

Consumer Perception on the Redness and Off Flavor Upon Stored Red Chili Paste with Ozone Treatment

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Abstract

Red chili considered as a perishable commodity due to its high moisture content and respiration rate. The decrease in chili quality during storage can be identified based on its redness and aroma. Ozone has been widely used to inhibit the degradation of horticultural products. This study aims to determine the effect of ozone pretreatment on chili paste's redness and aroma during storage as a quality measurement of consumer perception level. The treatment was carried out by soaking the red chilies in ozonated water for 15 minutes using ozone generator while the control treatment was done with pure water. Samples were stored for 7 days and the analysis of redness and aroma was conducted every day. Data were obtained by calculating the average and standard deviation, then presented in a graph with error bars. The results showed that the redness value of control and ozone treatment started from 51.55 and 46.04 and on the seventh day became 42.94 and 43.81. The control treatment showed off-flavor on the third day of storage while the ozone treatment didn't show off-flavor until seventh day of storage. In conclusion, ozone treatment slowed down the decrease of red chili paste's redness value and off-flavor.

Keywords: ozone, red chili, storage

1. Introduction

Chili is an agricultural commodity that is easily damaged during storage. The damage can occur due to the contamination of microorganisms such as fungi, yeasts, and bacteria as well as the occurrence of various oxidation reactions. The oxidation reaction will produce some compounds such as ketones and aldehydes that cause off-flavor in chili (Deng *et al.*, 2017; Puspitasari and Dwi, 2019). Color in chili can also experience a decrease in quality due to enzyme activity and non-enzymatic browning reactions during storage (Bignardi *et al.*, 2016). Chili paste is one of the processed chili products that is made by grinding chillies and added with or without seasoning. This product couldn't last long at room temperature or refrigerator temperature, so further treatment is needed to extend its shelf life (Apichratsrangkoon *et al.*, 2013).

Ozone (O₃) is a triatomic oxygen molecule which recently has been widely used as a sterilizer for food because of its antimicrobial properties and high oxidizing ability. Ozone can be obtained through oxygen (O₂) molecule separation into oxygen free radicals using high energy inputs. The single oxygen atom will then react with a diatomic oxygen molecule to form an O₃ molecule which is ozone (Manjunath *et al.*, 2015). According to Sukarminah *et al.* (2017) the limit for continuous ozone exposure in food is 0.1 ppm for 8 hours exposure and 0.3 ppm for 15 minutes exposure. Exposure of gaseous ozone has an additional advantage of promoting the biosynthesis of more antioxidants, while slowing down metabolic processes that are associated with produce quality deterioration (Shezi *et al.*, 2020). In previous studies, ozone application gave positive effect on water loss, firmness, and weight loss of chili pepper and chili paste (Kusumiyati *et al.*, 2022; Al-Baarri *et al.*, 2022). In addition, ozone has been proven to be able to inhibit microbial and chemical activities of lettuce, spinach, and parsley (Karaca and Velioglu, 2014).

The color and aroma of chili paste is influenced by the chili that was used. Aroma and color have an important role in deciding the quality of a product. Changes in color and a rancid aroma can be a sign of a decrease in chili quality. According to Al-Barri *et al.* (2022) the good quality of chili paste can be seen from the color and aroma that is not rancid. The use of ozone in chili is expected to maintain the color and aroma of the chili paste. Research on the effect of ozone on the aroma and color of chili paste is needed.

2. Material and Methods

2.1. Materials

The red chilies used in this study were obtained from the local market in Banyumanik, Semarang. Other materials used in this study were ozone generator (D'Ozone), chopper (Oxone, Indonesia), colorimeter (AMT501, US), zip lock, stainless spoons, and spatula. Ozonated water used for treatment is done by dissolving 0.25 ppm of ozone in water.

2.2. Methods

2.2.1. Red Chili Preparation

Preparation of red chili refers to Marnoto *et al.* (2012) with modification. The red chili used is second grade chili with quality that refers to the Indonesian National Standard (SNI) 4480:2016 regarding chili. The red chilies that have met the requirements are then separated from the stalks and washed using running water. The red chilies were then divided into 2 treatment categories, namely control treatment and ozone treatment. A total of 110 g of sample was used for each treatment.

2.2.2. Application of Ozone and Chili Paste Preparation

Application of ozone on red chili and chili paste preparation refers to Contigiani *et al.* (2018) with modifications. Treatments that were given to the sample consisted of control treatment and ozone treatment. Red chilies for the control treatment were immersed in water for 15 minutes, while for ozone treatment samples were immersed in ozonated water with a concentration of 0.25 ppm for 15 minutes. Then each sample was chopped for around 2 minutes, and every 10 g sample was packed in a 10x6 cm sealed-zip lock. Chili paste samples were stored for 7 days at room temperature. Parameter analysis was carried out every day.

2.2.3. Redness Value (a^*) Analysis

Redness value analysis referred to Nagle *et al.* (2016), using colorimeter method. Redness value could be seen from the a^* value in $L^*a^*b^*$ colorimeter display. colorimeter was calibrated with standard black and white plates. colorimeter sensor was applied onto each of the samples. The a^* value can be seen from the colorimeter display.

