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The Potency of Chanthidermismaculates Fish for Surimi Production

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***Abstract*— The aim of this study was to explore the potency of *Chanthidermis maculates* fish (spotted oceanic triggerfish) for surimi production. The effect of washing frequency (one or two washing cycle) and sucrose concentration (0, 2, 4, and 6%) as cryoprotectant on the quality of the surimi was investigated. The analyzed parameters in the study consisted of yield, moisture, protein, ash and fat contents, pH value, folding and sensory evaluation test (color and texture). The results showed that the best treatment in this study based on the protein content, folding and sensory test was obtained from the combination of treatment with no addition of sucrose and one washing cycle. That treatment resulted surimi with the yield of 80.62%, moisture, protein, ash, and fat contents of 71.47%, 20,88%, 0.61%, and 2.34%, respectively, and pH of 6.37%, folding test of 3.00, and color sensory test of 5.12 (light cream), texture of 3.75 (elastic).**

***Keywords*— Surimi; Chanthidermis maculates fish; washing frequency; sucrose concentration.**

I. INTRODUCTION

Surimi, minced and water-washed fish muscle tissue, has been used as a primary material for gelling foods enriched in myofibrillar proteins, such as kamaboko and shellfish analog products. Surimi is a labile product chemically, physically, and microbiologically, and thus frozen surimi is produced for practical use. To allow shipping and preservation at ambient temperature, the production of freeze-dried surimi has been attempted [1].

Alaska pollock (*Theragra chalcogramma*) is the most common fish for such product [2; 3]. But recently the use of and access to sources of Alaska pollock has been limited. Studies show that besides Alaska pollock, other fish species may also be used and produce high quality surimi, especially after the appliance of specific chemical methods. One alternative of fish types that can be used is *Chanthidermis maculates* (spotted oceanic triggerfish). In Aceh, the fish is relatively easy to obtain and present in large quantities. However, the fish usually is less favored because of its very hard skin, and therefore it is mostly processed into meatballs.

There are several reasons that drive the research on the manufacture of surimi, namely: the growing demand for surimi and the increasing attempt to process fish from lesser-known species such as the by-product of fishermen's catching. The use of surimi as raw material or feedstock for further processing products is more efficient, in terms of transportation, storage, supply of raw materials, and better quality than the use of fresh fish.

The frequency of fish muscle washing is important, since the colour of surimi can be improved by increasing the washing cycles [4], washing time and water quantity [5]. However, long period washing would result in high hydration of mince and degradation of myofibrillar proteins, making the subsequent dehydration process more difficult and could repress the gel-forming ability [5].

Therefore, in general the aim of this study is to explore the potency of *Chanthidermis maculates* fish (spotted oceanic triggerfish) for surimi production. Specifically, the aim of this research is to study the effect of cryoprotectant (sucrose) and washing cycle to the quality of surimi produced.

II. MATERIALS AND METHODS

A. Materials

Chanthidermis maculates fish was obtained from fish landing site in Lampulo, Banda Aceh (Indonesia). Sucrose, sorbitol and sodium tripolyphosphat were purchased from Gemilang Sukses Company, Medan (Indonesia).

B. Sample Preparation

Surimi preparation started by taking the fillets from fresh fish and then ground them into minced fish. Then, surimi was prepared into two different washing cycles, i.e. one and two washing cycle. In the one washing cycle process, the minced fish was washed with cold water one time. While in the two washing cycle process, the washing process was repeated twice. The ratio of minced fish to cold water was

1:5. The homogenate was then filtered through filter cloth. Later the washed minced fish were homogenized with sucrose (0, 2, 4 and 6%). After that, the surimi obtained was packed and froze until analysis.

C. Proximate Analysis

The proximate analysis was determined according to AOAC methods [6]. Moisture content was determined by drying samples for 5 hours at 105^0 C Protein content was determined using the kjeldahl method and lipid content was determined by soxhlet method. Ash content was determined by ashing sample overnight at 550^0 C.

D. Yield, pH and folding test

The yield of surimi obtained from the washed minced fish was calculated as follows:

$$\text{Percentage of yield} = \frac{\text{weight of surimi}}{\text{wet weight of minced fish}} x100$$

The pH value was determined according to AOAC method [6] using pH meter (FE20, Mettler Toledo, Switzerland) calibrated with pH 4.0 and 7.0 buffers.

Folding test was determined according to Lanier [7]. Samples was cut into a round-shape slice 3 mm thick, and evaluated by a five stage method, as follow:

Grade	Condition
1	breaks by finger pressure
2	cracks immediately when folded in half,
3	crack gradually when folded in half,
4	no crack showing after folding in half,
5	no crack showing after folding twice

E. Sensory evaluation

Sensory evaluation was determined according to Meilgaard et al. [8]. The sensory panel comprised of 30 semi trained panelists and sensory evaluation was conducted based on a 5-point Hedonic scale method (1 - dislike extremely and 5 - like extremely). The panelists were trained before sensory test. The panelists were from undergraduate student in Agricultural Product Technology Division at Faculty of Agriculture, Syiah Kuala University. Panelists have learned about sensory science by either theoretically and/or practically. This was used to assess the colour and texture acceptability.

