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# Stabilization of the quality and anthocyanin in strawberry puree during storage

*by* I Gede Pasek Mangku

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# Stabilization of the quality and anthocyanin in strawberry puree during storage



# Stabilization of the quality and anthocyanin in strawberry puree during storage

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**Abstract**. During processing and storage of strawberry products like puree were often found some problems such as loss or change of red color anthocyanin, the formation of brown pigment and loss of ascorbic acid. The purpose of this research is to determine the best of precise dextrin concentration to stabilization of red color anthocyanin pigment and the quality during storage at temperature 10±2ºC for 30 days. Randomized block designed used with dextrin concentration as treatments that consists of three levels with four replications. The treatments are, dextrin concentration 0.8%, 1.6%, and 2.4%. The data were analyzed using ANOVA and continued by LSD analyzed if the treatment given significantly effect. The result showed that the treatment of dextrin 1.6% having the highest of total product value 2.27 and produced strawberry puree with the best quality during storage at temperature 10±2ºC for 30 days. The characteristics of the strawberry puree are anthocyanin concentration 23.67 mg/kg, total ascorbic acid 78.12 mg/100g, total soluble solid 13.23%, moisture content 79.88%, pH 3.16, red color intensity (a* value) +30.80, degree of lightness (L* value) 35.40, and total of microbe 21.6 x 103 cell/g.

## Introduction

Strawberries are consumed mainly as fresh fruit but in addition, many other strawberry products such as juice, nectar, puree, and juice concentrate, as well as jam, are commercially available [1], natural dyes [2], and health as antioxidants [3]. Strawberry is a fruit that is very perishable. This is to be one problem in the use of strawberries as an industrial raw material. To increase the shelf life and maintain the quality of strawberries it is necessary to process it into processed products that can be used as raw materials in the food industry but still have good quality during storage. One processed product that has not been widely developed by the food industry but is very much needed by the food industry is "strawberry puree".

The quality and stability of the color and anthocyanin in strawberry puree are affected by some factors such as structure and concentration of anthocyanin, pH value, temperature, light, and presence of copigments, metallic ions, enzymes, oxygen, ascorbic acid, sugar, and their degradation products [4]. The main problems are found during processing and storage of strawberry puree including of changed of red color, brown pigment formation, and loss of ascorbic acid [5].

Therefore, to stabilize the anthocyanin content, maintain the ascorbic acid content, and to prevent brown pigment formation as well in the strawberry puree during storage, requiring further research. This research has aimed to study the effect of dextrin to the quality and anthocyanin stability during storage.

## 2. Materials and methods

Strawberry fruit with the optimum ripe stage (red color) was used as material for producing of puree. The strawberry fruit has obtained in Batu Malang East Java-Indonesia. The step of produced strawberry puree consists of, cleaning of the strawberry fruit, sortation, blanching at 100°C for 45 seconds, trimming, destruction, evaporating, packaging, pasteurized, and storage in temperature 10 ± 2°C for 10, 20, and 30 days.

This research used of Experimental Complete Randomized Block Design with single treatment namely concentration of dextrin that consists of three levels including of 0.8%, 1.6%, and 2.4% with four replicates. The treatments of dextrin concentration applied when destruction step in strawberry processed.

During storage of the strawberry puree for 10, 20, and 30 days at 10 ± 2°C then the puree continued to analyze. Some parameters including of total of ascorbic acid, total soluble solids (TSS), moisture content, pH value, and microbe total were determined according to AOAC (2005) [6]. Anthocyanin concentration was analyzed by *the pH differential method* [7], red color intensity (a* value) and lightness (L* value) were measured by the colorimeter method [8]. The dates were analyzed by ANOVA. If the treatment has significantly affected ($P<0.05$) will be continued to the Least Significantly Difference test (LSD) 5% [9].

## 3. Result and discussions

### *3.1. Anthocyanin concentration*

Anthocyanin content of strawberry puree after given treatment with dextrin concentration during storage at 10, 20, and 30 days at 10 ± 2°C as shown in Table 1. The dextrin concentration treatment has significantly affected ($P<0.05$) to the anthocyanin content of strawberry puree during storage at temperature 10 ± 2°C.

