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Improving Functional and Sensory Properties of Brown Sugar With Addition of Nutmeg Powder.

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ABSTRACT

This study aimed to observe nutmeg powder addition giving best result in improving functional and sensory properties of brown sugar. Nutmeg powder addition in this study were 0%; 0.5%;1%; 1.5%; 2%. It can be concluded from this study that 2% addition of nutmeg powder showed the highest anti-oxidant activity 32.44%, total phenol 23.27 mg GAE/g, sucrose 81.92%, reduction sugar 3.21%, insoluble solid 2.43%, ash 1.01%, taste 4.65 (very like), color 4.00 (like), aroma 4.35 (like).

Keywords: brown sugar, nutmeg powder, functional value, sensory

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INTRODUCTION

Cane brown sugar is modification product of palm sugar. Comparing to palm sugar, brown sugar is easier to be applied since it is easy to be dissolved in water, easier to be measured, with interesting feature and cleaner. On the other hand, there is also possibility to improve its functional properties by adding natural ingredients with health advantages. Thus, consument will not only use brown sugar as sweetener for various food and beverages but also take its health benefit. One of those natural ingredients that can be added to brown sugar is nutmeg.

Nutmeg contains essential oil. Main components of essential oil from nutmeg are sabinene (21.38%), 4-terpineol (13.92%) and myristicin (13.57%) [1] while other components are allylbenzene and propylezene derivatives that can be utilized to strengthen aroma and taste in food and beverages industries [2]. It was noted that phytochemical monoterpene from nutmeg can prevent cancer and contain antioxidant [3]. Essential oil from nutmeg has been reported to have high antioxidant content [4].

It should be concerned related to nutmeg quantity since excessive amount of nutmeg powder cause strong nutmeg flavor or pungent thus decreasing consumer preference. Previous research used 1.5% of shredded nutmeg or essential oil of nutmeg for hard candy production [5].

MATERIALS AND METHODS

Materials

Sugar cane on prime ripe and nutmeg powder were be utilized in this study. Chemical used for analyzing were Luff reagent, H_2SO_4 24%, KI 20%, Thio 0.1 N, amylum 0.5%, aquades, HCl 6.76%, NaOH 20%, NaOH 0.1 and phenolphthalein.

Cane Brown Sugar Preparation

Samples were made from extracting fresh cut of sugar cane. Fresh cane juice were filtered and heated at temperature 100°C for 3-4 hours until foam disappears. Nutmeg powder was added into cane sugar at different concentration: 0%, 0.5%, 1%, 1.5% and 2%. Molasses was added into water whether it is hard already before stopping heating process. Molasses let to stand for 10 minutes without stirring. With fork wooden stirrer, molasses was stirred until crystallized. Crystal cane sugar then were crushed and sifted with 10 to 20 mesh. Cane brown sugar was packaged in plastic [6].

Analysis

Antioxidant activity, total phenol, insoluble solid, sucrose, reduction sugar with Luff Schoorl, ash and analysis sensory were conducted to analyze products.

Antioxidant Activity (DPPH)

One milliliter of 100 mM acetate buffer (pH 5.5), 1.87 mL of methanol and 0.1 mL of 3 mM DPPH in methanol were put in test tube. New DPPH solution was used in each analysis. Subsequently, 0.03 mL of sample solution was put in test tube and incubated at temperature 25°C for 20 min. Sample absorbance was read at 517 nm. A 0.03 mL distilled water was used as reference solution. The more the DPPH solution neutralized indicated by increasingly fading color of the reaction mixture or even the magnitude of the absorbance of the blank solution. Antioxidant activity (%) = (1- Sample Absorbance/Blank sample absorbance) x 100% [7].

Total Phenol Content Assay

Phenolic content was determined according to the Folin-Ciocalteu Colorimetric Method. Various concentration of gallic acid which were 10, 25, 50, 75, 100, 125, and 150 ppm in distilled water were as standard solution. As for reagent, 50 mL Folin-Ciocalteau reagant in 50 mL distilled water was made while a 5 g

of Na_2CO_3 was diluted in 100 mL of distilled water to make Na_2CO_3 solution. For analysis, 1 mL of sample or standard solution was diluted in 5 mL of distilled water and 0.5 mL reagent then allowed to stand for 5 minutes in dark room. A 1 mL Na_2CO_3 solution was added and sample was incubated again in dark room for one hour. Sample was agitated and measured at 725 nm [8].

