Packaging materials of red chilli puree

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Abstract. Puree of red chilli is processed chilli products as industrial raw material, which the need will continue to increase due to the increasing demand and consumers tastes for various chilli products. Therefore, we need quality characteristics of raw materials, especially types of packaging materials. The objective of this research was to identify various types of packaging materials on the quality of red pepper puree during storage. The types and packaging materials used are jar bottles, plastic bottles, glass cups and polyvinyl dichloride (PVDC) plastic. Fresh red peppers were crushed by waring blender and adding water in a ratio of 2: 3, after which they were packaged and stored for 3 months. Research emphasized on the effect of various types of packaging materials on the quality of red chilli puree during storage. Observations include color, water content, pH, total soluble solid and vitamin C. The results showed that the type and packaging materials had an effect on the quality of red chilli puree during storage. After three months, the puree of red chillies packed with glass cups and PVDC plastic did not show significant differences, but puree packed with plastic bottles shows a significant difference. Results concluded that the puree of red chilli packaged in jar bottles and stored for three months at room temperature can maintain the quality of puree, especially bright red colors, such as L = 64, a = +32, b = +40; water content of 67%, total soluble solid of 18° Brix and vitamin C of 58 mg.

1. Introduction

The necessity of red chilli as industrial material gradually increased and the industry tries to tackle the needs by creating a diversification of chilli processed food based on consumer tastes. According to Central Bureau of Statistics and Directorate Jenderal of Horticulture [1], the production of red chilli in Indonesia was increased for the last 5 years with approximately 7.5% per year. In 2014, the production of red chilli was 695.707 ton and a year later, the number was increased to 954.310 ton. The production of red chilli will keep increasing to fulfill the demand of food industry.

Chilli processed food are chilli sauce, dry chilli, chilli powder and grind chilli [2]. For daily consumption, the consumer prefers grind chilli since it is easy to get. Another half-processed food of chilli, which practically easy to use, is red chilli puree. Puree is different from paste in terms of total soluble solid and other additional ingredients. In the previous research by Gould [3], the total soluble solid of puree was 8-24%. Besides that, puree is also different from grind chilli since the shelf life of
Grind chilli is relatively low with about less than 1 week, even with the additional of preservatives ingredients. Whilst, the texture of puree is like pulp, with approximately 2 months of shelf life. According to Renate et al. [4], red chilli puree packed with jar bottle and stored for 2 months showed a better chemical component quality compared to the original red chilli puree. Moreover, red chilli puree packed with plastic container and stored for 2 months also showed a good quality, in particular capsaicin and vitamin C content. However, there was an increased of microbial content [5].

Plastic is currently being used as a packaging material since plastic has advantages like flexible, transparent, no fragile and cheap. However, plastic is not environmentally friendly since this material is non-biodegradable. Thus, the accumulation of this material could harm the environment. Besides environmental issue, the safety of synthetic polymer is also questioned since a higher temperature could cause monomer contamination to the food. The long-term accumulation of this contamination could be harmful to human [6].

The aim of this study was to find the best packaging materials for red chilli puree based on the color, moisture content, total soluble solid and vitamin C content. The red chilli puree was produced from fresh red chilli, packed in several packaging materials, such as jar bottle, plastic bottle, cup plastic and PVDC plastic for 10 weeks. The quality control was performed in week 6, 8 and 10.

2. Materials and Methods
The materials for red chilli puree production were fresh red chilli from Kerinci district, Jambi. The packaging types were jar bottle, plastic bottle, cup plastic and PVDC plastic. The method of this research was using randomized design with two times repetition. The red chilli puree was stored in the packaging for 10 weeks (6, 8 and 10 weeks).

Some fresh red chillies were chosen with fully red color, even size, with approximately 40 to 45 pieces in 1 kg of fresh red chilli. The sorted red chilli then was separated from the stalk and was weighed with around 150 g for one experiment. After that, the red chilli was washed out in running water. Then, the chilli was soaked in water (80 °C, 3 min), blend with blender. 0.1% citric acid, 0.1% benzoic acid and 1% salt were added during the blending [7]. After, heat up the mixture, and packed the red chilli puree in jar bottle, plastic bottle, cup plastic and PVDC plastic. The puree was stored in room temperature (30°C) for 10 weeks. The quality control was performed in week 6, 8 and 10 to the color, moisture content, total soluble solid and vitamin C content [8]. The data was analysed using Duncan Multiple Range Test (DMRNT) of 5%.

3. Results and Discussion
Red chilli puree was produced from fresh red chilli and stored in several packaging material as shown in Figure 1-4.
3.1. Color of red chilli puree
Color analysis was objectively performed using color reader with L*, a* and b* as the units. L* value indicate the lightness of material with value of 0 to 100, where 0 indicate black or dark color, while 100 indicate white or bright color. a* value indicate chromatic red-green mixture color with +a* (positive) from 0 to +80 for red color and -a* (negative) from 0 to -80 for green color. b* value indicate chromatic blue-yellow mixture color with _b* (positive) from 0 to +70 for yellow color and -b* (negative) from 0 to -70 for blue color.

