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Original Article

Effect of Chitosan Modified Process from Shrimp Shell (*Littopenaeus vannamei)* toward the Fat Oxidation of Tuna Fish Fillet (*Thunus thunus*)

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ABSTRACT

This research was aimed to know the influence of chitosan modified process from vannamei shrimp shell (Littopenaeus vannamei) toward the fat oxidation of tuna fish fillet. The treatment used in this research was the storage time period along with the submersion process using chitosan toward the chemical parameters (fat, TVB, and TBA content). The result showed that the long-lasting storage time of tuna fish fillet that had been dissolved into chitosan (DMPA) influenced the fat oxidation of tuna fish fillet than the chitosan control (DPMA). The hindrance of the fat oxidation was indicated by the chemical parameter value which went below the standard limit of food which are good to be consumed. The result was derived from the seventh-day-treatment which included fat content of 11,559%, TVB content of 4,504 mg N/100 g, and TBA content of 1,800%.
Key words: Chitosan, Fat Oxidation, Tuna Fish Fillet

INTRODUCTION

Indonesia possesses great oceanic resources, such as fish. Fish belongs to the perishable food due to its condition that can be easily decayed. Consequently, a special treatment to extend the period fish storage should be given until the fish successfully delivered to the customers [1].

Tuna fish is one of pelagic fish which brings high economic value and is favorable by the throughout the world customers [2]. Besides the big size the fish has, the customers love this fish due to its nutrient. Moreover, tuna fish which comes in the form of fillet is one of efforts given to extend the quality of the fish, especially when the fish is exported. The decay toward food is commonly caused by the microbe and fat oxidation. The fat contributes to the decayed condition of food in terms of either taste or smell. This decay reduces the nutrient of its food, sensory, and the safety of the food to be consumed. It is due to the toxic secondary compound that is formed.

Shrimp is one of favorite food of the society. The production process of shrimp generates waste of 40-50% out of the total weight of shrimp. 40% of this amount is the chitin that contains calcium carbonate and astaxanthin layers on the flesh and fat residue [3]. Chitin is a natural polysaccharide which can be easily found in the crustacean shells. This polymer is composed by poly linear chain (β1-4)-N-acetyl-glucosamine) [4]. Moreover, chitin can be processed into chitosan which functions as natural preservatives. Chitosan is a product of chitin distillation process. Moreover, chitosan is only soluble in the acid solution which contains amino group [5]. Not only functions as anti-bacteria, chitosan also functions as natural preservatives. Chitosan can be an anti-microbe which can inhibit the growth of microbe. The molecule of chitosan can interact with the compound on the surface of bacteria cell which is then absorbed and forms a layer which can inhibit the cell transportation [6].

This research aimed to obtain the influence of modification to the production of chitosan which is able to inhibit the fat oxidation of tuna fish fillet. It was expected that this research could contribute new knowledge on the utilization of shrimp shells to make chitosan as natural preservatives.

MATERIALS AND METHODS

Research Materials

Vannamei shrimp shells (*Littopenaeus vannamei*) as the main materials were obtained from Sidoarjo, JawaTimur. The fresh tuna fish as testing materials along with the length of storage time and temperature were obtained from SendangBiru, Malang, and JawaTimur.

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Other substances used to make chitosan were aquades, HCL 1 N, NaOH, labeling paper, plastic clips, PP plastic. Meanwhile, the materials used for the chemical test were water, aquades, tissue, labeling paper, aluminum foil, plastic, HCl, N-Heksan, tashiro indicator, K_2CO_3, H_3BO_3, TCA 5%, alkohol 96%, and TBA reagen.

The Prodecure to Make Chitosan from Vannamei Shrimp Shells (*Littopenaeus vannamei*)

The process of making chitosan included two processes, which were setting the chitosan under a controlled treatment and setting the chitosan undera modified treatment. The steps to process the controlled treatment of chitosan (DPMA) were material preparation step, drying step under the temperature of 50^0C for an hour, smoothening step, deproteinasi step, demineralization step, distillation step, and drying step using vacume oven for 2 hours long. The chitosan with modified process was treated slightly the same. The difference was only the sequence of step. In the modified treatment of chitosan, demineralization step was conducted before deproteinasi and distillation step. The application of chitosan as natural preservatives for the tuna fish fillet was then conducted as the next step.

