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Natural Caramelisation: A Sweet Dodol Snack Made from Ipomoea batatas (L.) Blackie. Sweet Potatoes with the Addition of Amorphophallus Oncopphyllus Blume. Tuber Flour as a Healthy Snack and Sustainable Food

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A B S T R A C T

This study examines the natural caramelisation that occurs in purple sweet potato (Ipomoea batatas (L.) Blackie.) when combined with flour from the porang tuber (Amorphophallus oncopphyllus Blume.). The results of this study indicate that natural caramelisation during the production of dodol from purple sweet potato (Ipomoea batatas (L.) Blackie.) and formulated with porang tuber (Amorphophallus oncopphyllus Blume.) showed a significant effect according to Duncan's test, and the means indicated the highest treatment across all tested variables, namely a soft texture, sweet taste, attractive colour with a reddish-purple hue, and a distinctive aroma reminiscent of sweet potato. In conclusion, it can be concluded that dodol made from purple sweet potato (Ipomoea batatas (L.) Blackie.) and formulated with porang tuber flour (Amorphophallus oncopphyllus Blume.) enhances diversity and offers a naturally sweet flavour. Analytical testing revealed that the treatment involving Purple Sweet Potato (Ipomoea batatas (L.) Blackie.) and Porang Tuber Flour (Amorphophallus oncopphyllus Blume.) yielded the highest values across all observed variables compared to the others.

Keywords: Ipomoea batatas, Caramelisation, Purple Sweet Potato, Amorphophallus oncopphyllus, Porang Tuber

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INTRODUCTION

Dodol is a traditional snack made from various ingredients, such as a mixture of glutinous rice flour, coconut sugar and coconut milk, which is cooked until it becomes thick and oily and no longer sticky; when cooled, the dodol becomes firmer and chewier, and can be cut into small pieces ready to eat (Haryadi, 2006 *in* Vitriasari & Suyanto, 2021). According to Laurie *et al*. (2012) as cited *in* Utomo (2019), the sweet potato, commonly known as ubi jalar, is a staple crop that plays a vital role in addressing major issues such as malnutrition, food shortages, and the severe lack of agricultural knowledge and technology in this era of progress. The main ingredient used in making dodol is usually rice flour or glutinous rice flour; this is because rice flour and glutinous rice flour have a very high amylopectin content, which influences the product's elasticity (Sembiring, 2013 *in* Vitriasari & Sunyanto, 2021).

The purple sweet potato, also known as the purple yam, with the Latin name *Ipomoea batatas* (L.) Blackie., is a plant belonging to the bindweed family (*Convolvulaceae*). This purple sweet potato is rich in anthocyanins and antioxidants. Purple sweet potato (*Ipomoea batatas* (L.) Blackie.) is a tuberous plant that contains the highest levels of non-rice carbohydrates after rice (*Oryza sativa*), maize (*Zea mays*) and cassava (*Manihot esculenta*). Sweet potatoes are a cultivated crop commonly known as sweet potato vines, sweet potatoes, Javanese sweet potatoes or sweet potatoes, and it is the root that is utilised and harvested; this part is also rich in nutrients such as carbohydrates. According to Lubis (2026), in addition to their high carbohydrate content, purple sweet potatoes (*Ipomoea batatas* (L.) Blackie.) are rich in vitamins, minerals, phytochemicals and fibre, such as pectin, cellulose and hemicellulose.

Sweet potatoes contain starch, sugar, vitamin C, provitamin A, iron and minerals. In some varieties of sweet potato (*Ipomoea batatas* (L.) Blackie.), the presence of pigments causes the colour of the tubers to vary; this is due to the presence of β-carotene and anthocyanins, which cause the colour of sweet potatoes to vary (Panda et al., 2019; Burri, 2020; Shabrina & Farida, 2022). The porang tuber (*Amorphophallus oncopphyllus* Blume.) is a tuberous plant containing 64.98% glucomannan (Mahirdini & Afifah, 2016). This glucomannan content helps to lower cholesterol and blood sugar levels. Glucomannan is a type of water-soluble fibre; when porang flour (*Amorphophallus oncopphyllus*) is mixed with water-soluble fibre, it can inhibit the formation of triglycerides in the blood by forming

fatty acids, thereby helping to lower blood cholesterol levels (Urli *et al*., 2017; Nurdiana *et al*., 2019; Shabrina & Farida, 2022 *in* Utomo & Octasari, 2023).

