Color Evaluation of Dry Vermicelli Made from Combination of Arenga Starch, Rice Flour and Sorghum

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Abstract. In Indonesia, vermicelli is usually produced using arenga starch. But the arenga starch has limited in the term of quantity and the nutritional quality. In order to improve the arenga starch vermicelli, the formulation was combined with rice flour and sorghum. Each single change in vermicelli formulation will be modifies the final product color. This research studied the effect of vermicelli formulation on the color change of dry vermicelli. During the production of vermicelli, arenga starch was mixed with 10-90% of rice flour. The color parameter was observed as L* (lightness), a* (redness and greenness), and b* (yellowness and blueness). The total color difference was also calculated. The procedure was repeated with addition of sorghum. Result showed that the addition of rice flour increased the L* value. Meanwhile, the addition of sorghum decreased the L* value. Total color difference was higher in addition of sorghum.

Keywords: arenga starch; rice flour; sorghum; vermicelli

1. Introduction

Vermicelli are one type of noodle that is widely consumed in Indonesia as a complementary material or raw material for certain food products. Processed foods that generally use vermicelli are meatballs, soto or as a filling for snacks such as spring rolls and other market snacks. Some of the raw materials that can be used in vermicelli formulation are tubers and cereals including green beans, wheat, rice, and flour from various other ingredients such as potatoes, sweet potatoes, and sorghum (Chen, 2003; Gurusree et al., 2011; Tan et al., 2009).

The most common Indonesian vermicelli business use arenga starch as the main ingredients. Arenga flour has almost the same nutritional content as sago flour (Adawiyah et al., 2013). Arenga flour has a higher amylose content (37-37.6%) when compared to some other ingredients such as tapioca (17%), potato (20-25%), wheat (26-27%), corn (26-28%) and sweet potatoes (30%) (Sanyang et al., 2015). High amylose content increases dough stability, attractiveness, texture and reduces loss during the cooking process in noodles (Jeong et al., 2017). Although the arenga can produce flour in large quantities, generally it only can be harvested around the planting age of 15-25 years. So, it takes a long time to produce the arenga flour. It is important to find the new materials to vermicelli production.

The process of adding other raw materials is important to maintain the continuity of the vermicelli noodle production process. Rice flour and sorghum flour may be added in the process of making vermicelli noodles because of their easy availability and characteristics. The addition of ingredients in the formulation will certainly change the color of the vermicelli. Though the color will affect consumer acceptance of the resulting product. This study aimed to evaluate the effect of the vermicelli formulation on the color change of dry vermicelli. The addition of other raw materials to vermicelli noodles from palm flour, is expected to improve or enhance the characteristics of the resulting vermicelli noodles.

2. Method

2.1. Materials

In this study, the arenga starch was produced by Dua Naga Ltd., (West Java, Indonesia). The rice flour was purchased from Budi Starch & Sweetener Ltd., (Subang, Indonesia) and the sorghum was purchased from Kusuka Ubiku.
Xanthan gum was used as the emulsifier and was purchased from Fufeng Group Ltd. (Shandong, China). The initial moisture content of the ingredients was observed to calculate amount of water in formulation

2.2. Vermicelli Preparation

The vermicelli samples were prepared from the arenga starch with addition of rice flour and sorghum by the previous method with several modification (Li et al., 2016). The formulation was divided into dried form (amount 80% weight of the total formulation) and gel form. The gel form was processed by addition of water (1:7 w/v) and then was heated until gel formation. The xanthan gum (amount 1% of the total weight of formulation) and the gel form was added in dried form. The solution then was mixed and was casted using vermicelli extruder. The vermicelli was cooked in the hot water (90°C) for 30 s. Then vermicelli was removed and put in cold water with a temperature of ±8 C for 3 minutes then was drained for 5 minutes. Wet vermicelli noodles were dried in an oven at 105°C to a constant sample weight to determine the moisture content of wet vermicelli noodles. Each sample of wet vermicelli noodles was placed on a mesh pan and dried using the sun drying method.

2.2. Color Measurement

The color of vermicelli was measured using a Chroma Meter (CR-300, Minolta Co., Ltd., Osaka, Japan) in terms of L (lightness), a (redness and greenness) and b (yellow and blueness). Then the L*, a* and b* values were recorded. The total color difference (ΔE) was calculated as follows in equation 1 (Djaeni et al., 2018):

$$\Delta E = \sqrt{(L - L_0)^2 + (a - a_0)^2 + (b - b_0)^2}$$

where L, a, and b was the measured values of modified vermicelli (addition of rice flour and sorghum), and L₀, a₀, and b₀ was the values of vermicelli that was produced by arenga starch.

3. Result and Discussion

3.1. Effect of the Rice Flour on Vermicelli Color

Based on Figure 1, it can be seen that the addition of rice flour to arenga starch vermicelli has an effect on the L* value. The higher the concentration of rice flour added, the higher the L* value in vermicelli. The color of the arenga starch vermicelli with the addition of rice flour is influenced by the color of the raw material used, namely white rice flour. The higher the concentration of rice flour, the brightness of the vermicelli noodles increased. The values of a* and b* did not show a significant change. Changes in the values of a* and b* will be significant with the addition of colored rice such as brown rice, brown rice and black rice (Kraithong et al., 2018).

3.2. Effect of the Sorghum on Vermicelli Color

The color of the vermicelli with the addition of sorghum indicates that the higher the concentration of the addition of sorghum flour, the L* and b* values decrease while the a* values increase. This shows that the increase in the concentration of sorghum in the vermicelli causes the color of the vermicelli become darker. In accordance with Xu et al., (2020 which states that a decrease in the value of L* in the sample indicates an increase in color density in the sample.

![Figure 1. Color of arenga starch vermicelli with addition of rice flour](image)
Sorghum contains high amount of protein, about 4.4–21.1% (Khalid et al., 2022). In this study the presence of protein in sorghum and the drying process can affect the color of vermicelli noodles. The addition of sorghum flour causes a darker color change which is indicated by an increase in the a* value. Proteins derived from non-gluten sources can change color during the process (Sudha et al., 2011). In addition, with the higher protein content in sorghum along the drying process leads to Maillard reaction (Djaeni et al., 2018).

3.3. Total Color Difference

Color is one of the parameters that affects the consumer acceptance. The materials in vermicelli preparation also affected the color. For the example, in this study the color of vermicelli become darker with addition of sorghum that contain high amount protein. Based on the ∆E value (see Figure 3), it can be seen that the value of ∆E was higher than 2. The higher amount ∆E value, indicated that the addition of sorghum can change the color of vermicelli and the changes detected through close observation. Several study also reported that higher flour protein content resulting with darker vermicelli (Morris, 2018). While with addition of 10-30% weight rice flour, the ∆E value was below 1. It indicated that the addition of lower contain of rice flour did not change the color of vermicelli and the changes did not detected by the human eye (Djaeni et al., 2017). Meanwhile, the addition of rice flour higher than 30% weight, the color change detected at glance.
4. Conclusion

This study successfully substituted the arenga starch with the rice flour and sorghum for vermicelli production. The content of materials affected the color of vermicelli. The $L^*$ value of vermicelli was higher with the addition of rice flour. While the addition of sorghum, the higher the concentration of sorghum flour causes a decrease in the value of $L^*$. Furthermore, with addition of rice flour below 30% weight, there was no difference with vermicelli made from arenga starch. Meanwhile, the addition of sorghum flour causes the total color difference to be quite large between 2-13 and the color of the vermicelli becomes dark.

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References


