The Making of Vegetable and Tropical Fruit Sheet as Alternative of Traditional Packaging and Improving Daily Intake

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Keyword: Vegetable Fruit Sheet, Edible Packaging, Drying.

Abstract: Indonesia has natural and traditional ethnic diversity as well as traditional cake and culinary, which are generally packaged or served using natural leaves. At the same time, Indonesia also has daily nutrition intake issues, especially daily intake of fruits-vegetables that still far from the standar. The limitations of processing technology and perceptions of fruits and vegetables have resulted in minimal use and intake. The purpose of research is utilization of vegetables-fruit as part of the packaging or serving of traditional cake-culinary in the form of fruit-vegetable sheet as edible packaging. For that purpose, green spinach (Amaranthus gangeticus) has been choosen as vegetable sheet materials. Persimmon (Diospyros) and mango (Mangifera indica) has been choosen as fruit sheet materials. The drying method using a combination of vaccum drying at temperature of 60-65˚C and a microwave for 90 minute. As a binder, using 15% fiber-based binder which has barrier function while providing flexibility and a strong structure of sheet. The sheet product are tested for acceptance level base on taste, aroma and structure attribute. Analysis of chemicals characteristic focusing on macronutrien of spinach and carotenoid of fruit. Carotenoid analized using spectrophotometer on 400-600 λ. Based on the results of the organoleptic test using 60 untrained panelist, the average panelist perception for all attribute between standar and product, increase from 2-3 scale to 3-4 scale with the P value <0.05 for aroma, taste and texture attribute. The nutrient test resulted that edible vegetable sheet containing 72% of fiber and 3,2gr/100gr Fe. The carotenoid test resulted 2,9567 mg/ 100gr product, which is it still enough for intake. So it can be concluded that edible vegetable and fruit sheet has better sensory, still containing enough Fe, Fiber and antioxidant carotenoid for intake, at the same time has good texture as edible packaging.

1 INTRODUCTION

Indonesia is located in the tropical zone where ethnic groups are spreading within thousands islands (Kemendikbud, 2016). The ethnic groups in Indonesia exhibits the large variations of cake-culinary across the country and some of it consistent using traditional packaging (leaf base, ex: banana leaf, corn leaf, coconut leaf) (Tyas, 2017). Thus, the variation of traditional cake-culinary related to the different kinds of plant there are localy. It makes Indonesia known as Mega-biodiversity country in the world. In opposite, Indonesia has very low consumtion in fruit and vegetable,only less than 160 gr/day in total daily intake (Susenas, 2016). This value is far from recommendation by The Health Ministry of Republic of Indonesia in The Regulation of The Minister of Health No. 41 about the guidance for balanced nutrition, 400 gr/day (Kesehatan, 2014).

The low perception of fruit and vegetable in customer mostly because of taste, aroma, texture and post-harvest handling process (Polard *et al.,* 2009; Richards *et al.,* 2010; Karagianni and Tsakiridou, 2003). The dried fresh processing is one of the best method to maintain fresh material content (Maskan *et al.,* 2002). Unfortunately, fresh materials irresistible from heat processing (Sundari *et al.,* 2015). Adding a binder is one of method to reducing active component losses during drying process by wall formation mechanism (Diamante *et al.,* 2014). So it can protected the core materials from heat penetration. Therefore, this research Aim to reform vegetables and fruits into flexible sheet with adding agar as a binder and texture base material, so it can be used as alternative edible traditional packaging while improving daily nutrional intake at a time.

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2 MATERIALS AND METHOD

This research is a laboratory experiment. This research was conducted in the processing laboratory of Universitas Kristen Satya Wacana, Salatiga. The sample of the vegetable using green spinach which has young and soft foliage, sample of fruit using mango and kesemek, the agar-agar was used as binder obtained from Salatiga, Central Java. The research process covered the puree-making, formulation, nutrient analysis, phytochemical analysis and the sensory acceptance rate.

