced by soaking in salt-water.

Utilization of “Beneng” taro that has been reported; it can be processed into “Beneng” taro flour, wet noodles (Lestari & Susilawati, 2015), and chips with various flavors (Mulyati & Nuraeni, 2016). The community around Mount

Karang, Pandeglang is currently developing “Beneng” taro in the form of flour and starch. “Beneng” taro starch processing will produce brownish-yellow waste as the result of the starch deposition process. This waste is not dangerous and generally is directly disposed. Research that has been done previously proved that “Beneng” taro flour contains 82.56% carbohydrates, 3.4% protein, 0.28% fat, 4.85% ash content, and 10.46% water content while for starch contains respectively 89.27%, 0.22%, 0.13%, 0.38% and 13.79% for each component (Rostianti et al., 2018). The “Beneng” taro waste is potential to be used as raw material for nata, which is named nata de taro.

Nata is a floating gel-like food. Nata is made through fermentation using *Acetobacter xylinum*, which requires sources of nutrients such as carbon and nitrogen. The nutrients produced by taro are needed for the development of *Acetobacter xylinum* but it needs additional nutrients to support its growth. Sucrose, glucose and fructose are used as a source of carbon. In the research of Hamad et al. (2011) showed that nata de coco

with the largest yield is produced by using fructose variant of carbon sources. Additionally, by using a carbon source of sucrose variant with a concentration of 5% in nata from yam juice also produced the highest yield (Wardhana, Rusmarilin, & Yusraini, 2016).

Nitrogen can be obtained from amino acids, proteins, ZA, and urea. Most of the nata producers still use ZA and urea as their nitrogen source due to its low price, but the addition of ZA and urea fertilizer raises concern in the community because of the possibility of migration of dangerous substances into the nata. Alternative natural sources of nitrogen are needed from safer materials, one of them is Isolated Soy Protein (ISP). ISP is a free or low-fat product of soy-based flour with a minimum of 90% of its protein content in a dry weight basis (Weingärtner & Owen, 2009). This protein condition is expected to be a source of nitrogen in nata production process.

The characterization of nata de taro produced by different carbon and nitrogen sources become the basis of the objectives of this study. The carbon sources are from sucrose, glucose and nitrogen sources from ISP 1.0%, 1.5%, and 2.0% as variables.

METHODS

One-year-old "Beneng" Taro used in this study was obtained in Juhut, one of the regions in Pandeglang Regency. *Acetobacter xylinum* as a starter was isolated grown by nata de coco producer in Rangkas Bitung. The treatment using carbon source was derived from glucose, sucrose, fructose, acetic acid, ZA, isolated soy protein and distilled water. Equipment used were scales, measuring cups, blenders, knives, pans, stoves, newsprint, volumetric pipettes, stirrers, back coolers, erlemeyer, filter paper, porcelain cups, desiccators, calipers, and fermentation trays.

Initial treatment was the sortation of 1 kg of "Beneng" taro, peeling and washing were carried out on selected taro. The next process was done by cutting the size of taro, grinding, adding 1 liter of water and settling for 24 hours to obtain starch. Starch sediment-water was separated as material for the nata de taro preparation process. The raw material for starch sediment-water was heated at 100 °C, treated with different C sources of sucrose and glucose, 5% each, added with acetic acid 2%, and treated with different N source from soy protein isolates with different concentrations of

1%, 1.5%, and 2% and ZA as much as 1%. Then the media were chilled to 25 °C and added with nata starter of *A. Xylinum*. The container was closed so as it will not be contaminated by other bacteria and incubated for 13 days at room temperature. The research was conducted at the Laboratory of Agricultural Product Technology Mathla'ul Anwar Banten, and testing at the IPB Food Analysis Services Laboratory and the Laboratory of Testing IPB's Department of Agro-industrial Technology.

The parameters analyzed in this study were yield, thickness, crude fiber content, and level of white color. The yield calculation used the scales by calculating the initial weights of all materials used for making nata de taro and the final weights produced. Thickness was measured using calipers at five different measurement points, white level using chromameter and crude fiber analysis by the AOAC method (1984). ANOVA SPSS 16.0 was used for statistical data followed by 95% confidence intervals using the Duncan test.