F. Statistical Analysis

One-way ANOVA was used and mean comparison was performed by Duncan`s multiple range tests. For all cases, Significance level was set at $P \leqslant 0.05$ and $P \leqslant 0.01$. Three replicates were carried out for each analysis measurements. Statistical analysis was carried out using the SPSS statistic program (Version 16.0) for Windows.

III. Results and Discussion

A. Yield of Surimi

Concentration of sucrose has a significant effect ($P \leq 0.05$) on the yield of surimi. Moreover, washing cycle has a very significant effect ($P \leq 0.01$) on the yield of surimi. However, the interaction between sucrose concentration and washing cycle has no significant effect ($P > 0.05$) on the yield of surimi (Figure1 and 2).

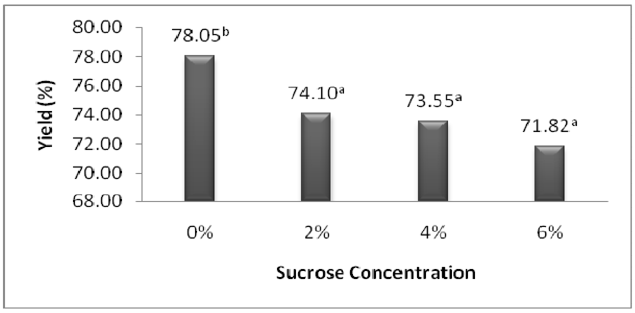

Fig. 1. The effect of sucrose concentration on the surimi yield

Figure 1 shows that as the sucrose concentration increased, the yield of surimi decreased. Surimi with no sugar addition resulted in the highest yield (78.05%). Moreover, the result shows that different sucrose concentration (2-6%) caused insignificantly difference yield of surimi.

Figure 2 shows that the treatment of two washing cycles produced a lower ($P \leq 0.05$) yield of surimi than one cycle which might be caused by the loss of some water-soluble components during the fish washing process.

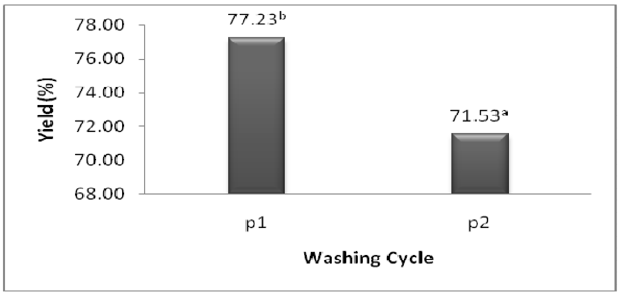

Fig. 2. The effect of washing cycle on the surimi yield (*p1 = one washing cycles; p2 = two washing cycles)

B. Proximate analysis

The washing cycle has a very significant effect ($P \leq 0.01$) on the water content of surimi (Figure 3) while sucrose concentration and the interaction between sucrose concentration and washing cycle has no significant effect ($P > 0.05$) on the water content of surimi.

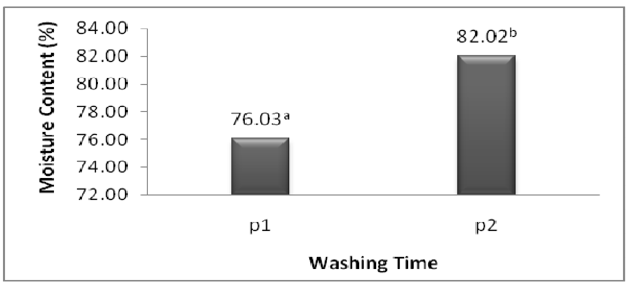

Fig. 3. The effect of washing time on moisture content of surimi (*p1 = one washing cycles; p2 = two washing cycles)

Based on Figure 3, it can be seen that the one washing cycle (76.03%) resulted a lower moisture content than the two washing cycles process (82.02%). This is presumably because the fish washed twice absorbs more water during washing process compared to the fish washed once.

The effect of sucrose concentration was highly significant ($P \leq 0.01$) on protein levels of spotted oceanic triggerfish surimi. Similarly, the interaction between sucrose concentration and the frequency of washing significantly affected ($P \leq 0.05$) the protein content of the surimi. However, the frequency of washing did not significantly affect the protein content of the surimi ($P > 0.05$). The effect of interaction between sucrose concentration and the frequency of washing towards the protein content of spotted oceanic triggerfish surimi is presented in Figure 4.

