

Effect of different pretreatments on dried chilli (*Capsicum annum L.*) quality

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Abstract. Chilli (*Capsicum annum L.*) has significant price fluctuation. When the chilli price is declined, it causes food waste from unsold chilli. Therefore, drying chilli is a solution for this condition. Furthermore, it can be processed for various product like chilli powder, chilli sauce, etc. The aim of this study was to investigate the effect of different pretreatments on dried chilli quality. Chilli was blanched with hot water and steam before drying. The purpose of this pretreatments is to inactivate enzyme that prevents color and vitamin C losses. The quality parameters were moisture content, colour, vitamin C content, and capsaicin. Changes were observed by gravimetry method for moisture content, chromameter in L* a * b * colour model, and iodine titration for vitamin C. After drying for 20 hours at 60°C, chilli with steam blanching pretreatment dried rapidly than other samples. Unpretreated chilli had higher vitamin C content and better color than blanched chilli.

1. Introduction

Chilli (*Capsicum annum L.*) is one of the potential commodities in Indonesia. It has been cultivated over past decades and has high economic value, because it widely used in Indonesian cuisines as raw material [1]. Unfortunately, chilli as commercial vegetables in Indonesia, has significant price fluctuation. When the price is low, it causes food waste from unsold chilli. Drying chilli is a solution for this situation. Furthermore, dried chilli can be processed for various products like chilli powder, chilli sauce, etc.

Indonesia has standard quality for dried chilli as raw material of food and pharmaceutical industries. Chillies contain capsaicin which has health benefiting and gives strong spicy flavour. Moreover, capsaicin has anti-bacterial, anti-carcinogenic, analgesic and anti-diabetic properties [2]. Chillies are also good sources of vitamin A and C, and rich in β -carotene and minerals that are essential in body requirement [3]. Basically, it is the main reason to dry the chilli in an appropriate method to produce good quality (colour and pungency) dried product [4].

Pretreatment methods can minimize the reduction in the nutritional quality of the dried food products [5]. It normally uses thermal treatments of various time–temperature combinations for the inactivation or decrease in number of microorganisms in order to develop safe products with a long shelf-life. Pretreatments require unit operations of heating (e.g. cooking, boiling, blanching) like final



heat treatments such as pasteurization and sterilization [6]. Blanching is the common pretreatment prior to drying of fruits and vegetables. The thermal blanching can improve β -carotene content and inactivate oxidative enzyme which prevent greater losses during drying process [7]. Recommended medium for blanching are hot water and steam. Hot water and steam blanching are adequate to inactivate peroxidase [8]. The right choice of temperature-time combination of blanching can optimize and control the quality of end product. Low temperature blanching in range 55-75°C has made improvement to firming effect for reducing physical breakdown and sloughing during further processing, and maintaining the texture [9].

Therefore, the objectives of this study were to investigate the effect of different pretreatments method of water and steam blanching method on dried chilli quality. Both hot water and steam blanching were assumed the suitable method that can be applied in small medium farmer.

2. Materials and Methods

2.1. Materials

Fresh chilli of good quality were obtained from local market then washed with tap water, packed in plastic bag and stored in a refrigerator at a temperature 5°C to reduce the biological and respiratory activities until experiment. The moisture content of fresh chilli was 80-90% (w.b) by using an oven (thermogravimetry) at 105°C.

2.2. Pretreatments

The following treatments used for red chilli before drying are

- Blank (B): Untreated sampel
- Water blanching (WB): chillies were soaked in a hot water bath at 90°C for 3 min and drained to remove excess water
- Steam blanching (SB): chillies were steamed using boiling water for 5 min.

2.3. Drying procedures

A laboratory hot-air dryer (Memmert, UN55, Germany) was used to dry chilli, both treated and untreated samples. The temperature and velocity of the dry air were kept constantly at 60°C and 2.0 m/s respectively. Temperature was monitored using a type-T thermocouple. The drying process was conducted for 20 hours. After drying process finished, the sample was placed in a desiccator for cooling down temperature prior to pack in an aluminum foil, and then kept in a desiccator for further quality evaluations.