RESULTS AND DISCUSSION

Nata Yield

The yield of nata de taro in this study was 28.63% - 44.28%. The addition of ISP 1% combined with glucose had the highest yield value of 44.28% then followed by a combination of Glucose + ZA 1% by 43.77%, and sucrose + ZA 1% by 42.86%. Glucose has the potential to be used as a substitute for sucrose. Research conducted by Hamad et al. (2011) reported that nata de coco from glucose tends to have a higher yield compared to sucrose.

The yield of the treatment with combination of sucrose and ISP tends to get higher in line with the increase in the concentration of the ISP, whereas the one with combination of glucose and the ISP decreases even when the concentration of the ISP is increased, however, the overall treatment is not significantly different (Figure 1). Glucose helps the process of cellulose formation through the polymerization stage so it produced the formation of cellulose thickness as in sucrose (Melliawati, 2003). In the treatment using the type of carbon sucrose and the glucose produced the same yields.

ISP is one source of nitrogen with a minimum nitrogen content of 90% of dry substance. Nitrogen content produces strong cellulose bonds (Safitri, Caronge, & Kadirman, 2017). However, excessive use of nitrogen in the same substrate

and the addition of sugar with the same concentration can cause a nutrient imbalance in the medium (Rossi, Pato, & Damanik, 2008). The increase of concentration of nitrogen is not followed by an increase of concentration of other substances, so the use of ISP as a source of nitrogen likely affected a lot of nitrogen that is not utilized. This may cause an increase in the concentration of ISP in the treatment of glucose tends to reduce the yield further.

Thickness

In line with the yield, nata tends to be thicker in the treatment with ZA addition. The treatment of sucrose + ZA 1% produced a maximum thickness of nata of 1.016 cm. Jagannath et al., (2008) stated sucrose is one of the optimal carbon sources used for nata production. His research

with 10% sucrose and pH 4 on nata de coco also produced a maximum thickness (Figure 2).

The overall treatment was not significantly different. The combination of sucrose + ISP tends to increase in thickness due to the increase of ISP concentration. Contrarily, it experiences a decrease in its thickness when glucose was added. Research by Fifendy, Putri, & Maria (2011) reported that the addition of nitrogen from bean sprouts is able to increase the thickness of nata de coco, but the difference in nitrogen concentration from sprouts extract have an insignificant effect. Furthermore, Nisa et al. (2001) also stated in her research that nata of tofu factory waste which is rich in protein added sucrose also had a positive effect on the thickness of nata de soya. Glucose + ISP 1% treatment produces thick nata that is equal to 0.956 cm. Moreover, nata has thickness between 0.9 and 1.5 cm in general.

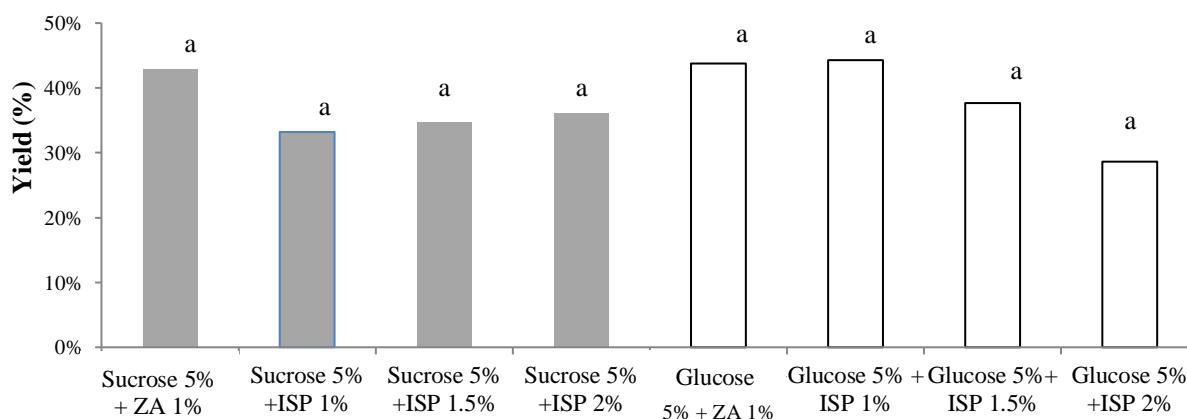


Figure 1. The yield of nata of treatment with carbon and ISP addition
The difference between letters shows a significant difference at $p < 0.05$