2.1 The Making Fruits and Vegetable Puree

As many as 500 gr of green spinach and mango – persimmon fruits had been washed and blanched using iced water along 10 – 15 minutes. Then it was mashed up by using blender until it became a puree. The next step was to take 100 g of puree and mix it with 5% agars as the binder. Blend it until evenly mixed.

2.2 Drying Process

The microwave was set to the low temperature (165^{o}F) until the level of the water content reached less than 13%. The puree would be spreader evenly on the baking sheet. The drying process was conducted to form the structure and the color of the product.

2.3 Analysis of Total Fe Content

The analysis of the total iron (Fe) content was determined using Atomic Absorption Spectrometry method (AAS) at 248 nm, slit-width 0.2 nm, sensitivity 0.12 ppm.

2.4 Analysis of Total Fruits Carotenoid Content

30 ml of 100% acetone on 10 gr of sample (fruit / vegetable puree) due to the maceration process and filtered using 2,7 micron and 1 micron filter paper to get filtrate. Carotenoid content analyzed using Spektrofotometer UV-Vis at 200 – 800 nm and calculate by formulation:

$$carotenoid = \frac{(AxVx10^{6})}{A1x100xG} \quad (1)$$

A1: extrinsic coefficient, V: volume (ml), G: weight of sample (g).

2.5 The Sensory Reception Test

The sensory reception test for the material of the real spinach and the green spinach leather used Hedonic rating test using the untrained 53 panelists. The test attribute used was flavor, texture, and aroma. The rating scale used was from 1 – 5 from very dislike, dislike, neutral, like, very like.

3 RESULT

3.1 Vegetable and Fruit Sheet

The vegetable and fruit sheet (**Figure 1**) still has bright green color which indicated the original color of the spinach.

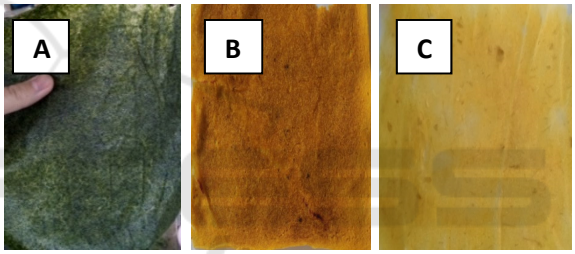

Figure 1: (A) Green spinach (Amaranthus spp) vegetable sheet, (B) Persimmon (Diospyros) Sheet, (C) Mango (Mangifera spp) sheet.

Characteristic of the vegetable and fruits sheet was dry on the surface but it still has flexibility textures and could be ripped out easily (Gujral and Brar, 2007). Flexibility is one of important characteristic as a packaging. The color of sheet was still bright as the original, some area shows uneven color because of the differences in thickness product surface. Color is one of indicator nutrient losses during process, especially on mango and persimmon fruits, the color component containing a pro vitamin A such as caroteoids. Base on the analysis (Table 1), the fruits sheet has 2,9 mg/100 gr in average of total carotenoids. This amount still enough to cover daily intake of vitamin A, although this value was far from the total amount of carotenoid in original fruit.

In the case of spinach vegetable sheet product, the main active component was in fiber and vitamine content, although the chlorophyll has biological activity, such as antioxidant, but the green spinach has been known as Fe source food. The Fe amount on

the fruit sheet (Table 1) quite high, 3.3 mg/100 gr. Normally total amount Fe originally is 3.5 mg/100gr.

The differences of losing active component between vegetable and fruit sheet because of the drying mechanism between those component. When drying process, the pigment act as barier protection for the other component. So it break down mostly in that process and structure of green spinach vegetable has containing more fiber than mango-persimmon, which Fiber basically are polysacharida that form a wall when heated (Gujral and Brar, 2007). Especially the binder that used is a fiber base. To ensure the loss of nutrient during drying process in the vegetable sheet, proximate analysis test was performed (Table 2).

Table 1: Fe and Caroteoid Analysis.