One method of processing sweet potatoes involves using a specific variety with simple technology, and this can now be turned into a delicious homemade treat. People still tend to think that sweet potatoes can only be sold in their raw form without further processing; however, they can be transformed into a high-value product. One such product is dodol, which undergoes natural caramelisation without the use of artificial sweeteners or added sugar. This caramelisation refers to the starch and sugar content found in sweet potatoes being utilised as a natural caramel and natural sweetener, without the addition of sugar or artificial sweeteners (Indonesian Ministry of Health, 2013; Anugrah & Suryani, 2020 in Lubis, 2026).

One study conducted by Nuraisyah (2020) found that the ingredient that can be mixed in is porang flour (*Amorphophallus muelleri*), which contains glucomannan at a concentration of 44%. It is hoped that this research will highlight the benefits of porang tuber flour (*Amorphophallus oncophyllus* Blume.) in the production of dried dodol as a tasty snack with natural caramelisation resulting from the natural sugar and starch content of purple sweet potatoes (*Ipomoea batatas* (L.) Blackie.), as well as contributing to sustainable food security. Therefore, this study involved the production of dodol as a homemade snack using flour made from porang tubers (*Amorphophallus oncopphyllus* Blume.) and purple sweet potatoes (*Ipomoea batatas* (L.) Blackie.), utilising natural caramelisation, with the aim of achieving sustainable food security.

METHOD

This study was conducted over a period of three months, from January 2023 to March 2023, at the Food Laboratory of the University of North Sumatra, Medan, and the Food Processing Centre, Medan. The ingredients used in this study were purple sweet potato (*Ipomoea batatas* (L.) Blackie.), water, glutinous rice flour, porang tuber flour (*Amorphophallus oncopphyllus* Blume.), margarine, sugar, coconut water, coconut milk and salt. The design used in this study was a non-factorial randomised block design (RBD) with 4 treatments and 6 replicates, namely

1. D_0 = Caramelised purple sweet potato (*Ipomoea batatas* (L.) Blackie.) + porang tuber flour (*Amorphophallus oncopphyllus* Blume.)
2. D_1 = Purple sweet potato (*Ipomoea batatas* (L.) Blackie.) + glutinous rice flour + sugar
3. D_2 = Purple Sweet Potato (*Ipomoea batatas* (L.) Blackie.) + Glutinous Rice Flour + Coconut Water
4. D_4 = Purple Sweet Potato (*Ipomoea batatas* (L.) Blackie.) + Glutinous Rice Flour + Coconut Milk

The scoring variables, based on physicochemical and organoleptic characteristics, were scored on a scale of 1 to 5, with the criterion that the higher the score, the better the product. The texture assessment consisted of: 1. Very soft, 2. Soft, 3. Hard, 4. Slightly chewy, 5. Chewy; whilst the aroma assessment consisted of: 1. Very little purple sweet potato aroma, 2. No purple sweet potato aroma, 3. Slightly purple sweet potato aroma, 4. Purple sweet potato aroma, 5. Very strong purple sweet potato aroma, and the colour assessment consisted of 1. Very little purple colour, 2. Slightly purple, 3. Moderately purple, 4. Purple, 5. Deep purple, and the taste assessment consists of 1. Very not sweet, 2. Not sweet, 3. Slightly sweet, 4. Sweet, 5. Very sweet. This study was conducted on four dodol products, comprising three flavours and one shape, from four dodol trials as a snack and to assess natural caramelisation, involving 30 untrained or randomly selected panellists

RESULTS AND DISCUSSION

Based on the results of research conducted into the production of dried dodol snacks, examining the physicochemical and organoleptic properties of the natural caramelisation of purple sweet potato (*Ipomoea batatas* (L.) Blackie.) with porang tuber flour (*Amorphophallus onccopphyllus* Blume.)

