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The Effect of Blanching and Drying Process to the Quality of Capsicum Frutescens L.

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Abstract
Capsicum frutescens L. contain a large vitamin C, which is easily changed by the temperature and time of processing. Factors such as blanching temperature (80°C - 85°C - 90°C), blanching time (2 minutes - 4 minutes - 6 minutes - 8 minutes - 10 minutes) and drying temperature (50°C - 55°C - 60°C) were surveyed. The results showed that blanching at 80°C for 4 minutes is optimal when that amount of vitamin C loss of about 19.4% and organoleptic norms such as color, texture, and smell good. According to the Vietnamese standard TCVN 3215-79 of the product reaching 18.7/ 20 points and classified as good, the overall sensory score was assessed. The product is then dried when the drying temperature at the optimal temperature is 55°C; the drying time is about 11 hours to get the dried chili product with the moisture content of 8% storage, the loss of vitamin C is about 89.7 % compared with blanching, the product's overall organoleptic score reached 18.1, then the product was classified as good.
Key Words*: Blanching, Capsicum frutescens L., vitamin C*

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I. INTRODUCTION

In our country, the area of Capsicum frutescens L. cultivation is concentrated at about 3000 hectares. Capsicum frutescens L. are mainly cultivated in the central and southern regions, provinces such as An Giang, Tien Giang, Tra Vinh, and especially Dong Thap. Paprika products are currently ranked first in vegetable products - spices exported. Vitamin C ingredients in 100g of fresh Capsicum frutescens L. reached 143.7mg reaching nearly 200% of the recommended daily needs, and Vitamin A reached 952IU equivalent to 32% of recommended daily requirements. The use of flavoring additives and nutritional value to Vitamin C from natural sources is perfect for health [1]. Vitamin C plays a significant role in preventing the production of free radicals, maintaining collagen, transporting fats, increasing iron absorption, increases resistance, preventing flu [2], while acting directly in cells and indirectly by reproducing vitamin E, the main antioxidant of cell membranes. Vitamin C is also involved in producing several neuro-mediates, such as maintaining alertness, attention, and concentration. When the body is deficient in vitamin C will appear pathological symptoms such as bleeding in the gums, teeth, pores, or internal organs. Therefore it is necessary to replenish the required amount of vitamin C for the body. The need for vitamin C varies depending on many factors: age, working conditions, occupation, climate [3]. According to the U.S. Food and Nutrition Council, the need for vitamin C for adult men is 90 mg/day and for adult women, it is 75 mg/day [4].

Blanching is commonly used before freezing, canning, or drying fruits and vegetables to inactivate enzymes; texture improvement; retain color, flavor and nutritional value; reduce pathogens and bacteria counts, and prolong the shelf life of food [5]. Capsicum frutescens L contains the enzymes polyphenol oxidase and peroxydase. It is easy to oxidize polyphenol compounds to form a black fluorbafen, reducing agricultural products' dried sensory value. Therefore, inactivation of these enzymes is necessary to give vegetables a brighter color in subsequent processing. Blanching agricultural ingredients before processing also helps to kill some of the less heat-resistant microorganisms that stick on the raw materials' surface. Besides, it is also essential to pay attention to the loss of Vitamin C and color, texture, and taste. It is highly susceptible to change by temperature and blanching time. These two factors are adjusted according to size, material properties and processing

requirements.

The process of blanching with hot water or by steam is commonly used at a temperature of 75°C ÷ 100°C for ÷ 15 minutes [6].

During drying by the hot drying method, the factor affecting products' quality is the drying temperature. If the product temperature during drying is higher than 60°C, the protein is deformed. If over 90°C, fructose begins to be caramelized, polymerized high molecular compounds. At even higher temperatures, vegetables can burn. Vegetables require a mild drying regime (low temperature). Drying temperatures for agricultural products usually range from 50 ÷ 70°C. [7] The drying method's downside is that the drying product is often deformed, and the quality is not high [6], which can be limited by the appropriate blanching method.

On the basis of abundant material with nutritional components and especially vitamin C, method of blanching combined drying can bring good effect for the product; this study surveyed to determine the parameters some of the blanchings and drying to produce the appropriate product quality dried chili organoleptic and nutritional ingredients remain at the highest level.

II. MATERIALS AND METHODS

2.1 Materials

2.1.1 Chemicals

HCl, Starch: Origin: China

KIO_3, KI: supplied from Sigmaaldrich Canada.