2.4. Quality parameters (physical and chemical test)

The effects of pretreatment methods on dried chilli quality were determined. The average moisture ratio (MR) was calculated using Eq. (1):

$$MR = \frac{M - M_e}{M_0 - M_e} \quad (1)$$

Where M is sample moisture content (d.b.), M_0 is initial moisture content (d.b.), and M_e is the equilibrium moisture content.

Surface colors of dried chilli were measured using a chromameter. Color was expressed in CIELAB, i.e., L^* (whiteness or brightness), a^* (redness/greenness) and b^* (yellowness/blueness) coordinates. A rectangular CIELAB system (L^* , a^* , and b^*) was measured, and color difference (ΔE) were calculated [10]. Furthermore, vitamin C content was measured according to iodine titration method.

Analysis of variance (ANOVA) was carried out using the SPSS 19.0 software. The results were expressed and plotted as the mean value \pm standard deviation (SD). ANOVA tests were performed for all experiments at 95% confidence interval. Mean differences in the treatments were tested for significance using the one way ANOVA and where significant differences were observed, the Duncan Multiple Range test (DMRT) was used to separate the means.

3. Results and Discussion

The physical and chemical qualities of all dried chilli with different pretreatment methods were compared to the fresh chilli. The drying curve (moisture ratio versus time) for the drying of pretreated and untreated chilli at 60°C are shown in Figure 1. The initial average moisture content of fresh chillies were 75-83%. After dried for 20 hours, the final moisture content were significantly different among the samples ($P < 0.05$). Average moisture content of dried chilli were 8.76, 23.03 and 10.203% for SB, WB and B respectively. WB had longest drying time because absorption of moisture and solutions during the blanching [11]. Drying process for steam blanching chilli faster than hot water blanching method. This is in similiar to the result obtained for bell pepper drying [5] that steamed sample has shorter drying time. Moisture content has great impact to physic quality of chilli. Mould should grow easily when moisture content was above 11% and colour loss occure when moisture content was below 4% [12]. This is also recommended for Indonesian dried chilli as regulated according to Indonesian National Standard (SNI 01-3389-1994), that standard quality of dried chili moisture content is below 11%.

