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## Antioxidant Activity of Vegetable Leather Composed of Gotu Kola (*Centella asiatica* L. Urban) and Seaweed (*Eucheuma cottonii*) with Addition of Strawberries (*Fragaria vesca* L.)

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**Abstract:** This research study was conducted at the Agricultural Biochemistry, Chemistry and Food Nutrition and Agricultural Process Engineering Laboratory, Faculty of Agricultural Technology andalus University in Padang. A Completely Randomized Design (CRD) with 6 treatments and 3 replications was used to analyze the data. The treatments included the addition of strawberry at levels of 0, 15, 20, 25, 30 and 35%. The organoleptic addition of 25% was the most preferred formula based on its color (45%), aroma (75%), taste (65%) and texture (60%). The moisture content was 20.15%, the ash content was 4.38%, the beta-carotene content was 1989 µg/100 mL, alkaloids were positive and the coarse fiber content was 6.57%. The addition of strawberry to vegetable leather of gotu kola leaf and seaweed had a significant effect on the moisture content, antioxidant activity, beta-carotene and crude fiber content but was not significant for ash content and alkaloids.

**Key words:** Gotu kola, seaweed, vegetable leather, antioxidant activity, beta-carotene

### INTRODUCTION

Vegetable leather is a processed product of vegetables and is a modification of fruit leather. According to Ernie and Lestari (1992), Reynold (1993) and Asben (2007), fruit leathers shaped of thin sheets with a thickness of 2-3 mm and water content of 10-15% have a specific consistency and flavor based on the type of fruit used.

Vegetable leather can be used instantly and, for many people, it has a taste that is more interesting than vegetables alone. Vegetable leather and fruit leather can be made from plant materials to be used as a source of nutrients and can be classified as a functional food.

Food or drink has properties that can effect functional criteria or health (Muchtadi, 2012). Functional food is a food or beverage that can affect physiological processes, thus improving the health potential of foods and beverages (Muchtadi, 2012).

Indonesia is a tropical country with various types of plants that have compounds that are good for health, one of them is the gotu kola plant (*Centella asiatica* L.) Urban). There are 6580 µg of beta-carotene in 100 grams of gotu kola plant (Dalimartha, 2006). According to previous studies, gotu kola plants contain saponin, including asiatikosida, asiatat acid and madecassoside, triterpene acids, carotenoids, fatty oil, salt, vellarine, tannin, pectin and sugar (Mahendra and Evi Rachmawati, 2005).

Seaweed (*Eucheuma cottonii*) is a raw material that contains high levels of iodine and fiber and is used in vegetable leather for texture.

Strawberry (*Fragaria vesca* L.) contains a variety of vitamins and minerals. According to Astawan (2009),

strawberries also have phyto chemical compounds, such as anthocyanins, ellagic acid, catechin, quercetin and kemferol. Based on the chemical compounds contained in strawberry, it may add to the antioxidant levels in vegetable leather.

This study evaluated the effects of adding strawberry to vegetable leather composed of gotu kola leaf and sea weed.

### MATERIALS AND METHODS

**Materials and equipment:** The materials used for making vegetable leather are gotu kola leaves, dried seaweed, strawberries, sugar, water, distilled water, HCl 6.67%, 1.25% H<sub>2</sub>SO<sub>4</sub>, Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub>, 1.25% NaOH, alcohol, ethanol 99.8%, acetone, n-hexane, Na<sub>2</sub>SO<sub>4</sub>, Whatman filter paper, methanol, DPPH, potassium chloride (0.025 M) pH 1, sodium acetate (0.4 M) pH 4.5, chloroform, iodine bromide reagent, chloroform ammonia, meyer and other chemicals used for the analysis.

The tools and equipment used included a blender, hot plate, electric stove, analytical balance, blade, clamp plate, disikator, measuring cups, aluminum plate, an oven, a bomb calorie meter, spectrophotometer, pH meter, furnace, pipette, porcelain cup, erlenmeyer flask, Buchner funnel, HPLC and other tools used for analysis.

