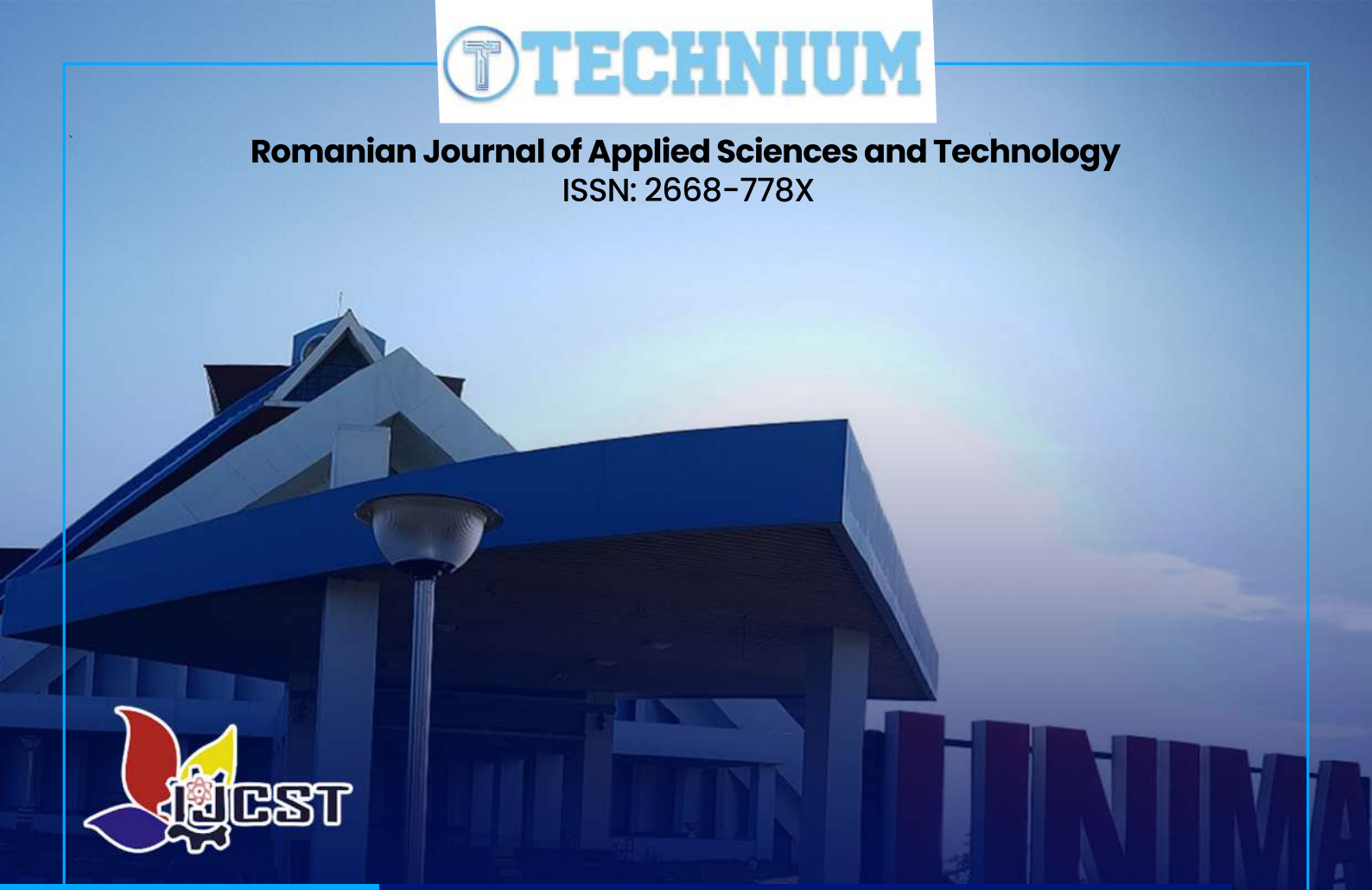
TECHNIUM

Romanian Journal of Applied Sciences and Technology
ISSN: 2668-778X



vol. 16 / 2023

The 7th International Conference on Science Technology

organized by
Faculty of Social Science and
Law Universitas Negeri Manado and
Consortium of International Conference
on Science and Technology

The Innovation Breakthrough in Digital and Disruptive Era

Technium: Romanian Journal of Applied Sciences and Technology
Vol. 16, 383-387, October, 2023
ISSN: 2668-778X
www.techniumscience.com

The effect of drying time on the characteristics of Bandeng Sapit during storage at room temperature