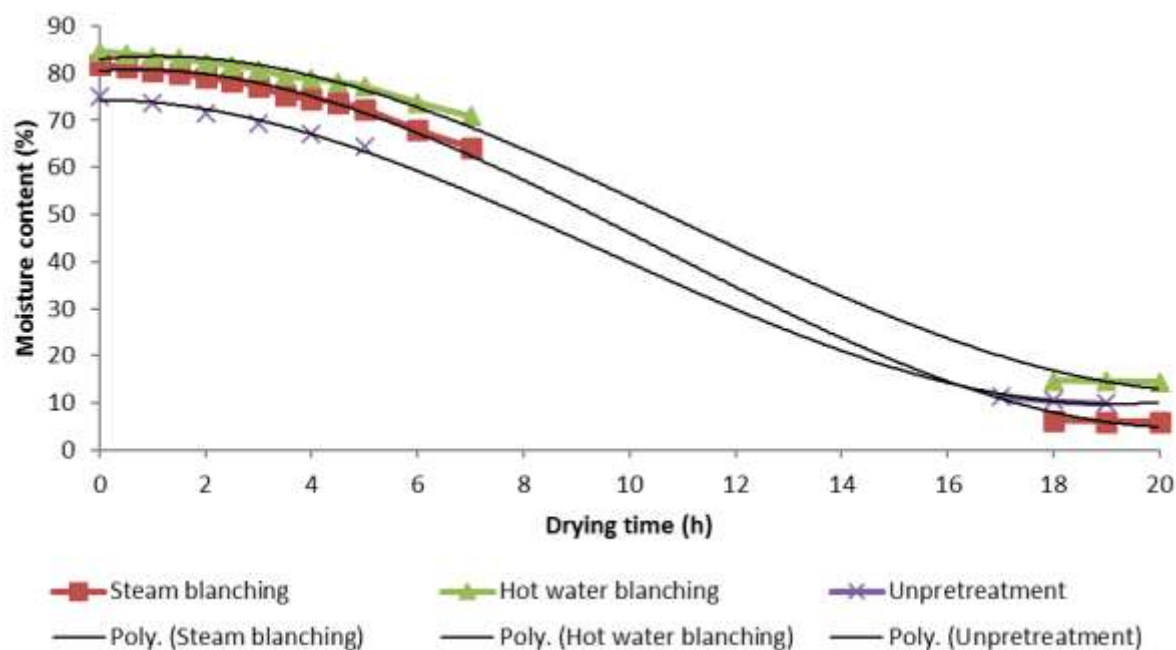


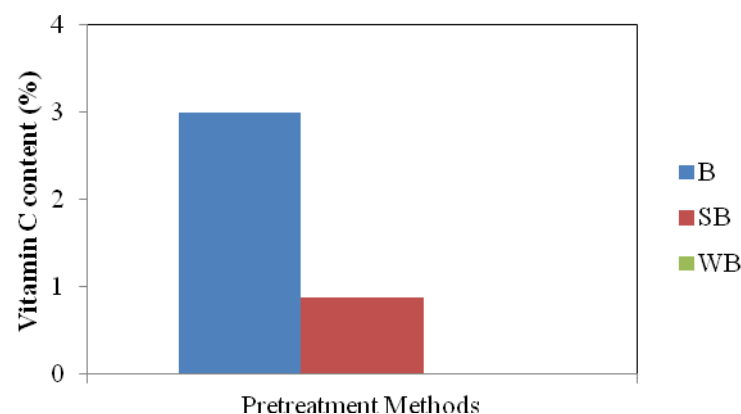
Figure 1. Effects of different pretreatment methods on drying time

The effect of different blanching methods on the colour qualities of dried chilli at 60°C is shown in Figure 2 and Table 1. It was shown that the L^* values of all dried chilli ranged from 30.675 to 35.575. The a^* values ranged from 23.95 to 32.69 and the b^* values ranged from 17.64 to 29.195. The brightness values of dried chilli with water blanching are higher than fresh chilli. The steam blanching pretreatments and untreated sample resulted in lower brightness values than fresh chilli. The values of redness decreased at varying method of pretreatments, except water blanching method. The values of yellowness increased at all method of pretreatment, especially for water blanching method (significantly different, $P < 0.05$). Although, the yellowness value are not desirable for high quality chilli variable [13]. The total color difference (ΔE) was found to be lowest for untreated samples. In the other hand, the dried chilli sample with all pretreatment methods had higher color difference than untreated sample ($P < 0.05$).

Table 1. The color values of fresh and dried chilli

Sample	Lightness (L)	Redness (a*)	Yellowness (b*)	ΔE
Fresh chilli	34.89 ± 0.106^a	32.69 ± 5.133^b	17.64 ± 3.75^b	0
Dried chilli (B)	32.80 ± 0.014^b	30.35 ± 0.120^{ab}	22.55 ± 0.028^b	5.83 ± 0.019^a
Dried chilli (WB)	35.58 ± 0.035^c	32.64 ± 0.177^b	29.19 ± 0.007^a	11.58 ± 0.004^b
Dried chilli (SB)	30.68 ± 0.007^d	23.95 ± 0.014^a	20.25 ± 0.057^b	10.05 ± 0.03^c

Vitamin C content of dried chilli of all treatments were significantly different ($P < 0.05$) and were shown in Figure 2. Untreated chilli has higher vitamin C content than others and water blanching chilli got a big losses of vitamin C content. This losses were caused not only by drying process but also pre-drying treatments. The important parameters that affect the vitamin C degradation were temperature and time [14]. Dried cumari peppers and vitamin C losses occur during convective drying from 32 to 68% in all treatments. It prove that vitamin C degradation increased with increasing temperature in the convective drying [15]. It occurred because of destruction or losses of some structure as a effect of heat application [16].

**Figure 2.** Effects of different pretreatment methods on vitamin C content

4. Conclusion

The drying time for water blanching pretreated chilli was longer than others and significantly different, because water blanching causes moisture absorption into the sample. In addition, it had highest color difference and vitamin C losses. Pretreatment methods of SB and WB, affect the lightness, yellowness, color difference, vitamin C content and drying time in all dried chilli. Steam blanching pretreatment was the best predrying method because it can maintain the vitamin C content and color of chilli. Moreover, it had lowest moisture content after drying process for 20 hours.

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