**Research design:** A completely randomized design (CRD) was used with 6 treatments and 3 replications. The raw materials used included gotu kola leaf and seaweed at a ratio of 1:2. The following formulas were based on the addition of different percentages of strawberries:

- Formula A: Addition of 15% strawberries
- Formula B: Addition of 20% strawberries
- Formula C: Addition of 25% strawberries
- Formula D: Addition of 30% strawberries
- Formula E: Addition of 35% strawberries
- Formula F: Addition of 0% strawberries

#### Preparation of materials:

- 1: Prepared dried seaweed *Eucheuma cottonii* was soaked in water for 2-3 days. Water was then drained from the seaweed
- 2: Prepared gotu kola leaf was sorted and separated from the stems. Then, the gotu kola leaf washed and drained
- 3: Prepared strawberry (*Fragaria vesca* L.) was added to the vegetable leather
- 4: Prepared white sugar was used as a sweetener

#### Making of vegetable leather:

- 1: Raw materials were weighed according to a predetermined formula
- 2: Gotu kola leaf was blended with the addition of 50 mL of water for 1 min and then the juice squeezed right after blending
- 3: Seaweed, gotu kola leaves juice, strawberry and sugar were blended
- 4: The blended dough was mixed until very smooth and then were cooked at 50°C
- 5: The material was flattened onto a baking sheet with a thickness of approximately 4 mm
- 6: After wrapping, trays were placed into the digital oven for 15 h at 60°C

**Observation:** Analyses were conducted as follows:

**Organoleptic test (Setyaningsih, 2010):** The taste, aroma, color and texture.

**Chemical properties:** Water content by oven method (Sudarmadji *et al.*, 1997), ash content (Sudarmadji *et al.*, 1997), beta-carotene (Nielsen, 1995), crude fiber (SNI 01-2891-1992) and alkaloids qualitatively (Harborne, 1987).

The analysis of crude fiber was only conducted for control formulations (treatment) and the best formulation (treatment) based on organoleptic test results.

## RESULTS AND DISCUSSION

**Organoleptic test:** The organoleptic test was used as an acceptability parameter and the vegetable leather was served to panelists after it was fried for 1 min at 85°C. Presentation of the panelists who expressed "like" and "really like" on color, aroma, taste and texture of vegetable leather is shown in Table 1.

**Color:** Based on the results in Table 1, the highest percentage of panelists who expressed "like" and "very like" of the color without the strawberry addition was 60%. The second highest was the addition of 15 and 20% of strawberries which was 55%.

Based on the results of the percentage of panelists who preferred the color of vegetable leather of gotu kola leaf and seaweed, the preference decreased with increasing the addition of strawberries, except for addition of 35% strawberries, since the higher addition of strawberries results in a dark reddish brown color which is caused by a nonenzymatic-browning reaction due to the presence of Vitamin C. According to Winarno (1997), Vitamin C is a redactor compound and can act as a precursor to form a nonenzymatic brown color (100 g of strawberries contains 60 mg of Vitamin C). Vegetable leather without the addition of strawberries has a greenish color so it is preferred by panelists.

**Aroma:** Based on Table 1, panelists who chose "like" and "really like" for vegetable leather ranged from 45-75%. The most preferred product based on organoleptic test was the product with an addition of 20 and 25% strawberry with a total percentage of "like" and "really like" of 75%, while the lowest percentage was the product with an addition of 15% strawberry. Acceptance increased because the smell was more acidic compared to the product without strawberries because the addition of strawberries exceeded the optimal limit for the aroma of the vegetable leather. According to Winarno (1997), each fruit has a distinctive aroma and it additions to a particular material in processing can affect the taste and aroma.

**Taste:** The highest percentage of panelists who expressed "like" and "really like" of the taste was with the product without strawberry addition with the percentage level of 70%, followed by the product with the addition of 25% strawberry of 65%, while the lowest score was given to the product with the addition of 35% strawberry of 50%.

The addition of 25% strawberry represents the most optimal limit of panelists' acceptance of the vegetable leather. The product with the highest addition of strawberry was given the lowest percentage of acceptance because the sour taste in strawberries was very noticeable and reduced the acceptability of the taste. The formula without strawberry had the highest percentage of acceptance of taste because there is no acidity.

**Texture:** Based on Table 1, the highest percentage of panelists who expressed "like" and "really like" based on texture is for the product without strawberry at 70%. The next highest was the addition of 15, 25 and 30% at 60% and finally the addition of 20 and 35% at 45%.

Based on Table 1 and Fig. 1, the addition of 25% strawberry provided the highest percentage of acceptance after the control formula.

**Analysis of chemical properties**

**Analysis of moisture content:** Analysis of the moisture content in the vegetable leather of gotu kola leaf and seaweed resulted in an average moisture content of 18.82-21.76%. The average value of the moisture content in the vegetable leather gotu kola leaf and seaweed is shown in Table 2.

The analysis of variance showed that the moisture content in the vegetable leather of gotu kola leaf and seaweed compared to moisture content with the addition of strawberry was significantly different ( $\alpha = 5\%$ ). Based on Table 2, the highest average value of moisture content was found in the product with an addition of 35% strawberry and the lowest average value of moisture content was found in product without strawberry.

The moisture content in the products that were obtained is directly proportional to the amount of strawberry added except with the addition of 25% because strawberry has a high water content, as 100 g strawberry contains 89.9 g of water (Astawan, 2009).

