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The Effect of Red Chili Drying Techniques in Making Bangkok Powder Sauce on Sensory Quality and Total Dissolved Solids

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Abstract

The present study aims to analyze the effect of drying techniques for red chili peppers in the production of powdered Bangkok sauce on sensory quality and total soluble solids. The research was conducted at the Food Processing Laboratory, with the experimental period running from December 2024 to August 2025. The research method applied was experimental, employing sun-drying, oven-drying, and dehydrator techniques for the chili peppers. Sensory quality analysis results showed a significant effect on color when chili drying was done using a dehydrator (α=0.05), whereas no significant effect was detected for chili aroma, texture, spicy taste, sweetness, or chili seed grain attributes. Hypothesis testing for total soluble solids (TSS) using ANOVA indicated a significant difference in sugar content due to drying methods, with the dehydrator technique resulting in 20.23°Brix. Duncan's analysis demonstrated that the dehydrator drying technique had a significantly greater effect compared to the other methods. Salt content analysis for TSS using ANOVA and Duncan also showed a significantly higher result for the dehydrator method, with 19.53°Brix. Overall, the dehydrator drying technique produced the best quality results.

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1. INTRODUCTION

In recent years, the food industry has experienced significant growth. The demand for convenient, easy-to-prepare foods with long shelf lives has increased as a result of lifestyle changes in cities, which are often rapid and dynamic (Statista, 2024). The popularity of Bangkok sauce globally has opened up opportunities for the development of powdered forms, especially considering the challenges in distributing liquid products, which have remained a challenge. International regulations, particularly in the logistics and aviation sectors, limit the volume of liquids that can be shipped across borders (*International Civil Aviation Organization* (ICAO), 2023), thus hampering market penetration of liquid sauce products. Liquid products generally have a shorter shelf life, are susceptible to microorganism contamination, and require additional preservatives that can affect the sensory quality of the product (Winarno, 2004).

One innovative solution to address this challenge is the transformation of liquid sauce into a dry-based powder form, using a drying process to process the main raw material, red chilies. However, improper drying techniques can lead to color degradation and the reduction of bioactive compounds (such as capsaicin), as well as changes in the texture and aroma of raw materials (Rahmawati, A., Putri, D., & Sari, 2022).

Bangkok sauce, a type of sauce originating from Thailand, has become popular worldwide for its unique flavor. This sauce is known for its balanced blend of sweet, spicy, and sour flavors. Bangkok

sauce's unique flavor is also derived from key ingredients such as red chilies, sugar, vinegar, and various other traditional spices. Bangkok sauce is commonly used as a seasoning or accompaniment to various dishes, such as fried and grilled dishes, and as a dipping sauce for snacks like spring rolls and fried chicken.

Differences in processing techniques, particularly the drying of raw materials, can affect the physical and organoleptic properties of the final product. Therefore, selecting the right drying technique is crucial for producing high-quality powdered sauce that remains safe, practical, and acceptable to consumers. Some commonly used drying methods include solar drying, oven drying, and dehydrator drying, each with its own advantages and disadvantages. Each drying technique results in different levels of water loss, the physical structure of the ingredients, and the intensity of color and aroma. Therefore, research is needed to compare these techniques with the final product of powdered Bangkok sauce.

2. MATERIALS AND METHODS

This research was conducted at Jakarta State University in July 2025. The subjects of this research were students majoring in culinary arts and culinary arts at Jakarta State University. The research sample consisted of 45 students majoring in culinary arts and culinary arts at Jakarta State University. This research used a quantitative approach. The method used was an experiment carried out by making powdered Bangkok sauce using three types of drying techniques, namely the sun drying technique, the oven drying technique, and the dehydrator drying technique as a treatment to observe its impact on sensory quality and total soluble solids.

The materials used in this study were curly red chilies, red cayenne peppers, tomato sauce, granulated sugar, salt, citric acid, garlic powder, cornstarch, and water. The tools used in this study included a digital scale, bowl, cutting board, blender, sieve, saucepan, wooden spatula, spoon, stove, dehydrator, oven, tray, and sauce container.