Generally, packaging types have no effect to the cili puree red color during the storage. During 8 weeks storage, red chilli puree did not show significant differences. However, after 8 weeks, red chilli puree packed with plastic bottle and PVDC plastic showed a shift of the color to brownish red, while plastic cup packaging showed dark brownish red color. Red chilli puree packed with jar bottle for 10 weeks showed bright red color (Table 1).

| Packaging material | Storage (weeks) | Color | Color description |
|--------------------|----------------|-------|-------------------|
|                    | L | +a | +b | |
| PVDC Plastic       | 6 | 27.57 | 11.52 | 18.56 | Very dark desaturated orange |
|                    | 8 | 27.32 | 11.33 | 18.23 | Dark saturated red |
|                    | 10 | 26.43 | 12.57 | 12.72 | |
| Plastic bottle     | 6 | 27.62 | 11.63 | 18.5 | Very dark desaturated orange |
|                    | 8 | 27.22 | 11.12 | 18.22 | dark saturated red |
|                    | 10 | 26.32 | 12.55 | 16.66 | |
| Jar bottle         | 6 | 27.81 | 11.87 | 18.62 | Very dark desaturated orange |
|                    | 8 | 27.54 | 11.67 | 18.54 | |
|                    | 10 | 27.12 | 11.35 | 18.73 | |
| Plastic cup        | 6 | 27.72 | 11.64 | 18.77 | Very dark desaturated orange |
|                    | 8 | 27.54 | 11.73 | 18.65 | dark saturated red |
|                    | 10 | 27.87 | 11.45 | 18.45 | |
This pigment is unstable in acidic condition. Moreover, packaging type could affect the degradation of red chilli puree color and oxidation reaction by light and temperature of the environment. Plastic bottle and PVDC plastic contain high polymer or combination from short chain monomer compounds [9]. The plastic properties which are permeable to gases cause the plastic packaging to be easily oxidized by oxygen, causing color alteration. On the other hand, glass packaging does not react, strong, good barrier to solid, liquid, and gas. In addition, the transparent properties of glass are also resistant to high temperature, thus it is not easily oxidized, causing the consistent color [6].

3.2. Moisture content and total soluble solid

The packaging of red chilli puree in jar bottle, plastic bottle, cup plastic and PVDC plastic did not affect the moisture content and total soluble solid during storage (Table 2).

| Packaging material | Storage (weeks) | Quality of red chilli puree |
|--------------------|----------------|---------------------------|
|                    | Moisture content (%) | TSS (%)         |
| PVDC Plastic      | 6              | 62                        | 19          |
|                    | 8              | 64                        | 18          |
|                    | 10             | 68                        | 18          |
| Plastic bottle    | 6              | 61                        | 20          |
|                    | 8              | 63                        | 19          |
|                    | 10             | 67                        | 18          |
| Glass bottle      | 6              | 60                        | 22          |
|                    | 8              | 62                        | 21          |
|                    | 10             | 64                        | 21          |
| Plastic cup       | 6              | 62                        | 20          |
|                    | 8              | 64                        | 19          |
|                    | 10             | 67                        | 19          |

3.3. pH and vitamin C content

Packaging types have an effect on vitamin C content of red chilli puree during 10 weeks storage. However, the packaging types have no effect on the pH of red chilli puree. The puree in jar bottle has a higher vitamin C content than the one packed in plastic bottle, plastic cup and plastic PVDC (Table 3).

Red color in chilli is caused by a carotenoid pigment, which consists of \textit{capsantin}, capsorubin, \textit{\beta-caroten}, zeasantin, criptosantin, neosantindan lutein [10]. This pigment is unstable in acidic condition [11]. Moreover, packaging type could affect the degradation of red chilli puree color and oxidation reaction by light and temperature of the environment. According to Mahmud [12], red chilli contains 50 mg/100g of vitamin C, where its content was significantly diminished between each packaging materials. The decrease of vitamin C content could be due to oxidation reaction by light as well as storage temperature in different packaging type [13]. Plastic packaging material, in particular PVDC has a low gas permeability and humidity compared to plastic bottle and plastic cup. Therefore, the
packaging could not minimize the oxidation. Bottle jar packaging could resist gas and humidity permeability, thus the chilli inside the packaging has limited interaction with oxygen. In general, the packaging of jar bottle, plastic bottle, cup plastic and PVDC plastic have no significant effect to the color, moisture content, total soluble solid and pH of red chilli puree, as previously reported by Priyanto [14].

| Packaging material | Storage (weeks) | pH   | Vitamin C (mg/100g) |
|-------------------|----------------|------|---------------------|
| PVDC Plastic      | 6              | 3.56 | 39.10a              |
|                   | 8              | 3.62 | 38.56b              |
|                   | 10             | 3.90 | 36.30c              |
| Plastic bottle    | 6              | 3.68 | 38.61a              |
|                   | 8              | 3.72 | 36.42b              |
|                   | 10             | 3.80 | 32.32c              |
| Glass bottle      | 6              | 3.30 | 48.62a              |
|                   | 8              | 3.46 | 47.32ab             |
|                   | 10             | 3.62 | 44.62b              |
| Plastic cup       | 6              | 3.60 | 44.12a              |
|                   | 8              | 3.68 | 42.32b              |
|                   | 10             | 3.80 | 39.07c              |

Note: numbers followed by the same small alphabet in horizontal column is not significantly different based on DNMRT (5%).

4. Conclusion

To conclude, the packaging types have no significant effect on the quality of red chilli puree. However, there was significant effect to vitamin C content after 10 weeks storage. Red chilli puree packed with jar bottle resulted in the best red chilli puree compared to other packaging type, especially in vitamin C content of 46.6 mg/100g, 62% of moisture content, pH 3.46 and 21% of total soluble solid.

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