Water is an important component in food stuffs, since water can affect the appearance, texture and taste of the food. The moisture content in food stuffs determines the acceptability, freshness and durability of the material itself (Winarno, 1997).

Currently, there are no quality standards from agencies for vegetable leather or fruit leather. But, when compared to the water content in fruit leather, vegetable leather has a higher moisture content because the addition of 50 mL water is added during the processing of vegetable leather, so that the resulting product needs a longer time to dried than fruit leather.

**Analysis of ash content:** The results of an analysis of variance showed that the ash content in vegetable leather of gotu kola leaf and seaweed with the addition of strawberry is not significantly different ( $\alpha = 5\%$ ). An analysis of the ash content in vegetable leather of gotu kola leaf and seaweed results in an average moisture content of 4.38-5.01%. The value of ash content in the vegetable leather of gotu kola leaf and seaweed is shown in Table 3.

The ash content in vegetable leather of gotu kola leaf and seaweed tends to increase with increasing additions of strawberry. A reduction in the moisture content in food stuffs also can result in increasing ash content (Winarno, 1997).

**Analysis levels of beta-carotene:** Levels of beta-carotene in vegetables were analyzed because it is a precursor of vitamin A, which is healthy if consumed in

Table 1: Panelists' impression of the color, aroma, taste and texture of vegetable leather

Strawberry addition	% panelists			
	Color	Aroma	Taste	Texture
F = 0 %	60	65	70	70
A = 15%	55	45	55	60
B = 20%	55	75	60	45
C = 25%	45	75	65	60
D = 30%	35	65	55	60
E = 35%	40	70	50	45

Table 2: Moisture content in vegetable leather of gotu kola leaf and seaweed

Strawberry addition	Moisture content (%)
F = 0%	18.82±1.10 <sup>a</sup>
A = 15%	19.49±0.27 <sup>ab</sup>
C = 25%	20.15±1.42 <sup>abc</sup>
B = 20%	21.05±0.96 <sup>bc</sup>
D = 30%	21.19±1.45 <sup>bc</sup>
E = 35%	21.76± 0.70 <sup>c</sup>
CV = 5.22	

Description: Numbers in the same column followed by the same lowercase letter are not significantly different at 5% level according to DN MRT

Table 3: Ash content in vegetable leather of gotu kola leaf and seaweed

Strawberry addition	Ash content (%)
C = 25%	4.38±0.21
B = 20%	4.65±0.24
D = 30%	4.67±0.19
A = 15%	4.74±0.10
E = 35%	4.79±0.33
F = 0%	5.01±0.33
CV = 5.67	

Description: Numbers in the same column followed by the same lowercase letter are not significantly different at 5% level according to DN MRT

Table 4: Alkaloid test results on vegetable leather without the addition of strawberry and with the addition of 25% strawberry

Strawberry addition	Alkaloid test
0%	(+)
25%	(+)

Description: (+) indicates that the sample solution contains alkaloids

raw form (Ahamad *et al.*, 2007). The analysis of beta-carotene in vegetable leather gotu kola leaf and seaweed evaluated the treatment without strawberry additions and the selected treatment by organoleptic test was the formula with an addition of 25% strawberry. The beta-carotene levels in the vegetable leather of gotu kola leaf and seaweed are shown in Fig. 2.

As shown inn Fig. 2, the greater the addition of strawberry, the lower the beta-carotene level of vegetable leather of gotu kola leaf and seaweed. Vegetable leather products contain beta-carotene, where the raw material per 100 g of gotu kola contains 6580 mg of beta-carotene. The treatment without the addition of

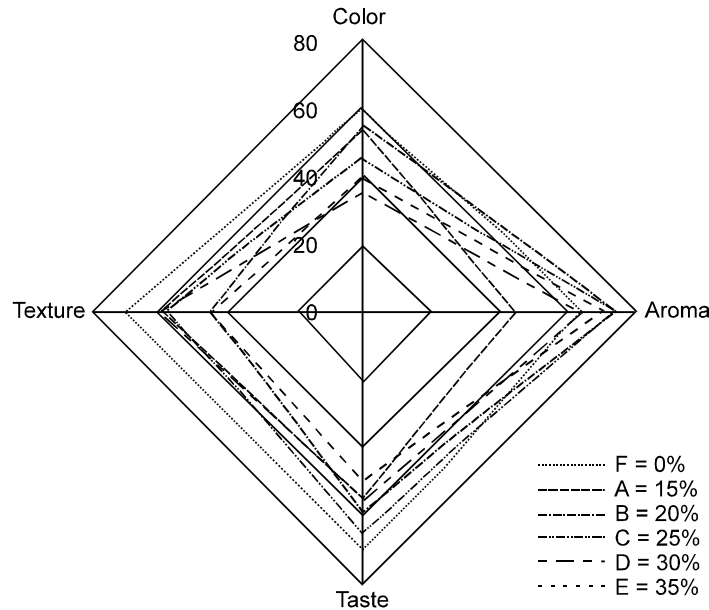


Fig. 1: Organoleptic test radar of vegetable leather of vegetable gotu kola leaf and seaweed