2.1.2 Capsicum frutescens L.

Capsicum frutescens L. is bought from the same field in Luong Hoa commune, Chau Thanh district, Tra Vinh province. Capsicum frutescens L. is ripe, intact, and not crushed.

2.2 Methods

2.2.1 Analytical methods

Vitamin C analysis: Use a standard method with KIO3/KI 0.001 N based on the starch pool rest play color change.

Principle: Vitamin C is an unsaturated compound containing the endiol (OH) C = C (OH) group, which is easily reversible redox, destroyed rapidly under the effect of oxidizing agents, and is stable on the lips Acid field. Therefore, vitamin C can be quantified by titration with iodine with the following reaction equations:

$KIO_3 + 5KI + 6HCl \rightarrow 3I_2 + KCl + 6H_2O$

$KIO_3 + 5KI + 6HCl + 3C_3H_8O_6 \rightarrow 3C_6H_8O_6 + 6KCl + 3H_2O + 6HI$

Assessment of sensory quality according to TCVN 3215 - 79: Evaluation of criteria: Color, structure, odor with 5 descriptive points corresponding to point 5 is the best, point 3 is the average quality level corresponding to for each sensory index, the critical coefficients corresponding to the sensory indicators are 2.5 - 1 - 0.5 respectively, here the vital coefficient of the color index is appreciated because it is a straightforward indicator. Most of the sensory quality of Capsicum frutescens L product is changed and decided. After calculating the overall score, the importance factor is multiplied, comparing the corresponding score to conclude the quality level of the product:

Bảng 1. The basis for quality classification is according to TCVN 3215-79

Quality	Excellent	Good	Average	Below average	Poor	Damages
Common point	18.6 ÷ 20.0	15.2 ÷ 18.5	11.2 ÷ 15.1	7.2 ÷ 11.1	4.0 ÷ 7.1	0 ÷ 3.9

Forensic determines the humidity: Use the cooling method in 105°C to the quantum mass, first scrub the potter and dryer to the cube, and select the weight mass of cups. Then crush the template to the gravitational mass, and stabilize the body, and stabilize the body of the body. First (w1). Then bring the dryer to the non-change mass. Calculate humidity (W) following protocol:

$$w = \frac{w1-w2}{w1} \times 100\ (\%)$$

2.2.2 Data processing methods:

The method of selecting the optimal parameters: using ANOVA variance analysis method to test the reliability with the 5% significance level (p-value <0.05), using STATGRAPHICS®Centurion XV statistical software.

2.2.3 Experimental layout method

The experiments were arranged entirely randomized, with 3 replicates as shown in Table 2 and Table 3

Table 2. *Experiment 1: Survey the effects of blanching on the sensory quality and vitamin C content of the product*

Temperature	**Time**				
	B1(2 minutes)	B2 (4 minutes)	B3 (6 minutes)	B4(8 minutes)	B5 (10 minutes)
A1(80°C)	A1B1	A1B2	A1B3	A1B4	A1B5

A2(85°C)	A2B1	A2B2	A2B3	A2B4	A2B5
A3(90°C)	A3B1	A3B2	A3B3	A3B4	A3B5

Fixed factor: Each sample 50g Capsicum frutescens L.
Variable factor: Temperature and blanching time.
Evaluation criteria: Vitamin C content and sensory quality.
Total number of treatments: 3 × 5 = 15; Total number of experimental units: 15 × 3 = 45

Table 3. *Experiment arrangement 2: investigating the effect of drying temperature on the sensory quality and vitamin C content of the product*

Factor	**Treatments**		
Dry temperature	C1(50°C)	C2 (55°C)	C3 (60 °C)

Fixed factor: the weight of Capsicum frutescens L. sample: 50g, the moisture content of Capsicum frutescens L. at the end of the drying process was 8%.
The variable factor: factor C (drying temperature). Total number of treatments: 3
Evaluation criteria: Vitamin C content and sensory quality.
Total number of experimental units: 3 × 3 = 9

III. RESULTS AND DISCUSSION

3.1 Effects of blanching on the sensory quality and vitamin C content of the product

Experimentally, the temperature and duration of blanching have a significant effect on the sensory quality of and vitamin C content of Capsicum frutescens L, as shown in Table 4 and Table 5. When the blanching temperature rises from 80°C to 90°C, Capsicum frutescens L sensory scores gradually decrease. There is a meaningful difference between them, corresponding to the sensory score fell from 16.7±1.9 to 15.1 ± 1.9 points on a scale of 20. In addition, the percentage of vitamin C losses also increased from 27.6 ± 15.9% to 37.4 ± 12.7%. The loss of vitamin C is not durable with heat, pH, metal ions, and light sensitivity, and can be decomposed by ascorbic acid [8]. Therefore, the use of temperature for enzyme inactivation needs to pay attention to keeping the sensory quality and nutritional composition of agricultural products, especially vitamin C, because vitamin C is often chosen as a nutrient to assess the loss of nutrients during blanching. The preservation of vitamin C after blanching is a good index for the conservation of other nutrients.