**Table 1.** The average of anthocyanin concentration of strawberry puree at several dextrin concentrations during storage at temperature 10 ± 2°C.

| Dextrin Concentrations (%) | Anthocyanin Concentrations (mg/kg) | | |
|---|---|---|---|
| | 10 days | 20 days | 30 days |
| 0.8 | 34.31 a | 30.17 a | 24.37 a |
| 1.6 | 32.48 a | 27.10 a | 23.67 a |
| 2.4 | 27.86 b | 19.43 b | 15.91 b |
| LSD 5% | 1.95 | 4.34 | 2.15 |

Table 1 showed that the anthocyanin content of strawberry puree is 15.91 mg/kg – 34.31 mg/kg. The highest anthocyanin content of strawberry puree storage for 10, 20, and 30 days was produced by treatment of 0.8 % dextrin namely 34.31; 30.17; and 24.37 mg/kg each. The addition of 0.8% dextrin to the strawberry puree will increase the stability of strawberry puree during storage. The reason is the dextrin can absorb of the water in the puree due to decreased mobility of dissolved oxygen and free metal ions, therefore, the oxidation of anthocyanin by dissolved oxygen and free metal ion can be reduced. According to Jackman and Smith, the stability of anthocyanin pigment can increase by reduced oxygen and metal ions [10].

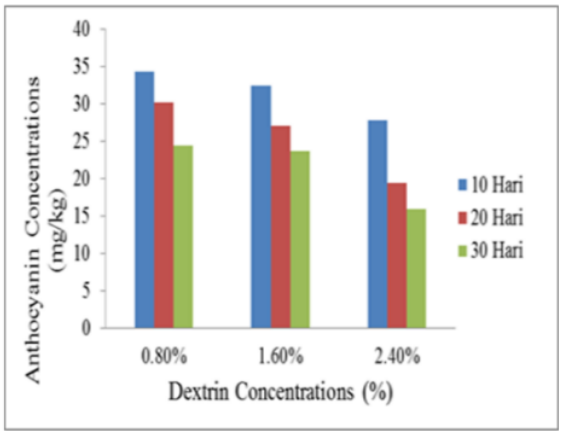


**Figure 1.** The effect of dextrin concentrations to anthocyanin content of puree during storage.

Figure 1 showed that the anthocyanin content of strawberry puree tends to decrease with longer storage and increasing of dextrin concentration. The longer storage of strawberry puree can increase the oxidation of anthocyanin compound and decompose to anthocyanin and glucose due to anthocyanin content will decrease. According to Kallio et al. that increasing of the hydroxyl group in anthocyanin will decrease the stability of anthocyanin [11].

*3.2. The red color intensity and lightness*

The highest red color intensity of strawberry puree was given by dextrin concentration 0.8% at 10 days storage (+ 33.15) and the lowest red color intensity was given by dextrin concentration 2.4% (+30.75). It is mean that the higher the red color intensity the higher of anthocyanin content in strawberry puree (table 2).

**Table 2.** The average of red color intensity and degree of lightness in strawberry puree at several dextrin concentration during storage at temperature 10 ± 2°C.

| Dextrin Concentration (%) | Red color intensity (a* value) | | | Degree of Lightness (L* value) | | |
|---|---|---|---|---|---|---|
| | 10 days | 20 days | 30 days | 10 days | 20 days | 30 days |
| 0.8 | +33.15 a | +28.65 a | +26.28 a | 34.53 | 34.00 | 33.60 |
| 1.6 | +32.65 a | +28.15 a | +25.78 a | 34.10 | 33.60 | 33.40 |
| 2.4 | +30.75 b | +25.80 b | +22.88 b | 33.70 | 32.80 | 32.70 |
| LSD 5% | 1.68 | 0.86 | 0.86 | 1.10 | 0.42 | 0.47 |

Table 2 showed that the red color intensity decreased with increasing of storage periods. The degree of lightness of strawberry puree tends to decrease with the increasing of dextrin concentration applied. The treatment of dextrin concentration of 2.4% given the darkness of color of strawberry puree (33.70) than the dextrin concentration of 0.8% (34.53).