Materials	Total Carotenoid (mg/100 g)	Total Fe (mg/100g)	Moisture Contain (%)
Fruit sheet	2.957	-	11.66%
Vegetable sheet	-	3.3	10.94%

Remark:
- The result of the total Fe content was the highest Fe content from triple repetition using AAS.
- The total carotenoids value is the calculation of the highest absorbtion value obtained.

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Adding agar as a binder, affect the fiber content wich is quite high in the sheet product as shown in Table 2. It mean, the binder has function not only binding fruit/vegetable puree, but also as fortificant as well (added value component).

3.2 Sensory Test Analysis

In the testing scale from 1 to 5, from very dislike to very like, in general, the panelist's respon in Figure 2.A mostly on the range rating 2 – 3, which is from dislike to like rating with a close enough difference between standard (green spinach) and the product (green spinach sheet). Generally, perception of vegetable sheet product higher than standard for all atribute, except the texture attribute. It means vegetable in the sheet form, affect to increasing the perception of original spinach vegetable.

Sensory test of fruit sheet resulted as similiar as vegetable sheet test result. Most of panelist's respon shows the fruit sheet product have better perception than the original fruit (Ayotte, 1980) in most of attribute, except aroma attribute. Naturally fruit has sweet aroma and sweet is a pleasant aroma. In other case, green spinach naturally has bitter and grass aroma. Bitter is unpleasant taste and aroma. Agar as a binder effectively covered the original aroma of fruit – vegetable in the mechanism of wall formation during drying process.

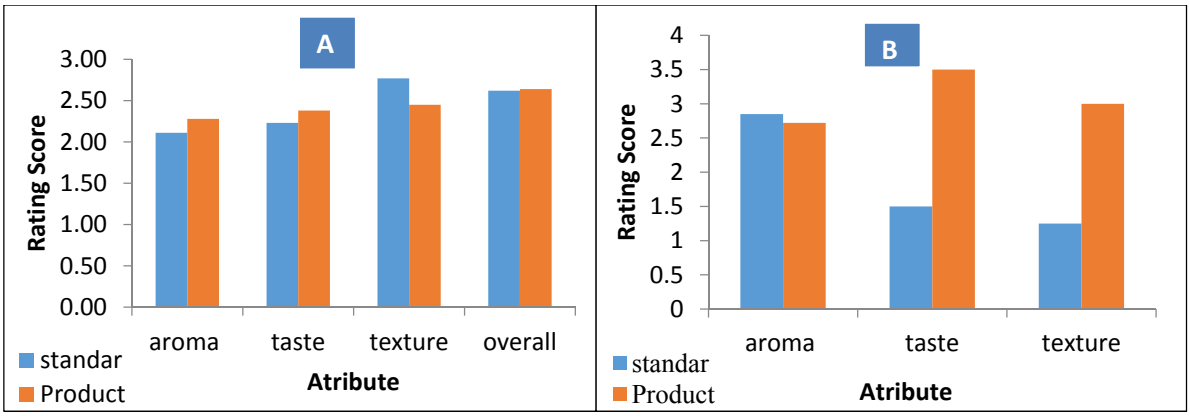

Figure 2: Hedonic rating test result (A) vegetable sheet - standard and (B) Fruit sheet – standar.

4 CONCLUSION

Base on the analysis result there are several conclusion related to this research:

a. Base on the flexibility charateristic, Vegetable and fruits sheet has good potential as alternative packaging (traditional).
b. Vegetable and fuit sheet has better perception than the originally form and still have enough amount of nutrient-minerals as daily intake.

Table 2: Proximate Aalysis Result of Green Spinach vegetable sheet (*Amaranthus spp*).

Nutritional Content	The Average Content of Green Spinach sheet (%)
Fiber	73,68
Carbohydrate	17,56
Protein	3,19
Fat	0,02

CONFLICT OF INTEREST

The author declare that there is no conflict of interest regarding the publication of this paper.

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