Data Collection Techniques

The collection of sensory quality data of Bangkok powder sauce using three types of drying techniques, namely sun drying technique, oven drying technique, and dehydrator drying technique, was carried out objectively through organoleptic testing with a hedonic quality test, which was tested on 45 semi-trained panelists, namely students of the Culinary Arts Education study program. Sensory quality testing was carried out on quality attributes consisting of aspects of color, chili aroma, texture, spicy taste, sweet taste, and chili seeds. Each sample was portioned into a 25 ml cup and given a secret code as a treatment marker. Then, the samples were presented to the panelists, where each panelist assessed 1 sample according to its sensory quality, which was adjusted to 5 categories of the assessment scale. The results of the assessment or panelist responses regarding the sensory quality of Bangkok powder sauce using three types of drying techniques, namely sun drying technique, oven drying technique, and dehydrator drying technique on the research instrument sheet that had been provided.

Data collection on total dissolved solids was conducted objectively using a hand refractometer on each sample group, with 3 repetitions. A total of 3 drops of kedondong chili sauce product samples from each treatment were taken using a dropper and dripped onto the glass prism of the hand refractometer. Next, the total dissolved solids value was read on the Brix scale by pointing the hand refractometer lens at a light source. In addition to the Brix scale, measurements were also carried out on the salinity scale to determine the dissolved salt content in the sample. The use of these two scales aims to obtain more comprehensive data on the sugar and salt content of the product. After that, the values read on both the Brix and salinity scales were recorded on the test instrument provided as a data collection medium.

Data Analysis Techniques

The data obtained from the research results on and total dissolved solids were analyzed statistically using parametric data analysis through a one-way ANOVA (Analysis of Variance) test with a significance level of 0.05 to determine whether or not there was an effect of the applied treatment. If there was an effect, the analysis was continued with a significant difference test through the Duncan Multiple Range Test (DMRT) test with a significance level of 5% to determine which treatment was significantly different. Data from the organoleptic test results with the hedonic quality test were analyzed statistically using a non-parametric test, namely the Kruskal-Wallis test, to determine whether or not there was an effect caused by the application of sun, oven, and dehydrator drying techniques on red chilies as treatments. If the results obtained showed a significant effect, the analysis was continued with Tukey's test to determine which treatment was different. Data analysis was carried out using SPSS software version 27 for Windows.

3. RESULTS

Sensory Quality Test

Organoleptic Test

1) Color Aspect

Rating Scale	**Score**	**Treatment**					
		Sun		**Oven**		***Dehydrator***	
		n	**%**	**n**	**%**	**n**	**%**
Bright Red	5	9	60	6	40	13	86,6
Red	4	6	40	8	53,3	2	13,3
Dark red	3	-	-	1	6,7	-	-
Brownish Red	2	-	-	-	-	-	-
Blackish Red	1	-	-	-	-	-	-
Number (N)		15	100	15	100	15	100
Rate-Rate		4,6		4,3		4,9	

The calculation results show that the drying treatment dehydrator had an average value of 4.9. The color of the samples approached bright red. The sun-drying treatment had an average value of 4.6, which was closer to the bright red category. The oven-drying treatment had an average value of 4.3, which was closer to the red category.

2) Aroma Aspects of Chili

Rating Scale	**Score**	**Treatment**					
		Sun		**Oven**		***Dehydrator***	
		n	**%**	**n**	**%**	**n**	**%**
Very strong	5	3	20	6	40	4	26,7
Strong	4	8	53,3	5	3,33	9	60
Quite Strong	3	4	26,7	4	26,7	2	13,3
Not strong	2	-	-	-	-	-	-
Very Weak	1	-	-	-	-	-	-
Number (N)		15	100	15	100	15	100
Rate-Rate		3,9		4,1		4,1	

The calculation results show that sun drying has an average value of 3.9. The results for these samples approach the strong aroma category. Meanwhile, oven drying and dehydrator had an average value of 4.1. The chili aroma in this sample approached the strong category.