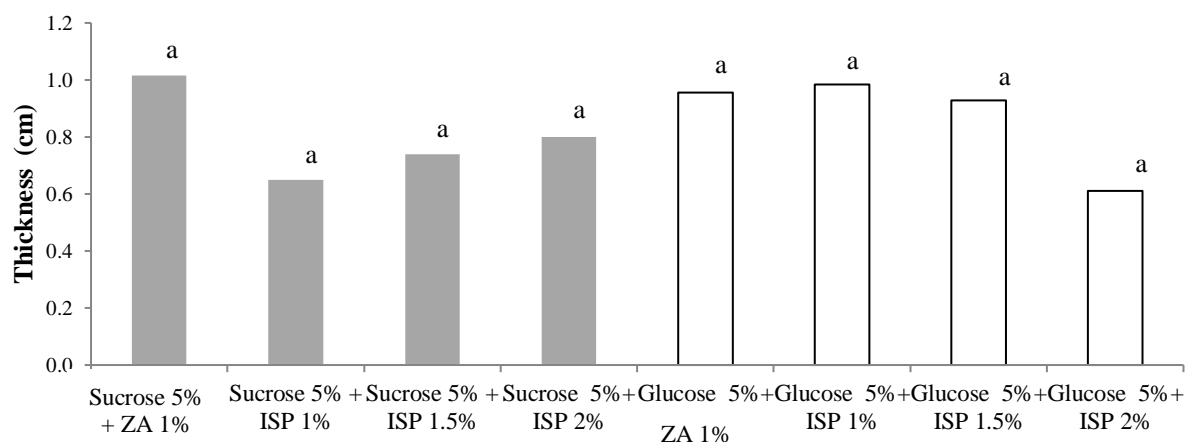


Figure 2. The thickness of treatment with carbon and ISP addition
The difference between letters shows a significant difference at $p < 0.05$

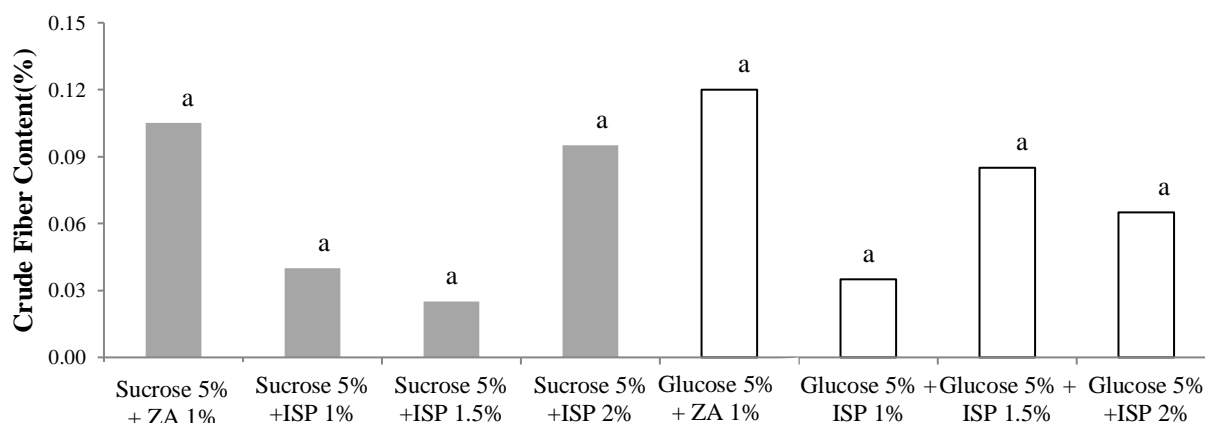


Figure 3. The fiber content of treatment with carbon and ISP addition
The difference between letters shows a significant difference at $p < 0.05$