Besides the temperature factor, blanching time also significantly affects the organoleptic quality and vitamin C content. When blanching at a high temperature and short time, it leads to higher vitamin C retention. Specifically, when blanching at 80°C for 10 minutes, vitamin C loss was 43.13%, while blanching at 90°C for 2 minutes, vitamin C loss was 19.67%. Therefore, the blanching process should not be to blanch at too high temperatures for a long time to stabilize agricultural products' color and structure, clean the surface of agricultural products, and destroy enzymes, especially chemical enzymes. Brown in agricultural products while retaining the sensory properties and maintaining the nutritional profile of farming products.

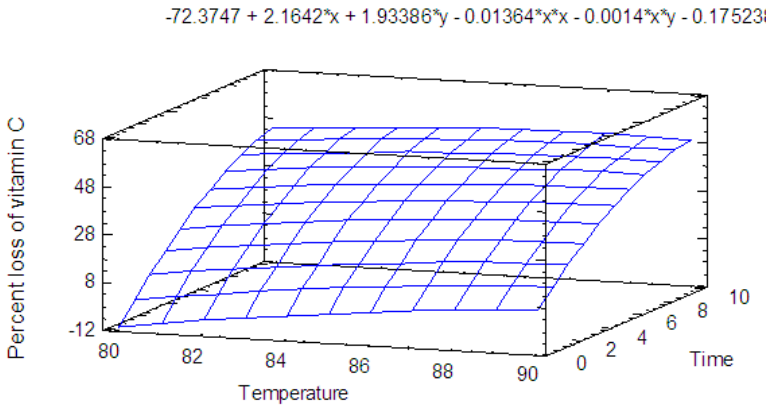

Figure 1: Sensory assessment score by temperature and blanching time

Table 4. Effects of blanching on the sensory quality of Capsicum frutescens L.

Temperature (°C)	**Time (Minutes)**					**Average**
	2	4	6	8	10	
80	16.07	18.86	18.50	15.50	14.50	16.7 ± 1.9^{a}
85	15.14	18.07	18.14	15.07	14.64	15.1 ± 1.7^{b}
90	14.64	17.07	17.00	13.57	13.00	15.1 ± 1.9^{c}

Average	15.2 ± 0.7 [b]	18.0 ± 0.9[a]	17.9 ± 0.8[a]	14.7 ± 1.1[b]	14.1 ±0.9[b]

Table 5: *Effects of blanching on% of vitamin C loss in Capsicum frutescens L.*

Temperature (°C)	**Time (minutes)**					
	2	**4**	**6**	**8**	**10**	**Average**
80	3.86	19.42	34.72	37.01	43.13	27.6 ± 15.9[a]
85	16.36	24.26	38.54	44.92	51.04	35.1 ± 14.4[ab]
90	19.67	32.42	42.62	39.82	52.57	37.4 ± 12.7[b]
Average	13.30 ±8.34[a]	25.37 ±6.57[b]	38.63 ±3.95[c]	40.58 ±4.01[c]	48.91 ±5.06[d]	