*3.3. Total ascorbic acid*

The higher total ascorbic acid contains strawberry puree were given by dextrin concentration 2,4% to all the storage times. This treatment showed difference significantly with the other treatments except for 1,6 % at 10 days of storage (table 3).

**Table 3.** The average of total ascorbic acid of strawberry puree at several dextrin concentration during storage at temperature 10 ± 2°C.

| Dextrin Concentration (%) | Total ascorbic acid (mg/kg) | | |
|---|---|---|---|
| | 10 days | 20 days | 30 days |
| 0.8 | 80.57 b | 78.63 c | 76.61 c |
| 1.6 | 82.51 a | 81.46 b | 78.12 b |
| 2.4 | 84.04 a | 83.19 a | 81.26 a |
| LSD 5% | 1.66 | 1.51 | 0.65 |

Figure 2 showed that the total ascorbic acid contains increased with increasing of dextrin concentration application. During storage, the total ascorbic acid decreased and the lower concentration of total ascorbic acid found at storage 30 days.

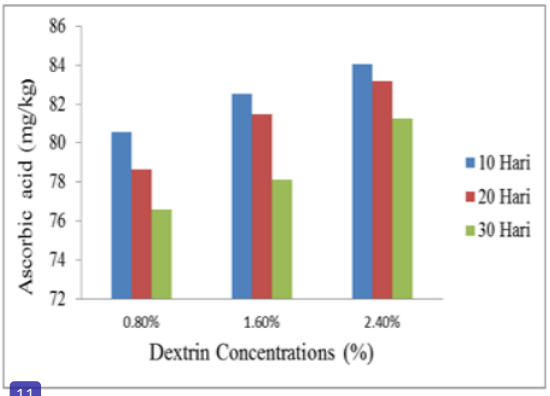


**Figure 2**. The effect of dextrin concentrations on the total ascorbic acid content of puree during storage.

*3.4. pH value*

The effect of dextrin concentration to pH value strawberry puree during storage at temperature 10 ± 2°C shown in Table 4. Table 4 showed that the highest pH of strawberry puree was given by dextrin concentration 0.8 % during storage but the lowest pH is given by 2.4 % of dextrin concentration. The increased of dextrin concentration that applied to the strawberry puree and the increased of storage times at temperature 10 ± 2°C, the pH of strawberry puree produced tend to decrease during storage at 10, 20, and 30 days. The reason is dextrin can be used as substance by microorganism for metabolism and decomposed the substance to organic acid compound that can be reduced of pH strawberry puree. According to Lehninger, the higher ascorbic acid content can produce greater of $H^+$ ion [12].

**Table 4.** The average pH of strawberry puree at several dextrin, concentration during storage at temperature 10 ± 2°C.

| Dextrin Concentration (%) | pH | | |
|---|---|---|---|
| | 10 days | 20 days | 30 days |
| 0.8 | 3.023 a | 3.350 a | 3.173 a |
| 1.6 | 3.015 b | 3.268 b | 3.163 a |
| 2.4 | 3.010 b | 3.250 b | 3.070 a |
| LSD 5% | 0.006 | 0.034 | 0.189 |

### 3.5. *Total Soluble Solids (TSS)*

The effect of dextrin concentration to total soluble solids (TSS) of strawberry puree during storage at temperature 10 ± 2°C shown in table 5. Table 4 showed that the highest TSS of strawberry puree were given by dextrin concentration 2.4% during storage but the lowest TSS were given by 0.8% of dextrin concentration.

**Table 5.** The average of total soluble solid of strawberry puree at several dextrin, concentration during storage at temperature 10 ± 2°C.

| Dextrin Concentration (%) | Total soluble solids (Brix) | | |
|---|---|---|---|
| | 10 days | 20 days | 30 days |
| 0.8 | 13.80 b | 13.38 c | 13.08 b |
| 1.6 | 13.95 b | 13.53 b | 13.23 a |
| 2.4 | 14.00 a | 13.75 a | 13.50 a |
| LSD 5% | 0.11 | 0.12 | 0.23 |

In table 5 above showed that the increased of dextrin concentration and storage times applied to the strawberry puree at temperature 10 ± 2°C, the TSS of strawberry puree produced tend to increase during storage at 10, 20, and 30 days. The reason is dextrin is the oligosaccharide compound that consists of glucose which waters soluble, due to increase of total soluble solids in strawberry puree. Polysaccharides that added will condense with anthocyanin to form a complex compound that can increase the color and stability of promo for in the anthocyanin pigment [12].