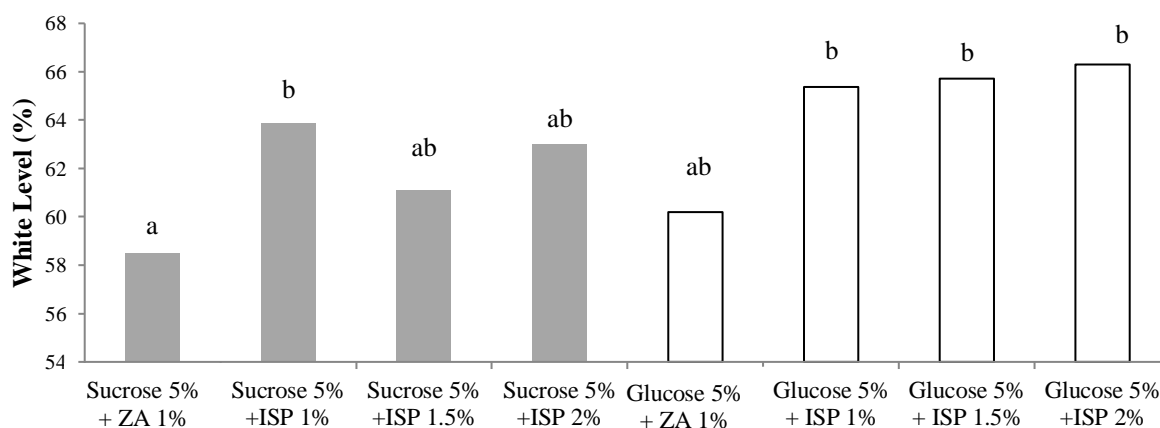


Figure 4. White level of treatment with carbon and ISP addition
The difference between letters shows a significant difference at $p < 0.05$

Fiber Content

Fiber is generated by *A. xylinum* metabolism process (Anastasia & Afrianto, 2008). There is no significant difference between treatment with nitrogen of food grade ZA addition and ISP (ranging from 0.025% to 0.120% (Figure 3). Nata with high fiber can influence its weight due to trapped water content. According to Wijayanti, Kumalaningsih, & Effendi (2012) the presence of glucose metabolism into cellulose in *A. Xylinum* activity produces a maximum value of crude fiber. Additionally, it was also influenced by the adequacy of nutrients as a growth medium. The amount of growth in the number of microorganisms is from the nutrient content of the media.

According to Fifendy et al. (2011) in his research using nata de coco that if the media in the form of carbon, sufficient nitrogen and optimum pH conditions, thickness and fiber will also be produced optimally, because the expected

media and conditions for *A.xylinum* to work optimally are achieved. The levels of nata de taro fiber with ZA treatment tended to be higher at 0.105% in sucrose and 0.120% in glucose compared to using an ISP. This fiber content is related to the elasticity of the nata. Elasticity of nata is a result of high and tight fiber content and composition. The high wet weight results in the structure of fibrils having a high amount of water, this causes reduced viscosity of nata (Fifendy et al., 2011).

White Level

Color is one of the crucial characteristics of product appearance. Nata is a fermented product made from a sugar-rich medium by *Acetobacter xylinum*. Enzymes of these bacteria will convert sugars in fermentation media into millions of cellulose fibers that are white or transparent and have a compact form (Panesar et al., 2012; Suwanposri et al., 2013).

Nata de taro harvested tends to have yellowish-white color and not transparent but the color of nata turns whiter and more transparent after it is boiled. Ulfah, Salsabila, & Rohmawati (2018) stated that the color of nata can be influenced by a lot of water absorbed. When the nata tissue absorbs a lot of water, it then rises and decreases the intermolecular force, and causes the polymer matrix to absorb a lot of water. Consequently, nata loses its transparency and becomes brighter.

The usage of white level in color testing showed that the addition of an ISP gave a higher white degree value or had a brighter white color compared to the treatment with the addition of ZA (Figure 4). The addition of glucose and ISP 2% produced the highest value of white degree which was 66.3% and the lowest was the addition of sucrose + ZA 1% which was only 58.48%.

CONCLUSION

The combination of glucose with ISP 1% gave the best results and yield of 44.28%, thickness of 0.984 cm and brightness of 65.37% and it was not much different from the treatment with ZA addition that produced a yield of 43.77%, thickness of 1.016 cm, brightness of 60.195%. The treatment of adding sucrose + ISP tends to have a higher yield and thickness with increasing ISP concentration but the value is still lower compared to ZA. Nata fiber content tends to be higher in the treatment with the addition of ZA. Hence, the value of the white level is getting higher or nata become brighter in the treatment of glucose with ISP and significantly different from other treatments. The addition of ISP has the potential as an alternative for substitution of ZA and tends to increase the brightness of nata color.

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