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Physical, chemical, and sensory characteristics of catfish karak crackers as nutrition value added

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Abstract. Traditional Karak crackers made from rice with an addition of salt and "bleng". Bleng (borax) is a prohibited food additive. The purpose of this research was to know the effect of the addition of catfish to the sensory, chemical, physical characteristics, and yield. This research used Completely Randomized Design with one factor that is the amount of catfish addition. There were two experiments, the addition of raw catfish and steamed catfish. The research results would be analyzed statistically by using oneway ANOVA. If the result showed the difference then proceed using Duncan's Multiple Range Test (DMRT) with significance level $\alpha = 0,05$. The results showed that the addition of catfish affects the characteristics of sensory, chemical, physical and yield of Karak. The higher the concentration of raw catfish in the making of the Karak, then the lower the panelist's preference toward the color, texture, and overall parameters. The higher the concentration of steamed catfish in the making of the Karak, then the lower the panelist's preference toward the color and overall parameters. The best formula based on weighting test that is the Karak with the addition of steamed catfish amounted to 10% w/w.

1. Introduction

Rice is the main commodity in Indonesia. One of the products from rice is Karak crackers. Traditional Karak made from rice with an addition of salt and "bleng". Natrium Tetraborat ("bleng") is a prohibited food additive. One of the SMEs in Sukoharjo has been using baking soda as a food additive for Karak. However, the use of baking soda as a food additive needs more tools and equipment. There are several studies on Karak production with STPP (Sodium tripolyphosphate) as the food additive. The use of STPP as a food additive in Karak can resemble traditional Karak textures making it more economically profitable. Indonesia has great potential and abundant fishery field. Catfish is one of the cultivated fishery products that occupy the top position in the amount of product produced. Therefore, the study of Karak's production with STPP as food additive and addition of catfish must be done.

The purpose of this research was to know the effect of the addition of catfish to the sensory, chemical, physical, and yield characteristics. This research used Completely Randomized Design with one factor that is the amount of catfish addition. There were two experiments, the addition of raw catfish and steamed catfish. The research results would be analyzed statistically by using oneway ANOVA. If the result showed the difference then proceed using Duncan's Multiple Range Test (DMRT) with significance level $\alpha = 0,05$. The results showed that the addition of catfish affects the characteristics of sensory, chemical, physical and yield of Karak.

2. Research Methods

2.1. Materials

The material used to make Karak in this research was Bulog rice, Kapal salt, catfish (*Clarias* Sp), cooking oil, STTP (*Sodium Tripolyphosphate*), baking soda, and material to analyze such as aquadest, H_2SO_4 solution, H_2BO_3 solution, NaOH solution, HCl solution, K_2SO_4 solution and MRMB reagent.

2.2. Steaming catfish



Fresh catfish that have been cleaned from entrails, then they were washed water flow. After washing, it was done the fillet without filleting the skin because the skin is very sticking and it is hard to separate from the meat. After filleting and obtaining the meat, then it was scaled as the formula then it was milled for raw catfish Karak. Raw catfish meat that had been scaled for making catfish Karak was steamed and milled.

2.3. Making Karak

First, rice is scaled according to formula, then it is washed and drained so that there was no water. Karak formula with M as raw catfish Karak 10%; K as Steamed catfish Karak 10%; S as STPP Karak; B as Baking soda Karak. After that, it is done boiling rice and it is added STPP and salt according to formula. Furthermore, if the water is almost sipped by rice or it is estimated that few glass water in the past, so that it will not burn, then it is drained so that all of the water is absorbed into the rice and the rice is half-baked. Half-baked rice is then steamed until it is well done. Hot rice is added with catfish's meat or steam catfish meat as the formula and it is milled. Inform of long beam shape, it is silenced then sliced. The slices are dried about 2 until 3 day. Dried Karak then are fried to frying pan about 20-30 seconds until it changes to brown [17].

2.4. Physical, Chemical, and Sensory Analysis

Physical analysis performed included a test of swelling power, hygroscopicity, and hardness. The hardness test was performed using the TA-XT2 Tool [1]. Chemical analyzes performed were water content test using thermal gravimeter method, test ash content with oven method, protein test with the Kjeldahl method, fat test with soxhlet method [2], carbohydrate test by different and organoleptic test with hedonic scoring and ranking method.

2.5. Data Analysis

Obtained data examination is analyzed with One Way Analysis of Variances method (ANOVA). if there is a difference among the treatment, it is continued with Duncan Multiple Range Test (DMRT) insignificant of 5% ($p \leq 0,05$).