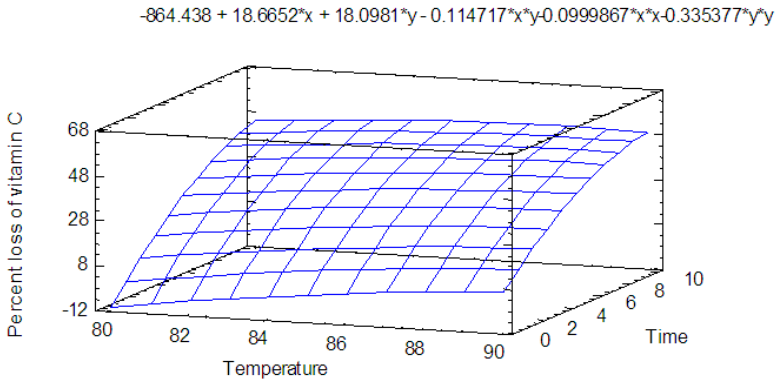

Figure 2. Percent loss of vitamin C according to temperature and blanching time

3.2 Effect of drying temperature on sensory quality and vitamin C content of dried Capsicum frutescens L.

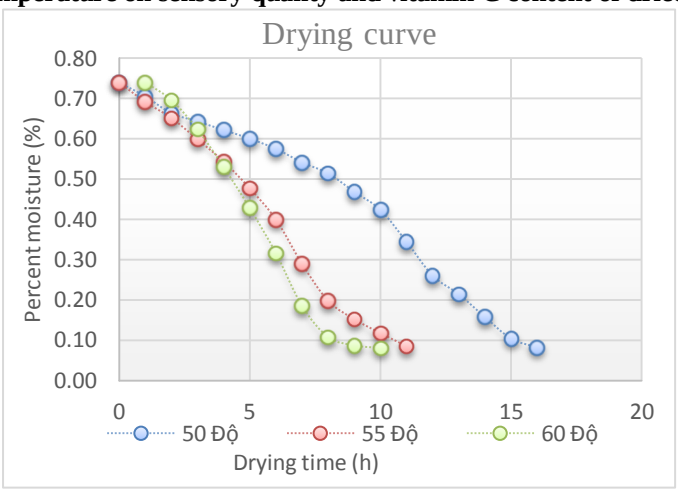

Figure 3. Effect of drying time on the moisture content of dried Capsicum frutescens L. product

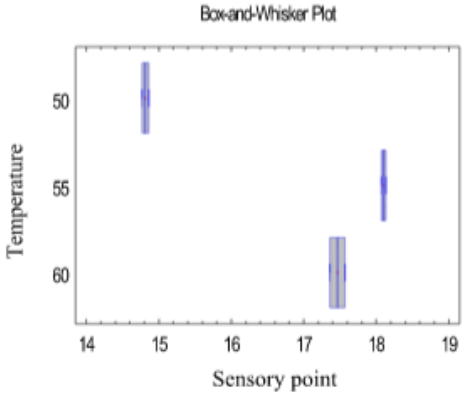

Figure 4. Effect of drying temperature on sensory point of Capsicum frutescens L.product

Table 6. Effects of drying temperature on sensory scores and vitamin C content of Capsicum frutescens L.product

Drying temperature (°C)	50	55	60
The overall sensory score on the total score is 20	14.81 ± 0.07^{c}	18.10 ± 0.04^{a}	17.46 ± 0.15^{b}
vitamin C content of Capsicum frutescens L.product (mg/50g samples)	4.84 ± 0.27^{b}	5.92 ± 0.26^{a}	5.29 ± 0.19^{b}

Table 6 shows that the difference in vitamin C loss of Capsicum frutescens L. at different air temperature is statistically significant. Capsicum frutescens L. contain 57.5 ± 2.2 mg of vitamin C / 50 g of sample.

At a temperature of 50°C, losses of about 91.6% compared to the original Capsicum frutescens L. sample, the highest of the three temperatures is due to long-term drying, so more exposure to air oxygen at this time vitamin C will be oxidized converted into dehydroascorbic acid.

At 60°C, the loss is about 90.8% because the high drying temperature increases the decomposition rate of vitamin C

Drying at 55°C lost about 89.71%, and the difference was statistically significant compared with drying at 50°C and 60°C. Because at this temperature, the drying time is shorter than drying at 50°C, so the exposure to oxygen to the air is reduced, and the drying process at this temperature is lower at 60oC, causing the decomposition rate of vitamin C under the temperature is also less.

The thermal stability of vitamin C depends on the drying temperature. As the processing temperature increases, the decomposition rate of vitamin C also increases. It can be seen that the higher the drying temperature, the longer the drying time, the lower the amount of vitamin C retained. It can be explained that vitamin C is an index of low stability during heat treatment [9].

Vitamin C's temperature depends on the cooling temperature, when the temperature increases the vitamin C molecules. The longer the heat dryer is rising, the longer the vitamin C stays low. It can explain that vitamin C is just some low levels of steady levels in the process.

IV. CONCLUSIONS

Blanching has a good effect on moisture evaporation for the drying process, destroying enzymes, suspending biochemical activities, and limiting color changes due to the enzyme polyphenol oxidase activity. Blanching at high temperatures for a long time harms the nutritional content, especially vitamin C, product texture, and reduces the sensory effect of dried chili products. Therefore, it is essential to consider the correlation between enzyme inactivation and keeping the produce less nutrient loss, less undesirable color changes, and texture degradation of the product. The study results can be applied in the manufacture of Capsicum frutescens L. products or as a basis for preserving and processing other products from Capsicum frutescens L.

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