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Abstract. Bandeng Sapit is processed milkfish that is baked and smeared with spices made using sapit. The simple processing causes the shelf life of Bandeng Sapit to be very short. The drying process is one of the solutions to increase the shelf life of Bandeng Sapit. The objective of this research was to evaluate the effect of drying time on the characteristics of milkfish during storage at room temperature..This study used a *Completely Randomized Design* (CRD) factorial pattern with two factors and two replications. Factor I: drying time (5 hours, 6 hours, 7 hours) and factor II : storage time (2 days, 4 days, 6 days). Data were analyzed using *Analysis of Varians* at 5% level and then using *Duncan's Multiple Range Test* (DMRT). The results showed that Bandeng Sapit with a drying time of seven hours and storage at room temperature for two days was safe and suitable for consumption, with characteristics of water content 53.21%, water activity 0.86, total microbes 5.19 CFU/gr, TBA value 1.7469 mg eq/kg, TVB-N 4.6267 mg/100gr, texture 4.6267 mm/10sec/50gr.

Keywords: Milkfish, drying time, storage time

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Technium: Romanian Journal of
Applied Sciences and Technology
Vol. 16, 383-387, October, 2023
ISSN: 2668-778X
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1 Introduction

Milkfish (*Chanos chanos*) is a fish that lives in brackish water and is mostly cultivated in ponds. One of the milkfish producing areas in East Surabaya is Gunung Anyar Tambak, which is located on the east coast of Surabaya. Utilization of milkfish as processed Bandeng Sapit is a product that is not widely known by the public, especially residents of the city of Surabaya.

Bandeng Sapit is milkfish seasoned with spices and cooked by grilled [1]. Bandeng Sapit at Barokah's Group is only produced if there is an order from a buyer. Bandeng Sapit that has been processed and grilled with half wet spices have a short shelf life.

The simple process of Bandeng Sapit processing causes a very short shelf life. The drying process is one of the solutions offered to increase shelf life [2]. Even though the grilling process has been carried out in the processing, bandeng sapit is a semi-wet product that still requires drying treatment, so it can have a drier texture and can be stored longer. The objective of this research was to evaluate the effect of drying time on the characteristics of milkfish during storage at room temperature

2 Research Methods

2.1 Material

Bandeng Sapit weighing between 240-270 grams obtained from Barokah's Bandeng Sapit Group, Gunung Anyar Tambak Surabaya.

2.2 Equipment

Cabinet dryer, water bath, laminar flow, incubator, cawan petri, autoklaf, oven, micropippet, vortex, magnetic stirrer, soxhlet,, erlenmeyer, spektrofotometer, penetrometer..

2.3. Methods

This study used a *Completely Randomized Design* (CRD) factorial pattern with two factors and three replications. Factor I was drying time (5 hours, 6 hours, 7 hours) and factor II was storage time (2 days, 4 days, 6 days). Data were analyzed using *Analysis of Varians* at 5% level and then using *Duncan's Multiple Range Test* (DMRT) [3].

2.4 Procedure

Whole milkfish weighing 240-270 gr, was dried in a cabinet dryer at 70^0C for 5, 6 and 7 hours. After the drying process is complete, the product is packaged using polyethylene (PE) plastic. stored at room temperature (27^0-30^0C) for 2, 4, and 6 days. Further analysis of water content, water activity (Aw), total bacteria, fat damage (TBA value), protein damage (TVB-N), texture/hardness.

3 Results and Discussion

3.1 Water Content

The result of statistical analysis shows that there was a significant interaction ($p \leq 0.05$) between the drying time and storage time on the water content of bandeng sapit, and each treatment had a significant effect. The average water content of bandeng sapit ranges from 53.21-75.17%.

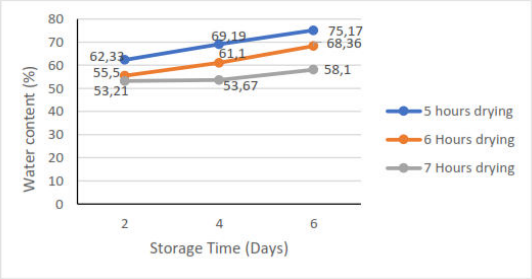

Fig. 1. Effect of drying time and storage time on the water content of Bandeng Sapit

Figure 1 shows that the longer the drying time, the water content of bandeng sapit decreases, and the longer the storage time the water content increases. Drying time affects the decrease in water content of Bandeng Sapit due to the evaporation of water molecules in the material through the drying process. According to [4] the decrease in water content of milkfish is caused by the release of water molecules in the food during the heating process.