The Texture

The results of the analysis show that there are differences in the texture analysis of dodol, both in terms of the mean and the final scores. The results of the texture assessment of the dodol products are shown in Table 1 below:

Table 1. Physicochemical and Organoleptic Properties of the Texture in Dodol Products

The Texture of Dodol		
Products	**Average**	**Panelist Score**
Ipomoea batatas (L.) Blackie. + Amorphophallus oncopphyllus Blume.	8,27	5
Ipomoea batatas (L.) Blackie. + Glutinous Rice Flour + Sugar	7,21	4
Ipomoea batatas (L.) Blackie. + Glutinous Rice Flour + Coconut Water	6,10	3
Ipomoea batatas (L.) Blackie. + Glutinous Rice Flour + Coconut Milk	5,20	3

Data source: Compiled by the author, 2026

Based on the results of the texture analysis tests shown in Table 1, the organoleptic test revealed that the average panelist preference for the texture of a dodol product made from purple sweet potato (*Ipomoea batatas* (L.) Blackie.) combined with flour from porang tuber (*Amorphophallus oncopphyllus* Blume.) , with the highest average score of 8.27 and a panelist score of 5. The higher the score given by the panelists for a product, the greater the level of preference for that product. Table 1 shows that the Duncan test (at the 5% level with $\alpha = 0.05$), based on the analysis of several dodol products, indicates a significant effect of various additives.

According to the panelists who conducted the trial, purple sweet potato (*Ipomoea batatas* (L.) Blackie) has a very soft texture—neither hard nor overly mushy. This is due to the role played by purple sweet potato (*Ipomoea batatas* (L.) Blackie.) and Porang tuber flour (*Amorphophallus oncophyllus* Blume.), which provide a soft texture, and the high starch content, resulting in a soft and elastic structure or texture compared to dodol made from pure glutinous rice flour (Hasanah *et al*., 2021 in Putri *et al*., 2023).

Aroma

The results of the analysis show that there are differences in the aroma assessment of the dodol, both in terms of the mean and the judges'

scores. The results of the aroma assessment of the dodol products are shown in Table 2 below:

Table 2. Physicochemical and Organoleptic Properties of the Aroma in Dodol Products

The Aroma of Dodol		
Products	**Average**	**Panelist Score**
Ipomoea batatas (L.) Blackie. + Amorphophallus oncopphyllus Blume.	4,44	4
Ipomoea batatas (L.) Blackie. + Glutinous Rice Flour + Sugar	3,57	3
Ipomoea batatas (L.) Blackie. + Glutinous Rice Flour + Coconut Water	2,85	2
Ipomoea batatas (L.) Blackie. + Glutinous Rice Flour + Coconut Milk	2,20	1

Data source: Compiled by the author, 2026

Based on the results of the aroma analysis tests shown in Table 2, the organoleptic test revealed that the average panelist preference for the aroma of a dodol product made from purple sweet potato (*Ipomoea batatas* (L.) Blackie.) combined with flour from porang tuber (*Amorphophallus oncopphyllus* Blume.) , with the highest average score of 4.44 and a panelist score of 4. The higher the score given by the panelists for a product, the greater the level of preference for that product. Table 2 shows the Duncan test (5% level with α = 0.05) based on the analysis of several dodol products, indicating a significant effect of various additives.

According to trials conducted by various panellists, the aroma tests revealed that the panellists preferred the aroma of products made from purple sweet potato (*Ipomoea batatas* (L.) Blackie.) with the addition of porang tuber flour (*Amorphophallus oncopphyllus* Blume.), which achieved the highest average score of 4.44, with a panellist score of 4. The results of the analysis, conducted using Duncan's multiple range test at the 5% significance level (α = 0.05), revealed that the analysis yielded significant results, indicating that the combination of purple sweet potato (*Ipomoea batatas* (L.) Blackie.) and porang tuber flour (*Amorphophallus oncopphyllus* Blume.) exhibits a distinctive aroma and a sweet, fragrant scent.

Colour

The results of the analysis show that there are differences in the colour assessment of the dodol, both in terms of the mean and the final scores. The results of the colour assessment of the dodol products are shown in Table 3 below:

Table 3. Physicochemical and Organoleptic Properties of Colour in Dodol Products

Colour of Dodol		
Products	**Average**	**Panelist Score**
Ipomoea batatas (L.) Blackie. + Amorphophallus oncopphyllus Blume.	5,23	4
Ipomoea batatas (L.) Blackie. + Glutinous Rice Flour + Sugar	4,10	3
Ipomoea batatas (L.) Blackie. + Glutinous Rice Flour + Coconut Water	3,45	2
Ipomoea batatas (L.) Blackie. + Glutinous Rice Flour + Coconut Milk	2,11	2