### 3.6. *Moisture content*

The effect of dextrin concentration to a moisture content of strawberry puree during storage at a temperature 10 ± 2 $^0$C shown in Tabel 6. In table 6 showed that the lowest moisture content of strawberry puree was given by dextrin concentration 2.4 % during storage but the highest of moisture content were given by 0.8 % of dextrin concentration.

**Table 6.** The average moisture content of strawberry puree at several dextrin concentration during storage at temperature 10 ± 2°C.

| Dextrin Concentration (%) | Moisture content (%) | | |
|---|---|---|---|
| | 10 days | 20 days | 30 days |
| 0.8 | 79.60 a | 80.86 a | 81.66 a |
| 1.6 | 78.16 b | 79.01 a | 79.88 b |
| 2.4 | 76.37 c | 76.83 b | 77.99 c |
| LSD 5% | 0.79 | 1.91 | 1.70 |

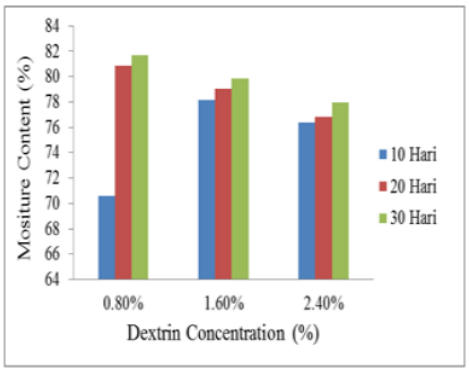


**Figure 3.** The effect of dextrin concentrations to a moisture content of puree during storage.

Figure 3 showed that the increased of dextrin concentration applied to the strawberry puree, the moisture content of strawberry puree produced tend to decrease during storage at 10, 20, and 30 days. The reason, dextrin is consists of glucose units that can be chelated of water in puree, therefore the moisture content of strawberry puree decreased. Figure 4 showed that the moisture content of strawberry puree tends to increase during storage of 30 days at 10 ± 2°C. This reason is decomposed of a complex compound to simple compound and water, therefore an increase of moisture content of strawberry puree during storage.

*3.7. Total of microbe*

The effect of dextrin concentration to a total of the microbe of strawberry puree during storage at temperature 10 ± 2°C shown in Table 7. In table 7 showed that the lowest microbe total of strawberry puree was given by dextrin concentration 1.6 % during storage but the highest of microbe total was given by 0.8 % of dextrin concentration.

**Table 7.** The average of Microbe total of strawberry puree at several dextrin concentration during storage at temperature 10 ± 2°C.

| Dextrin Concentration (%) | Total of Microbe (sell/g) | | |
|---|---|---|---|
| | 10 days | 20 days | 30 days |
| 0.8 | $1.6 \times 10^5$ a | $2.5 \times 10^5$ a | $5.3 \times 10^5$ a |
| 1.6 | $2.4 \times 10^3$ b | $9.1 \times 10^3$ b | $21.6 \times 10^3$ b |
| 2.4 | $2.1 \times 10^4$ b | $3.4 \times 10^4$ b | $11.9 \times 10^4$ b |
| LSD 5% | 1.04 | 1.02 | 0.81 |

In table 7 showed that during storage of strawberry puree the total of microbe tends to increase. The reason is due to during storage the moisture content increased and nutrients available in strawberry puree, therefore, can promote microbe growth in the puree. According to Gaman and Sherrington that all microbes need water and nutrients to grow and to survive their life [13].

## 4. Conclusions

The result showed that the treatment of dextrin 1.6% having the highest of total product value 2.27 and produced strawberry puree with the best quality during storage at temperature 10±2°C for 30 days. The characteristics of the strawberry puree are anthocyanin concentration 23.67 mg/kg, total ascorbic acid 78.12 mg/100g, total soluble solid 13.23 %, moisture content 79.88%, pH 3.16, red colour intensity (a* value) +30.80, degree of lightness (L* value) 35.40, and total of microbe 21.6 x $10^3$ sell/g.

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