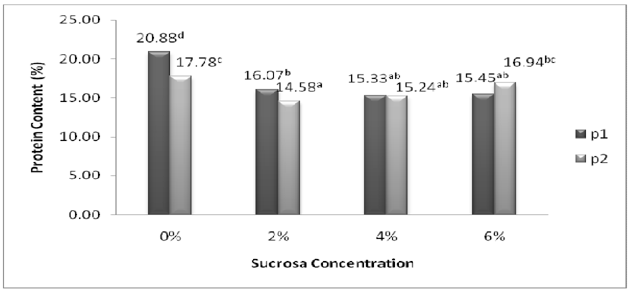

Fig. 4. The influence of sucrose concentration and washing cycle to protein content of surimi (*p1 = one washing cycles; p2 = two washing cycles)

Based on Figure 4, it can be seen that the highest protein content was obtained in surimi with sucrose concentrations of 0% and one washing cycle. From Figure 4 can also be seen that the surimi produced by one washing cycle tended to have a higher protein content than two washing cycles. This was presumably due to the fact that frequency of excessive washing can cause loss of protein from the surimi produced.

Washing frequency was significantly ($P \leq 0.05$) affected the ash content of spotted oceanic triggerfish surimi, while the sucrose concentration and interaction between sucrose concentration and frequency of washing did not significantly affect the ash content of surimi ($P > 0.05$). The effect of washing cycle towards ash content of surimi is presented in Figure 5.

Based on Figure 5, it can be seen that the one washing cycle produced surimi with higher ash content compared to two washing cycle. This was presumably due to the fact that frequency of washing caused the decrease of surimi ash content. Since some components, such as minerals, are dissolved during the washing process, thus the ash content of surimi is being reduced as well during the washing process.

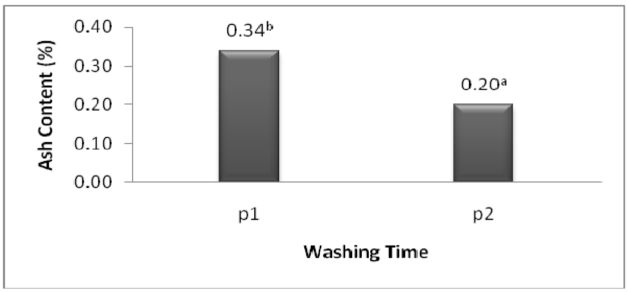

Fig. 5. The influence of washing time to ash content of surimi (*p1 = one washing cycles; p2 = two washing cycles)

The effect of washing cycle was highly significant ($P \leq 0.01$) on the surimi fat content. While the sucrose concentration, and the interaction between sucrose concentration and the washing cycle effects were not significant ($P > 0.05$) to the fat content of spotted oceanic triggerfish surimi. The influence of the washing frequency to the fat content of surimi is showed in Figure 6.

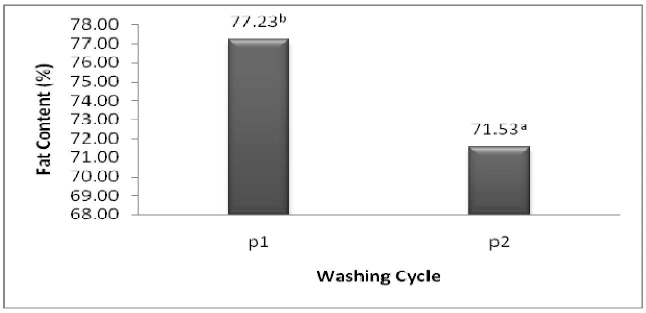

Fig. 6. The influence of washing cycle to fat content of surimi (*p1 = one washing cycles; p2 = two washing cycles)

Based on Figure 6, it can be seen that the treatment of one washing cycle produced fat content much higher than the two washing cycles. This was presumably because the fat contained in surimi dissolved and wasted during the washing process.

C. *pH Value*

Washing cycle also has a very significant effect ($P \leq 0.01$) on pH value of surimi (Figure 7), whereas the concentration of sucrose, and the interaction between sucrose concentration and washing cycle have no significant effects ($P > 0.05$) on the pH value of surimi.

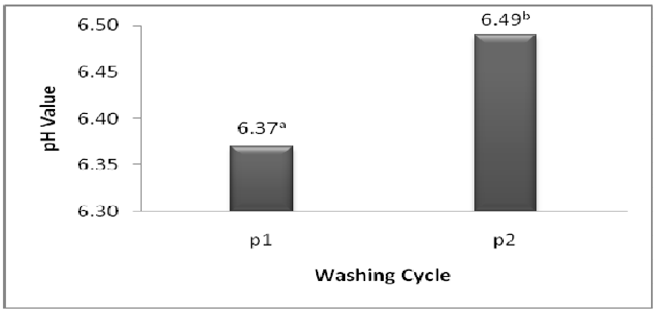

Fig. 7. The effect of washing cycle on the pH of surimi (*p1 = one washing cycles; p2 = two washing cycles)

Figure 7 showed that the one washing cycle process generated a lower pH (6.37) of surimi than two washing cycles process (6.49). The washing process was expected to cause the increase in the pH value. Okada & Park [9;10] reported that a pH range of 6 to 7 is a good range for surimi.