Data source: Compiled by the author, 2026

Based on the results of the colour analysis tests shown in Table 3, the organoleptic test revealed that the average panelist preference for the colour of a dodol product made from purple sweet potato (*Ipomoea batatas* (L.) Blackie.) combined with flour from porang tuber (*Amorphophallus oncopphyllus* Blume.) , with the highest average score of 5.23 and a panelist score of 4. The higher the score given by the panelists for a product, the greater the level of preference for that product. Table 3 shows the Duncan test (at the 5% level with $\alpha = 0.05$) based on the analysis of several dodol products, indicating a significant effect of various additives.

The analysis in Table 3 shows that the average liking scores for the colour of the dodol in the treatments using purple sweet potato (*Ipomoea batatas* (L.) Blackie.) and porang tuber flour (*Amorphophallus oncopphyllus* Blume.) were the highest. This is because the colouring agents in the Purple Sweet Potato produce excellent results, resulting in a better colour appearance in the dodol product. According to the findings of Wati & Holinesti (2019) as cited in Putri *et al*. (2023), the presence of anthocyanin pigments—natural compounds that impart an attractive purple colour to

dodol—contributes to the product's lightness and also provides a reddish hue, ensuring the dodol does not appear dull.

Flavour

The results of the analysis show that there are differences in the taste assessment of the dodol, both in terms of the mean and the judges' scores. The results of the taste assessment of the dodol products are shown in Table 4 below:

Table 4. Physicochemical and Organoleptic Properties of Dodol Products

Flavours of Dodol		
Products	**Average**	**Panelist Score**
Ipomoea batatas (L.) Blackie. + Amorphophallus oncopphyllus Blume.	8,67	5
Ipomoea batatas (L.) Blackie. + Glutinous Rice Flour + Sugar	6,12	3
Ipomoea batatas (L.) Blackie. + Glutinous Rice Flour + Coconut Water	5,89	2
Ipomoea batatas (L.) Blackie. + Glutinous Rice Flour + Coconut Milk	5,66	2

Data source: Compiled by the author, 2026

Based on the results of the taste analysis presented in Table 4, the organoleptic test revealed that the average panelist preference for the taste of a dodol product made from purple sweet potato (*Ipomoea batatas* (L.) Blackie.) combined with flour from porang tuber (*Amorphophallus oncopphyllus* Blume.) , with the highest average score of 8.67 and a panelist score of 5. The higher the score given by the panelists for a product, the greater the level of preference for that product. Table 4 shows that the Duncan test (at the 5% level with $\alpha = 0.05$), based on the analysis of several dodol products, indicates a significant effect of various additives.

Based on the results of the analysis, the dodol made from purple sweet potato (*Ipomoea batatas* (L.) Blackie.) and the formulation incorporating porang tuber flour (*Amorphophallus oncopphyllus* Blume.) exhibited a sweet taste and the characteristic flavour of purple sweet potato (*Ipomoea batatas* (L.) Blackie.). Research findings by Utomo (2019)

and Hasanah *et al*. (2021) indicate that taste is a key factor in food quality; whilst taste serves as a standard for research and the assessment of product quality, it is, on the other hand, a value that is perceived as highly relative. It can be seen from the results of the taste analysis of dodol production that the test using purple sweet potato (*Ipomoea batatas* (L.) Blackie.) formulated with porang tuber flour (*Amorphophallus oncopphyllus* Blume.) yielded the highest average taste score. The flavour of the dodol serves as a measure of the quality of the ingredients used in processing, including the production of dodol (Lestari & Yusuf, 2019).

CONCLUSION

In conclusion, it can be concluded that dodol made from purple sweet potato (*Ipomoea batatas* (L.) Blackie.) and formulated with porang tuber flour (*Amorphophallus oncophyllus* Blume.) enhances diversity and offers a naturally sweet flavour. Textural and taste tests showed average results that were significant at the 5% level ($\alpha = 0.05$) in Duncan's multiple range test. Meanwhile, tests on colour and aroma showed the highest values at the 5% level. Analytical tests recorded that the treatments involving Purple Sweet Potato (*Ipomoea batatas* (L.) Blackie.) and Porang Tuber Flour (*Amorphophallus oncopphyllus* Blume.) had the highest values of all observed variables compared to the others.

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