3. Results and discussion

3.1 Sensory Characteristic of Catfish Karak with STPP (Sodium Triphosphate)

Sensory examination was done in two stages (data no be shown), the first was done to find out the most favorite catfish Karak with addition of steamed catfish or raw catfish. The second sensory examination was done to find out panelist favorite level toward catfish Karak formula with addition of STPP (hedonic test). Sensory examination with ranking test method was done in Karak by adding raw catfish of 10%;20%;30%. Ranking test showed that different formula of adding raw catfish dis not give difference in favorite aroma and taste level and gave difference in favorite in parameters of color, texture and overall. Formula 10% raw catfish formula was preferable will be profitable. Therefore, raw catfish, M formula were used to further stage research. In steamed catfish, ranking test showed that different formula of adding steamed catfish did not give significant difference in favorite level of aroma, taste and texture, but it gave significant difference in favorite level of color and overall. Based on ranking test level in color and overall parameter, K formula was more preferable by panelist. Formula 10% steamed catfish was used to further research stages.

Second test that is hedonic test was the most-used-test to measure favorite level toward the product. In this test, Panelist was asked to value their favorites in sample if it is compared with comparison. In this test, panelist were asked to compare given sample with provided comparison. In overall parameter, panelists prefer catfish Karak of both sensory tests, with control of Karak STPP or Karak baking soda.

3.2 Chemical Characteristic of Catfish Karak with adding STPP (Sodium Tripolyphosphate)

3.2.1 Water Content

Table 1. water content of catfish Karak with adding STPP (*Sodium Tripolyphosphate*)

| Formula | Parameter | |
|---------|--------------------------------|----------------------------------|
| | Water content of raw Karak (%) | Water content of fried Karak (%) |
| M | 10.367±0.206 ^b | 1.762±0.063 ^c |
| K | 10.468±0.373 ^b | 2.001±0.083 ^d |
| S | 10.236±0.595 ^b | 1.507±0.065 ^b |
| B | 9.560±0.033 ^a | 1.055±0.094 ^a |

Information: different notation in one same column shows significant difference in standard $\alpha=0.05$. Karak formula: M= raw catfish Karak 10%; K = Steamed catfish Karak 10%; S = STPP Karak; B = Baking soda Karak.

Based on Table 1, water content test result gives result of significant difference formula especially in fried Karak. Water content of raw Karak, steamed Karak and STTP Karak not significantly different, three of them have significant difference with baking soda Karak. STTP has character that can react with starch. Phosphate plays role to strengthen the bond, so water content in ingredient is easier to hold while drying process, when starch reacts to STTP, it will result polar phosphate groups. Phosphate groups STTP is hydrophilic so phosphate fraction is soluble in water molecules and it can form hydroxyl bond [3].

Table 1 shows water content of fish Karak M and K have real different water content with Karak S without adding catfish. Phosphate in STTP has role to strengthen the bond [4]. Water content in Karak is easier to maintain during frying. If it is compared with formula B, formula M, K and S are real different. Baking soda has character than can generate CO₂ gas when it meets water and polar in heating, so it will form air pores and there is more water evaporation during frying process [5].

3.2.2 Chemical Characteristic of Catfish Karak with Adding STPP (*Sodium Tripolyphosphate*)

Based on table 2, ash content test result gave significant different and showed that adding additive of catfish gave effect toward ash content. Catfish has mineral content of 1.2% [6-7] and has phosphor content of 200 mg per 100 g [6][8].

Table 2. Chemical Characteristic of Catfish Karak with Adding STPP (*Sodium Tripolyphosphate*)

| Formula | Ash Content db(%) | Fat Content db(%) | Protein content (%) |
|---------|--------------------------|---------------------------|--------------------------|
| M | 2.528±0.263 ^c | 28.056±3.744 ^b | 8.232±0.212 ^c |
| K | 2.572±0.196 ^c | 22.647±1.730 ^a | 7.930±0.242 ^c |
| S | 2.119±0.208 ^b | 20.159±0.423 ^a | 7.123±0.278 ^b |
| B | 1.796±0.174 ^a | 35.737±1.871 ^c | 6.362±0.539 ^a |

Information: different notation in the same one column shows significant difference in standard $\alpha=0.05$. Karak formula: M = raw catfish Karak 10%; K = steamed catfish Karak 10%; S = STPP Karak; B= baking soda Karak.

Fat content has significant different between formula and shows that adding catfish gives effect toward fat content. In fresh catfish (M) has significant difference with STTP Karak (S), it can be caused by fat content in meat. Effect of adding meat fish in processing fish cracker can add fat [9]. Fat content in catfish is (4.8%) [6][7]. Fat content in baking soda Karak is different from fresh/ raw catfish Karak (M) and steamed catfish Karak (K), it can be caused baking soda has character that can make forms air pores. It will be fulfilled by the oil while frying, and it enables Karak absorbs much oil, so that it causes high fat content [5]. Steamed catfish Karak (K) and STP Karak (S) have no significant difference. It is because fat content in fish decreases due to

cooking process. Cooking speeds up fat molecules movement so the distance among the fat becomes bigger and ease fat expenditure [10].