Sensory Analysis

There were 20 panelists for sensory analysis on taste, color, and aroma with a hedonic scale of one to five criteria: dislike (1), less like (2), average (3), like (4), very like (5). Hedonic test result would be shown as radar graphic [9].

RESULT AND DISCUSSION

Anti-oxidant Activity

Anti-oxidant activities were identified on 1000 ppm. Anti-oxidant activities of cane brown sugar on different concentration of nutmeg powder are shown on Figure 1.

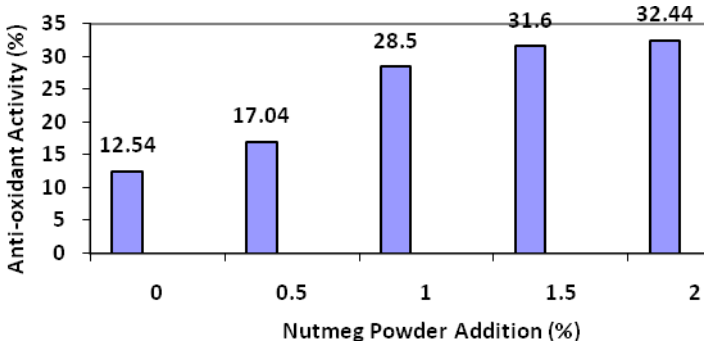

Figure 1: Anti-oxidant activity of can brown sugar with different concentration of nutmeg powder addition

From Fig.1, it can be observed that increasing nutmeg powder concentration on cane brown sugar was related to increasing its anti-oxidant activity. Increasing anti-oxidant activity is related to anti-oxidant content of nutmeg ppowder. Anti-oxidant activity from nutmeg powder was quite high (39.08%) while its activity in cane brown sugar was about 12.54%.

Extract of nutmeg powder has a quite enough anti-oxidant activity related to its tanin, flavonoid and terpenoid contents [10, 13]. Phenolic compound is responsible for anti-oxidant activity [11]. Essential oil from nutmeg powder contains about 70% of mono-terpene hydrocarbon [12]. Monoterpene is phytochemical component with anti-oxidant content and ability to prevent cancer [3]

Total Phenol

Polyphenol content was identified on concentration 100.000 ppm. Total phenol of cane brown sugar with different addition of nutmeg powder is shown on Figure 2 below.

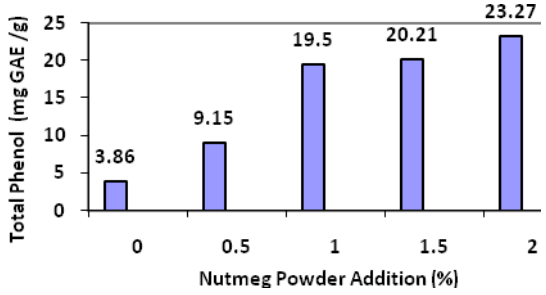

Figure 2: Total phenol of cane brown sugar with different addition of nutmeg powder

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It can be inferred from Fig 2. that the higher addition of nutmeg powder mean the higher total phenol of cane brown sugar product. Further, nutmeg powder has higher phenol content (27.7%) compared to those in cane brown sugar (3.86%).

Nutmeg powder contains tannin, polyphenol with anti-oxidant activity [3]. Phenolic constituent has the highest anti-oxidant activity [14]. Polyphenol is an anti-oxidant compound and work as reduction by releasing hydrogen or catching singlet oxygen [15]. Phenolic compound in essential oil from nutmeg powder such as methyl eugenol is related to anti-oxidant activity [16-17].

Sucrose Content

Figure 3 shows sucrose content of difference nutmeg powder addition in cane brown sugar as follows.