Texture Aspect

Rating Scale	Score	Treatment					
		Sun		Oven		*Dehydrator*	
		N	%	n	%	n	%
Thick	5	9	60	8	53,3	11	73,3
A bit thick	4	6	40	7	46,7	4	26,7
Not Thick Enough	3	-	-	-	-	-	-
Thin	2	-	-	-	-	-	-
Very Thin	1	-	-	-	-	-	-
Number (N)		15	100	15	100	15	100
Rate-Rate		4,6		4,5		4,7	

The description indicates that the drying dehydrator had an average value of 4.7. The results for this sample were close to the thick category. Sun-drying had an average value of 4.6, which was closer to the thick category. The average value for oven-drying was 4.5, which was closer to the slightly thick category.

3) Spicy Taste Aspect

Rating Scale	Score	Treatment					
		Sun		Oven		*Dehydrator*	
		n	%	n	%	n	%
Spicy	5	2	13,3	2	13,3	1	6,7
Quite Spicy	4	8	53,3	10	66,7	9	60
Less Spicy	3	4	26,7	2	13,3	4	26,7
Not Spicy	2	1	6,7	1	6,7	1	6,7
Not very spicy	1	-	-	-	-	-	-
Number (N)		15	100	15	100	15	100
Rate-Rate		3,7		3,9		3,6	

Tests showed that oven drying had an average value of 3.9, which is close to the slightly spicy category. Sun drying had an average value of 3.7, which is close to the slightly spicy category. The average value of the drying was determined. *Dehydrator* is 3,6, which is closer to the somewhat spicy category.

4) Sweet Taste Aspect

Rating Scale	Score	Treatment					
		Sun		Oven		*Dehydrator*	
		n	%	n	%	n	%
Sweet	5	3	20	4	26,7	3	20
Quite Sweet	4	11	73,3	8	53,3	11	73,3
Less Sweet	3	1	6,7	2	13,3	1	6,7
Not Sweet	2	-	-	1	6,3	-	-
Not Very Sweet	1	-	-	-	-	-	-

Number (N)	15	100	15	100	15	100
Rate-Rate	4,1		4		4,1	

Test values show that sun drying and drying dehydrator had an average value of 4.1. The results for this sample approached the slightly sweet category. Oven-dried samples had an average value of 4, which falls into the slightly sweet category.

5) Chili Seed Grain Aspects

Rating Scale	**Score**	**Treatment**					
		Sun		**Oven**		***Dehydrator***	
		n	**%**	**n**	**%**	**n**	**%**
Big	5	6	40	4	26,7	4	26,7
Currently	4	7	46,7	6	40	10	66,7
Small	3	1	6,7	5	33,3	1	6,7
Very small	2	1	6,7	-	-	-	-
Smooth	1	-	-	-	-	-	-
Number (N)		15	100	15	100	15	100
Rate-Rate		4,2		3,9		4,2	

The results of the organoleptic test showed that sun drying The average value for the drying process was 4.2, which is close to the moderate category. Meanwhile, the oven drying process had an average value of 3.9, which is closer to the moderate category.

Hypothesis Testing

Kruskal-Wallis Test

Testing Aspects	**x count**	**x table**	**Conclusion**
Color	7,158	5,99	$X_{count} > X_{table}$, eye H_0 rejected and H_1 accepted
Chili Aroma	0,792	5,99	$X_{count} < X_{table}$, eye H_0accepted
Texture	1,294	5,99	$X_{count} < X_{table,}$ face H_0accepted
Spicy Taste	0,775	5,99	$X_{count} < X_{table}$, eye H_0accepted
Sweet Taste	0,077	5,99	$X_{count} < X_{table}$, eye H_0accepted
Chili Seeds	1,548	5,99	$X_{count} < X_{table}$, eye H_0 accepted

Tuckey's Advanced Test

Based on the results of the hypothesis test above, it shows that in the color aspect, there is an influence of the comparison of red chili drying techniques in making powdered Bangkok sauce, so it is necessary to continue with a multiple comparison with Tukey's test as follows:

1) Advanced Color Aspect Test

Treatment	Difference	Results
F1 : F2	4,60 – 4,33 = 0, 27 < 0,435	No Real Difference
F1 : F3	4,60 – 4,87 = 0,27 < 0,435	No Real Difference
F2 : F3	4,33 – 4,87 = 0,54 > 0,435	Real Difference

Total Dissolved Solids Test

Measurement of total dissolved solids test was carried out objectively using a hand refractometer with a scale of °Brix and salinity. The results of the total dissolved solids test are described in the following table

1) Sugar Level

Evaluation Aspects	Connected	Treatment		
		Sun	**Oven**	***Dehydrator***
Sugar Level	1	19,8 °Brix	18,6°Brix	20,2°Brix
	2	19,6°Brix	19°Brix	20°Brix
	3	19,5°Brix	19,2°Brix	20,5°Brix
Amount		58,9	56,8	60,7
Rate-rate		19,63	18,93	20,23

The results of the sugar level hypothesis test using ANOVA analysis show that F count > F table, so H_0 was rejected, and there was a significant effect between the treatments tested. Further testing using the Duncan method was conducted to determine which treatment produced a significant difference. These results indicate that the drying method affects the total amount of soluble solids in the product, especially the water-soluble sugar content. The drying method with *dehydrator* able to maintain soluble compounds such as sugar because it uses low and stable temperatures and good air circulation, thereby reducing sugar degradation due to heat and oxidation (Monsalves & Scheuermann, 2023). On the other hand, sun drying that lasts longer and is exposed to light and free air risks increasing the degradation of soluble compounds, including sugar (Sulistijowati et al., 2022).

2) Salt Level

Evaluation Aspects	Connected	treatment		
		Sun	**Oven**	***Dehydrator***
Salt Level	1	19°Brix	19,2°Brix	19,6°Brix
	2	19,2°Brix	19,6°Brix	19,4°Brix
	3	19,2°Brix	19,4°Brix	19,6°Brix
Amount		57,4	58,2	58,6
Rate-rate		19,13	19,47	19,53

The results of statistical analysis using ANOVA on the salt content in Bangkok sauce showed that the calculated F value > F table, so H_0 was rejected, and there was a significant effect between the treatments tested. Based on the results of the Duncan test, it was known that the Bangkok sauce using dried chilies with the drying method of dehydrator showed a significant difference compared to the other two treatments. This treatment had the highest average total soluble solids value of 19.53°Brix. Meanwhile, the sauce using sun-dried chilies had an average value of 19.13°Brix, and the sauce made from oven-dried chilies showed the lowest value at 19.47°Brix.

These results indicate that the drying method affects the total amount of dissolved solids in the product, especially the content of water-soluble salts. The drying process causes a reduction in water content so that solid components, such as minerals, will be more concentrated (Winarno, 2004).

4. CONCLUSION

Referring to the results of research that has been carried out on the effect of drying red chilies in Bangkok sauce powder by drying red chilies in the sun, oven and *dehydrator* was found that the best drying technique was the drying technique of *dehydrator*. With this method, the red chilies produced are better in terms of color, where the red color of the chilies is more stable and does not experience much browning.

Based on the results of sensory quality tests carried out on the manufacture of powdered Bangkok sauce using sun, oven, and drying techniques of a *dehydrator*. The results showed an effect on color. The results of the hypothesis test on color in sensory quality indicated that H1 was accepted, so further testing was conducted using Tukey's test. Meanwhile, no significant effects were detected on chili aroma, texture, spiciness, sweetness, and chili seed size, so no further testing was conducted.

Based on the results of the total dissolved solids test in the manufacture of powdered Bangkok sauce using sun, oven, and drying techniques of a *dehydrator*, shown that there is an influence of sugar content and salt content based on ANOVA and Duncan analysis. The influence is found in the drying technique of the *dehydrator in* making powdered Bangkok sauce.

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