Protein level has significant difference among formula and shows that adding catfish in Karak formula gives effect toward protein content. Protein content with adding fresh catfish (M) of steamed catfish (K) has significant difference with Karak protein content STPP without adding catfish (S) and baking soda Karak (B). The different protein content because of adding catfish in Karak, protein content in catfish is 17.7%. Karak protein content STPP (S) had significant difference from baking soda Karak (B), it is because STPP can preclude the decrease of protein content [6][7].

3.3 Physic Characteristic of Karak with Adding STPP (Sodium Tripolyphosphate)

Physical properties are important components to determine the quality of a product. The physical properties Karak with the addition of STPP observed include flower power, hygroscopicity, and hardness.

Table 3. Physic Characteristic of Catfish Karak with Adding STPP (*Sodium Tripolyphosphate*)

| Formula | Swell (%) | Hygroscopicity (%) | F-maks (N) |
|---------|-----------------------------|---------------------------|---------------------------|
| M | 187.157±11.220 ^b | 2.247±0.182 ^{ab} | 17.832±0.740 ^c |
| K | 135.675±5.028 ^a | 2.105±0.182 ^a | 12.492±0.601 ^b |
| S | 207.073±11.154 ^b | 2.452±0.154 ^b | 13.260±0.273 ^b |
| B | 398.89±29.895 ^c | 2.780±0.251 ^c | 9.683±0.495 ^a |

Information: different notation in the same one column shows significant difference in standard $\alpha=0.05$. Karak formula; M = raw catfish Karak 10%; K = steamed catfish Karak 10%; S = STPP Karak; B = baking soda Karak.

Based on table Table 3 Karak expanding capability is significantly different between formulas and indicated that the addition of catfish on Karak affects on expanding capability. The expanding proses started with the increase of the temperature then the change of water on the surface and inside the food into steam. When the starch reacted with STTP will produce phosphate cluster that has polar properties. The polar clusters of STTP are hydrophilic so the phosphate fraction soluble in water molecules and can form hydroxyl bond [3]. STPP can increase the ability of starch to bind water so that at the time of frying tend to be more difficult to steam and the expansion is not maximum. This is in accordance with the result of the study, that is the expanding capability of Karak STPP (S) is lower than the the expanding capability of Karak baking soda (B). Protein functions to thicken amylopectin granules, so at the time of frying the water will be difficult to get out of the starch granules [11]. This is in accordance with the result of the study, that is the expanding capability of Karak with the addition of steamed catfish (K) is lower than the expanding capability of Karak STPP (S). The higher the content of the protein then the more difficult for the crackers to expand and it will affect its crispness. The expanding capability of raw catfish (M) is higher than expanding capability of steamed catfish (K). This is related to the denaturation experienced by steamed catfish meat before added into the Karak dough so it decreased the ability to bond the water.

The expanding capability of Karak with the addition of the steamed catfish (K) is significantly different from the Karak baking soda (B). According to [12], high water content in the materials will cause a decrease in the expanding capability. Table 1 shows that the water content of fried Karak steamed catfish (K) is significantly different and higher than the water content of fried Karak STPP (S) and Karak baking soda (B), therefore, the expanding capability of catfish (K) is lower than the expanding capability of STPP (S) and Karak baking soda (B). This happens, due to the greater water content in the material [12], then when experiencing the frying process causes the amount of water left in the finished product is excessive so that the product is less expanding. Furthermore [13], the water content which is too low or too high does not produce fried crackers

that expands very well. In addition, the use of baking soda will react with other materials that produce CO₂ gas. This CO₂ gas forms air cavities in the dough, so when carry out heating causes a product to expand and have a crispy texture [14]. The oil at the time of frying will fill the air cavities formed so that the product will expand.

Hygroscopicity is the ability of a product to absorb water vapor. The value of hygroscopicity can be calculated based on the difference between the weight of the initial sample and the weight of the final samples when the sample is lack of hardness [15]. Test result of Hygroscopicity can be seen from Table 3. Karak (fried) is a food that has a low water content with a maximum water content of 8% [16]. Based on Table 3 the hygroscopicity is significantly different between the formulas and shows that the addition of catfish to the Karak affects hygroscopicity. Factors that affect hygroscopicity is the expanding capability. Expanding capability could affect on hygroscopicity [17]. The expanding capability is directly proportional to hygroscopicity. This is due to high expanding capability causes more air cavity with the resulting in the higher amount of absorbed water [17].

The hardness is significantly different between the formulas and shows that the addition of catfish in Karak affects the hardness capacity. The hardness of the Karak raw catfish (M) is significantly different from the Karak of STPP (S) and the Karak of baking soda (B). On food products with water content less than 10%, the strength of the structure will decrease as the water content also decrease [18].

4. Conclusion

The higher the concentration of raw catfish in the making of the Karak, then the lower the panelist's preference toward the color, texture, and overall parameters. The higher the concentration of steamed catfish in the making of the Karak, then the lower the panelist's preference toward the color and overall parameters. The best formula based on weighting test that is the Karak with the addition of steamed catfish amounted to 10% w/w.

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