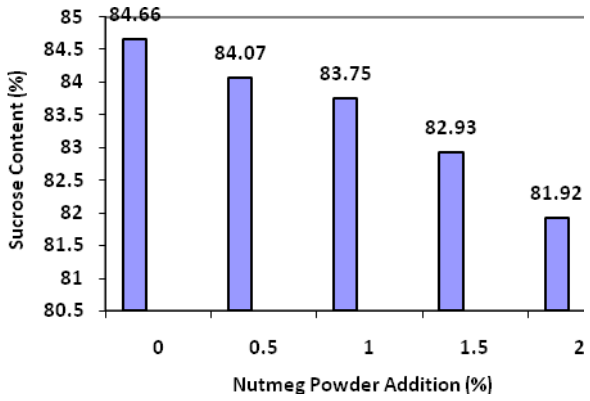

Figure 3: Sucrose content of cane brown sugar with different addition of nutmeg powder

From this graph, it can be concluded that higher addition of nutmeg powder means lower sucrose content of cane brown sugar. Nutmeg powder is not sucrose sources while brown sugar was produced from cane with high sucrose content. Sugar crystalized in brown sugar production is depended on sucrose content from its juice. High sucrose contents become important requirement in brown sugar production [18]. Thus, high sucrose content results better quality of brown sugar compared to brown sugar from lower sucrose content. Therefore, sucrose content from all nutmeg powder addition were acceptable to Indonesian Industry Standard (SII) for brown sugar (SII: 2043 – 87) with minimal content of sucrose is 80% [19].

Reduction Sugar

Sugar reduction for different nutmeg powder addition of cane brown sugar is shown on Figure 4 as follow.

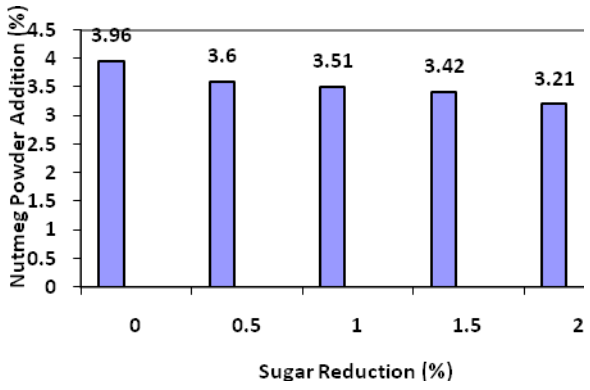

Figure 4: Sugar reduction of cane brown sugar with different addition of nutmeg powder

It can be observed from Figure 4 that there was a reverse relationship between sugar reduction content and nutmeg powder addition while the higher addition of nutmeg powder resulted a lower sugar reduction content of brown sugar. Further, reduction sugar of cane brown sugar with nutmeg powder addition had lower sugar reduction content (0.3%) compared to sugar reduction of native brown sugar (3.36%). It has been explained before that crystallization of brown sugar is depended on sugar reduction content. Higher glucose content or higher inversion sugar content demands hardening process and shortens its shelf life product since it is easily melted [18]. However, sugar reduction from all treatment of nutmeg powder addition were still acceptable to Indonesia Industry Standard (SII) of brown sugar (SII: 2043 – 87) with maximal sugar reduction is 6% [19].

Insoluble Solid Content

Insoluble solid content of brown sugar from all nutmeg powder addition are shown on Figure 5 as follow.

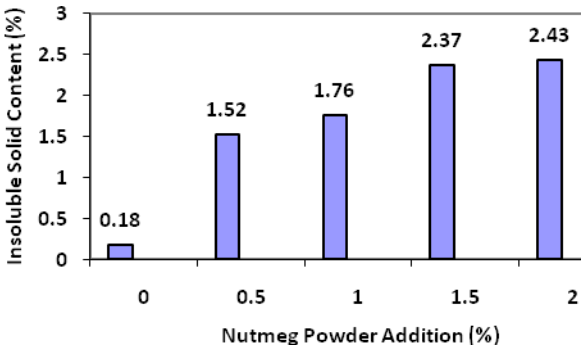

Figure 5: Insoluble solid content of cane brown sugar with different addition of nutmeg powder

It can be shown on Figure 5 that increasing nutmeg powder addition resulted increasing of insoluble solid content as the rsult of high insoluble solid content of native nutmeg powder which was about 80.43% compared to brown sugar (1.69%). However, only A (without nutmeg powder addition) was acceptable to Indonesia Industry Standard (SII) for brown sugar (SII: 2043 – 87) which is 0.2% [19].

Ash Content

Ash content with different addition of nutmeg powder are shown on Figure 6 as followed.