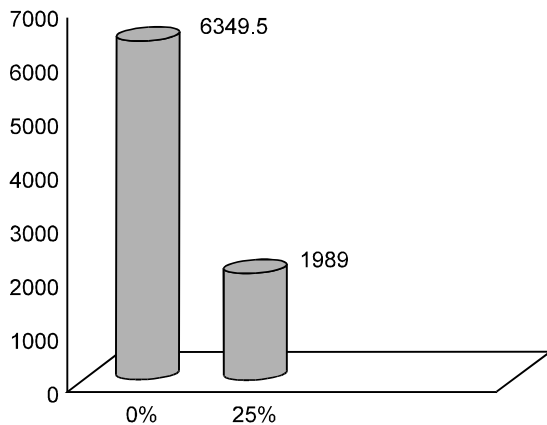


Fig. 2: Comparison of beta-carotene analysis results in vegetable leather without the addition of strawberry and with the addition of 25% strawberry

strawberry contained beta-carotene level of 6349 mg/100 mL whereas the addition of 25% strawberry formula contained beta-carotene levels of 1989 mg/100 mL.

**Alkaloids:** Alkaloid test using qualitative methods on vegetable leather was only tested in products without the addition of strawberry and formulas with the addition of 25% strawberry, which is the best formula based on organoleptic test. Alkaloid test results are shown in Table 4.

Based on the results of Alshendra and Ridawati (2013), alkaloids are a class of compounds containing

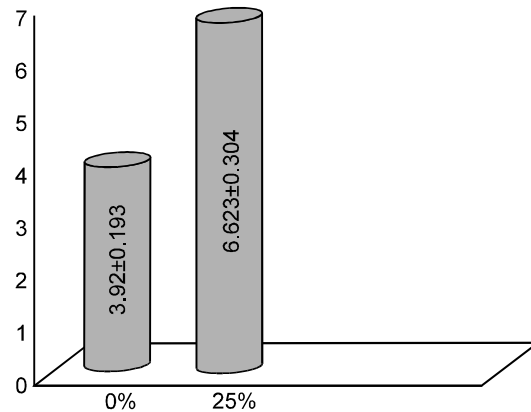


Fig. 3: Comparison of crude fiber analysis results in vegetable leather without the addition of strawberry and with the addition of 25% strawberry

nitrogen bases and are present in many plants. They are toxic in high concentrations but induce a stimulating effect at low concentrations. Table 4 shows that the addition of strawberry in each treatment did not affect the content of alkaloids contained in the vegetable leather of gotu kola leaf and seaweed. Alkaloids in samples are characterized by the presence or absence of sludge or white haze after treated with a Dragendoff reagent. According to Suhartatik (1989), the alkaloids that are contained in gotu kola are *alkaloids hidrokotilina*. It can be concluded that if the content of an alkaloid derived from the plant *Centella asiatica* can be lost in the process of making vegetable leather.

**Crude fiber:** Crude fiber analysis has only been tested on products without the addition of strawberry and formulas with addition of 25% strawberry, which is the most favorable formula based on organoleptic tests. The comparison of crude fiber analysis is shown in Fig. 3. Figure 3 shows that the addition of strawberry on vegetable leather of gotu kola leaf and seaweed increases the fiber content of the product, since the product with the addition of 25% strawberry has a higher crude fiber content than the product without the addition of strawberry. There are 0.5 g of fiber in 100 g of strawberries, resulting in an increase in crude fiber content as the percentage of strawberry increases.

#### Conclusions:

- 1: An addition of strawberry to vegetable leather of gotu kola leaf and seaweed has a significant effect on water content, beta-carotene and crude fiber content but it does not have a significant effect on ash content or alkaloids
- 2: An addition of strawberry affects the organoleptic test of vegetable leather of gotu kola leaf and seaweed, with the most preferred formula based on addition of 0% strawberries, followed by the addition of 25% strawberries

#### Suggestions:

- 1: A proposal for the next study is to analyze iodine values and the antioxidant activity of gotu kola leaf and seaweed
- 2: A recommendation for subsequent researchers is to analyze the shelf life of vegetable leather of gotu kola leaf and seaweed

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