The increase in water content of Bandeng Sapit during storage at room temperature is due to the absorption of water molecules around the storage room. According to [5] during storage at room temperature there was an increase in the water content of dried nike fish caused by the conditions of the storage room and the type of packaging material used. Dried nike fish packaged in plastic will absorb moisture, so that it reaches equilibrium with the air humidity in the storage room. If the moisture content of the material is low while the relative humidity of the surrounding air is high, moisture absorption will occur from the air so that the moisture content of the material increases.

3.2 Water Activity (a_w)

Water activity (aw) indicates the amount of free water in food that can be used by microbes for growth. Water activity greatly influences the physical properties and shelf life of food products. Based on statistical analysis, it was found that there was no significant interaction between drying time and storage time on

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milkfish water activity, while each treatment had a significant effect.

Table 1. Water activity of Bandeng Sapit with drying time treatment

Drying time (hours)	Aw
5	0.93 ± 0.01^{c}
6	0.90 ± 0.02^{b}
7	0.89 ± 0.03^{a}

Description: The average value is accompanied by a different letter showed significantly different at $p \leq 0.05$

Table 1 shows that the longer drying time causes a significant decrease in aw ($p \leq 0.05$), because the longer drying time the more free water evaporates. This right is in accordance with [6], which states that drying is an effort to reduce water content and aw.

Table 2. Water activity of Bandeng Sapit with storage time treatment

Storage time (days)	Aw
5	0.89 ± 0.03^{a}
6	0.91 ± 0.01^{b}
7	0.92 ± 0.02^{b}

Description: The average value is accompanied by a different letter showed significantly different at $p \leq 0.05$

The longer storage time causes a significant increase in water activity. The increase in water activity was due to the absorption of water from the surrounding storage environment. [7] stated that the higher water activity during storage was due to the withdrawal of water from the surrounding environment and the formation of H_2O compounds resulting from the decomposition of smoked fish components by microbial and enzyme activity found in fish.

3.3 Total Bacteria

The result of statistical analysis shows that there was a significant interaction ($p \leq 0.05$) between the drying and storage periods, and that each treatment had a significant effect on the total bacteria of Bandeng Sapit. The results showed that the average total bacteria ranged from 5.19 – 7.70 CFU/g.

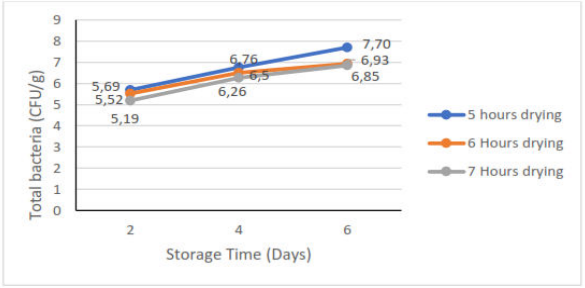

Fig. 2. Effect of drying time and storage time on total bacteria of Bandeng Sapit

The longer total drying time, the total bacteria in Bandeng Sapit decreased. The longer storage time, the total bacteria increased (Figure 2). This is due to the longer drying time can reduce the growth of microorganisms, but the longer storage at room temperature the growth of bacteria increases causing product damage. According to [8], drying is a method of preservation by reducing the water content of food ingredients so as to extend shelf life. The shelf life extension occurs because the activity of microorganisms and enzymes decreases as a result of lower water availability. Meanwhile the total bacteria is smaller than in the satay from previous research [9].

The increase in total bacteria during storage at room temperature is related to the increase in water content and water activity (aw) during storage, where free water is needed for bacterial growth. [10], stated that there was significantly increased bacterial growth in milkfish stored at room temperature (30^0C) for 24, 48 and 72 hours. Storage of processed fishery products at room temperature increases the growth of bacteria thereby accelerating spoilage and product damage.

3.4 Thiobarbituric Acid (TBA value)

TBA value is an index to determine the degree of fat oxidation which is calculated based on the amount of malonaldehyde in meat. The TBA value is one of the parameters that can determine the length of storage of a product. The result of statistical analysis shows that there was a significant interaction ($p \leq 0.05$) between the drying time and the storage time on the milkfish TBA rate, and each treatment had a significant effect.