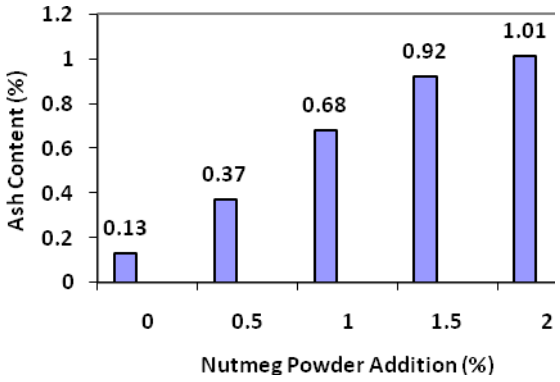

Figure 6: Ash content of cane brown sugar with different addition of nutmeg powder

It can be shown from Fig 6 that addition of nutmeg powder increased ash content of brown sugar. Increasing ash was result of higher ash content of nutmeg powder (2.45%) compared to ash content of brown sugar (0.13%). Nutmeg consists of several mineral such as calsium, ferrum, magnesium, zinc and phospor [20].

However, ash content of brown sugar with nutmeg was still under ash limit to Indonesia Industry Standard (SII) for brown sugar (SII: 2043 – 87) which is maximum 2% [19].

Sensory Analysis

Sensory analysis of brown sugar in different nutmeg powder addition is shown in Figure 7. Analyis was conducted using 5 scales with 1 stands for very dislike, 2= dislike; 3= normal; 4=like; 5= very like.

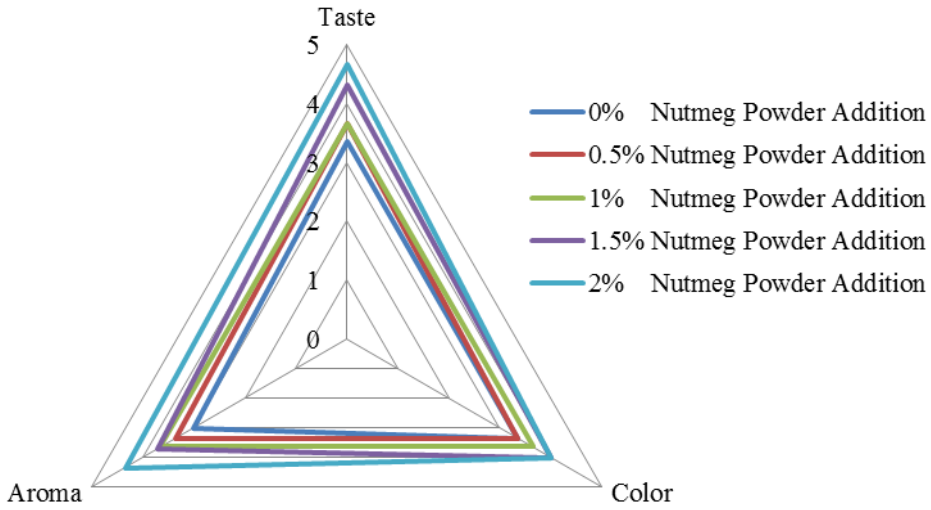

Figure 7: Radar Graphic for Sensory Analysis for brown sugar in different nutmeg powder addition

Taste

It can be observed from Fig 7. that panelists tended to like brown sugar with more nutmeg powder addition. This condition was related to sweetness reducing by bitterness of nutmeg since nutmeg powder is bitter [21]. Thus brown sugar with nutmeg powder addition made less sweet product but it was preferable by consumers.

Color

For color, panelists prefered brown sugar with more nutmeg powder addition. It might be related with nutmeg powder addition gave more brownish color to brown sugar. For addition, color of nutmeg powder is brownish orange [21].

Aroma

It is also shown in Fig.7 that panelist tended to choose brown sugar with more addition of nutmeg powder since it gave particular aroma for brown sugar product. Nutmeg powder gave interesting and warm aroma [21].

CONCLUSION

It can be concluded from this study that addition of 2% nutmeg powder gave the best result with anti-oxidant activity was 32.44%, total phenol 23.27 mg GAE/g, sucrose content 81.92%, reduktion sugar 3.21%, insoluble solid content 2.43%, ash 1.01%, taste 4.65 (very like), color 4.00 (like), aroma 4.35 (like).

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