2.2.4. Aroma Analysis

Aroma analysis referred to Villavicencio et al. (2021), using practitioner assessment with modification. Paste samples were smelled and assessed by the practitioner. The result described as negative (-) for Normal aroma and positive (+) for off-flavor.

2.2.5. Data Analysis

Data analysis was conducted using Microsoft excel 2019. The experiment's data were input into Microsoft excel. The a^* value average and standard deviation were calculated, then interpreted into a graph with error bars and scattered lines.

3. Result and Discussions

3.1. Redness

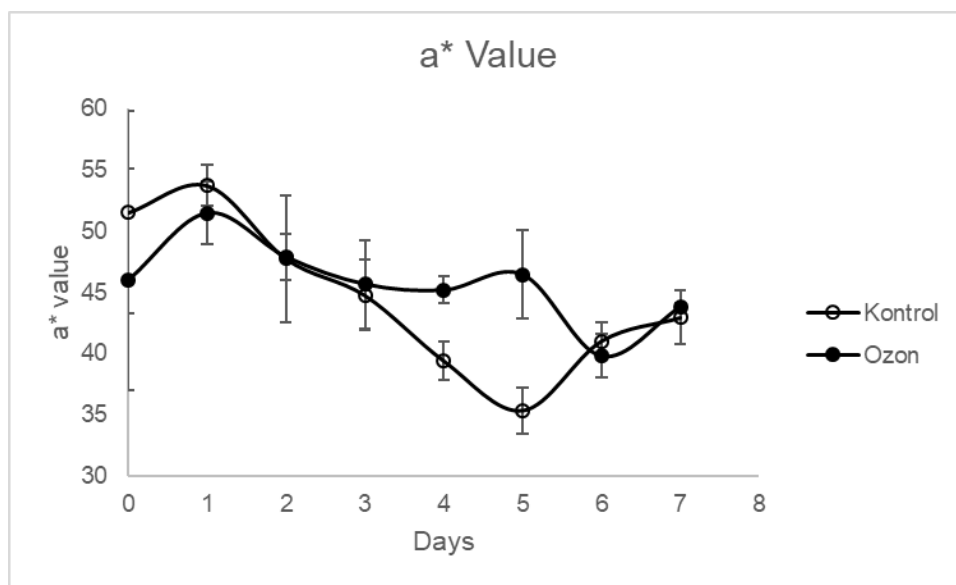


Illustration 1. Red Chili Paste a^* Value during 7 Days of Storage.

Based on the results of Illustration 1, the a^* (redness) value of red chili paste soaked with water and ozone treatment decreased during seven days of storage. This graph showed that red chili paste soaked only with water experienced a bigger decrease than red chili paste with ozone treatment. Chili paste experienced decrease of a^* value along with longer storage time. According to Giuffrida *et al.* (2014) color deterioration of chili during storage is mainly caused

by oxidative degradation of carotenoids. The deterioration in color is due to the degradation of antioxidant components such as carotenoids in chili. Carotenoids are pigments that give red chili its red color which is indicated by the a^* value. Carotenoids which give the chili its red color are β -carotene, capsorubin, capsanthin, zeaxanthin, and lutein (Bignardi *et al.*, 2016). Red chili paste also undergoes enzymatic browning which causes a decrease in a^* value.

Ozone treatment can maintain the color of chili longer than control treatment. Color is an important parameter that influences consumer's preference. The red color in chili paste is preferred by consumers because it indicates good chili quality. Ozone treatment suppressed the increases in the a^* value of red chili paste in storage because of enzymatic browning (Osiriphun, 2019). Ozone can slow down the decreased of a^* value that was caused by degradation of pigment and enzymatic browning. Ozone has an inhibitory effect on browning enzyme due to the high oxidation potential (Sachadyn-krol *et al.*, 2020).

3.2. Aroma

Table 1. Red Chili Paste Aroma Changes during 7 Days of Storage.

Aroma							
Day	1	2	3	4	5	6	7
Control	-	-	+	+	+	+	+
Ozone	-	-	-	-	-	-	-

Note: Off-flavor was described as positive (+) and normal aroma was described as negative (-)

Based on the results of Table 1, red chili paste that was only soaked in water showed off-flavor aroma on the third day of storage, while red chili paste with ozone treatment didn't show off-flavor aroma during seven days of storage. Microbial spoilage of red chili paste can take place during storage, leading to the formation of off-flavor compounds. Ozone treatment on chili paste could reduce microbial activity that gives off-flavor aroma due to its capability to cause damage to microbial cells (Premjit *et al.*, 2022). Besides that, ozone treatment could remove the off-flavor compounds by oxidizing the off-flavor compounds. This reaction yields hydroxyl radical throughout the interaction with hydroxide ions (OH^-) (Lehto *et al.*, 2022). Based on the consumer perspective, the chili paste without off-flavor is preferable to the other one. The distinctive aroma of chili is expected to give the best eating experience for consumers.

4. Conclusion

The study showed that ozone treatment gives better results on a* value and aroma of red chili paste compared to control treatment during seven days of storage. It can be concluded that ozone treatment maintains the quality of red chili paste thus the consumer perception of the product is preferred over the control treatment.

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