D. *Folding Test*

The concentration of sucrose very significantly affected ($P \leq 0.01$) the folding test of surimi (Figure 8), meanwhile washing cycle, and the interaction between sucrose concentration and washing cycle were not significantly affect ($P > 0.05$) the folding test of surimi.

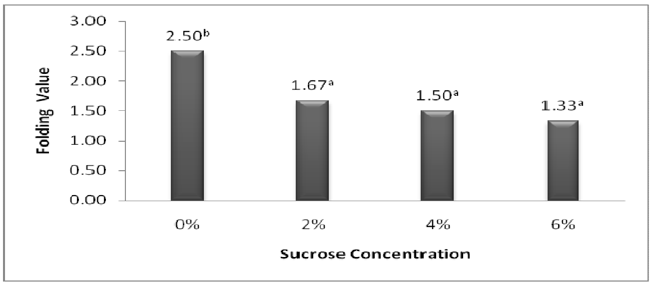

Fig. 8. The effect of sucrose concentration on the folding test of surimi

Based on Figure 8, it can be seen that as the concentration of sucrose increased, the folding test values tended to decrease, even though the values were not significantly different. This is presumably because the sucrose changes from solid to liquid in the produced surimi. The high of sucrose addition causes surimi texture getting soft, so it is difficult to be folded. As a result, it decreased the folding test value. Reppond et al [11] stated that the addition of sucrose in certain concentrations can cause surimi easily broken and cracked during the folding test.

E. Sensory Evaluation

The concentration of sucrose had a very significant effect ($P \leq 0.01$) on the color of surimi sensory test (Figure 9), whereas washing cycle, and the interaction between the sucrose concentration and washing cycle had no significant effect ($P > 0.05$) on the color of surimi sensory test.

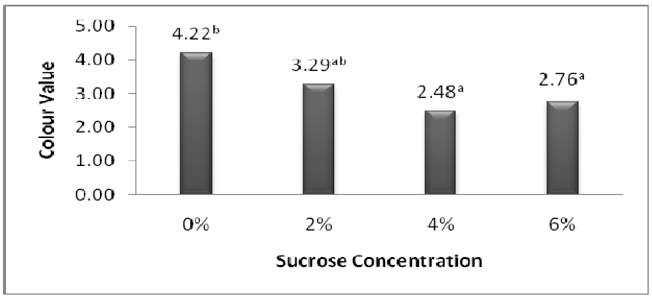

Fig. 9. The effect of sucrose concentration on color of surimi sensory test

Figure 9 showed that surimi without sucrose addition produce a bright color of surimi (4.22). Overall, the increase of sucrose concentration cause a darker surimi. It could be caused by the occurrence of browning reaction. Kim et al, [4] reported the same results, as the concentration of sucrose increases, the color of produced surimi become darker.

The result of the texture sensory analysis showed that only the interaction between the concentration of sucrose and washing cycle affected significantly ($P \leq 0.05$) (Figure 10). Based on Figure 10, it can be seen that the surimi with no sucrose addition and one washing cycle and the surimi with 4% of sucrose and two washing cycles exhibited higher texture sensory values compare to other treatments. The addition of sucrose and washing cycle more than once can affect the texture of surimi.

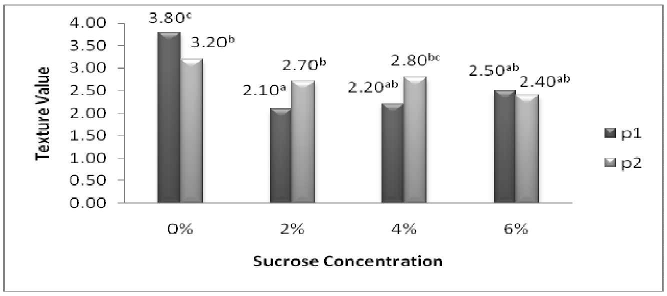

Fig. 10. The interaction effect of sucrose concentration and washing cycle on the surimi texture sensory test (*p1 = one washing cycles; p2 = two washing cycles)

IV. Conclusions

The results showed that the concentration of sucrose gave highly significant effects on protein contents, color and texture of surimi sensory tests, and resulted in significant effect on yield and fold test of the surimi. The frequency of washing gave very significant effects on yield, moisture, ash, and fat contents, as well as significantly affected the pH value. The interaction between sucrose concentration and frequency of washing produced significant effect on protein content and texture of surimi sensory test.

Acknowledgment

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