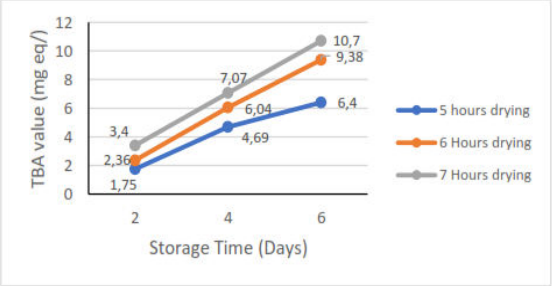

Fig. 3. Effect of drying time and storage time on TBA value of Bandeng sapit

The longer drying and storage, the TBA value of bandeng sapit increases (Fiq, 3). The TBA value shows the degree of fat oxidation from breakdown of fat/oil. The longer the drying process, the higher the oxidation level. Drying temperature and time greatly affect the level of damage to fat/oil. According to [11], drying smoked milkfish using high temperatures affects fat oxidation.

The increase in TBA during storage is due to the high content of unsaturated fatty acids in Bandeng Sapit which makes it easily oxidized. Saturated fatty acids can reduce the quality of fish during storage. [12] stated that an increase in the TBA rate was associated with an increase in peroxide as the initial product for the formation of malonaldehyde. [13] stated that the oxidation process occurs due to contact between

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oxygen and fat which produces fatty acids, then peroxide is further oxidized to form aldehydes in the form of malonaldehyde so that the TBA rate increases.

3.5 Total Volatile Base Nitrogen (TVB-N)

Testing the TVB-N value can determine the freshness of the quality or the decline in the quality of a product, especially fishery products. Determination of TVB-N is by evaporating volatile compounds formed due to the decomposition of amino acids contained in fish meat. Based on the statistical analysis, there was a significant interaction ($p \leq 0.05$) between the drying and storage periods, and each treatment had a significant effect on the levels of TVB-N in bandeng sapit.

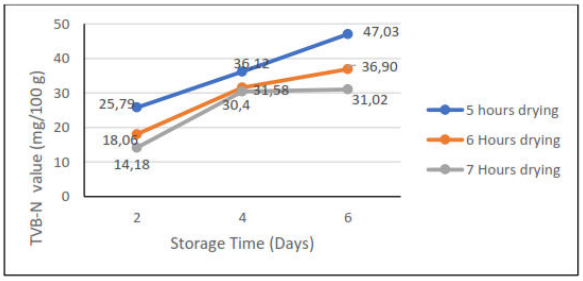

Fig. 4. Effect of drying time and storage time on TVB-N of Bandeng Sapit

The longer the drying time, the TVB-N levels decrease, but the longer the storage time, the TVB-N levels increase in bandeng sapit (Fiq. 4). The decreased levels of TVB-N during drying were due to decreased enzyme activity due to the unavailability of the required sufficient water.

The increase in TVB-N value during storage is due to the influence of bacteria which are able to decompose protein into amino acids. The decomposition process that occurs in fish causes the texture of the fish to not compact and become soft. According [14] increased levels of TVB-N during storage occur due to the overhaul of proteins or amino acids resulting in a number of volatile bases

3.5 Texture (*Degree of Hardness*)

The results of statistical analysis shows that there was a significant interaction ($p \leq 0.05$) between the drying time and storage time on the texture of Bandeng Sapit, and each treatment had a significant effect.

The longer the drying time can reduce the texture where the Bandeng Sapit becomes tougher, however the longer the storage time the texture increases where the milkfish becomes softer (Fiq. 5). This is because the longer drying time can reduce the water content of Bandeng Sapit so that the texture becomes hard. This is in accordance with the statement of [6] that drying is an effort to reduce water content, water activity (aw) and increase hardness.

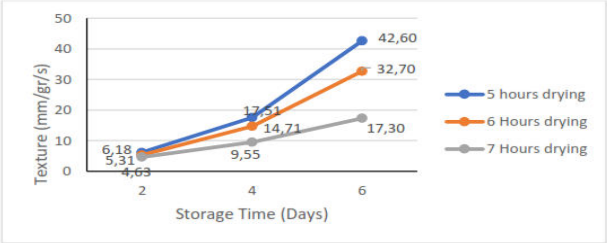

Fig. 4. Effect of drying time and storage time on texture of Bandeng Sapit

The longer the storage time, the lower the level of hardness, where beef milk becomes soft and mushy. The decrease in the level of hardness during storage is due to an increase in the water content of Bandeng Sapit due to protein degradation by microorganisms. According to [14], changes in water content during room temperature storage are caused by free water formed as a result of protein degradation by microorganisms.

4 Conclusion

Bandeng Sapit with drying time of seven hours and storage at room temperature for two days, is safe and suitable for consumption, with characteristics of water content 53.21%, water activity (aw) 0.86, total bacteria 5.1891 CFU/gr, TBA number 1.7469 mg eq/kg, TVB-N 4.6267 mg/100gr, texture 4.6267 mm/10 sec/50gr.

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