The Application Procedure for the Use of Chitosan for Tuna Fish Fillet (Thunus thunus)

The application of chitosan as natural preservative for tuna fish fillet consists of several steps, such as the process of composing chitosan concentrate 1,5% using acetic acid solvent 0,5% and 1%. Chitosan (DPMA) with acetic acid solvent 0,5% and 1% was given codes of AX and BX while chitosan (DMPA) was given codes of AY and BY. The samples of tuna fish fillet were then prepared for treatment 1, 3, and 7 days. Then, the tuna fish fillet was put in the chitosan solvent 1,5% for 3 minutes. The tuna fish fillet was then put in the PP plastic with 1,3, and 7 days treatment under room temperature. Each treatment was then analized using the chemical parameters of fat content, TVB content, and TBA content.

RESULTS

The research on the influence of modified process chitosan application toward the fat oxidation of tuna fish fillet (Thunus-thunus) yields several results, such as the chemical parameter of fat content, TVB content (Total Volatile Base), and TBA content.

Fat Content: The result of fat content of tuna fish fillet can be seen in figure 1. Based on the figure 1, the highest content of fat occurs on the seventh day treatment which accounts for 11,559%. This treatment was included the use chitosan (DPMA) with acetic acid solvent 0,5%. Moreover, the lowest content of fat occurs in the first day treatment which accounts for 2.6410% by the use of chitosan (DMPA) with acetic acid solvent 1%. Figure 2 also shows the influence of the storage period of time. The increasing content of fat was caused by the use of PP plastic which was not used properly as vacuum packed plastic which then triggered the oxidation to occur. This condition is in line withAfrianto et al. [7] that peroxide compound will be formed due to the process of oxidation during the fat storage.

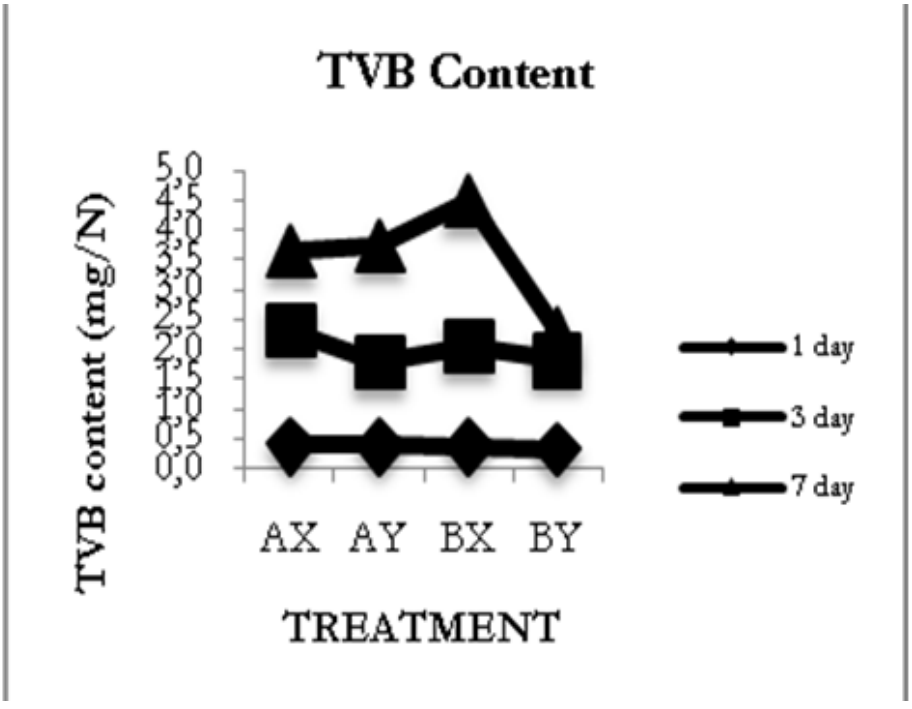

Figure 1. The Comparison Graphic on the Application of Chitosan on the Tuna Fish Fillet toward the Fat Content

TVB Content: The result of TVB content analysis can be seen in figure 2. As seen in the figure 2, the lowest content of TVB occurs on the seventh day of treatment which accounts for 4,504 mg N/100 g. Meanwhile, the lowest content of TVB occurs on the first day of treatment which accounts for 0.3173 mg N/ 100 g. based on this result, it is obviously seen that the content of TVB on the tuna fish fillet increases along with the storage process under the room temperature. The TVB content increases due to the protein degradation process or the derivative which forms amount of easily evaporated base, such as ammoniac, histamine, histamine sulfide, and trimetilamin that smells bad. Moreover, the TVB content of the tuna fish fillet from this observation is still proper to be consumed since the TVB content is still below the standard of TVB which is 30 mg N/ 100 g sample [8].

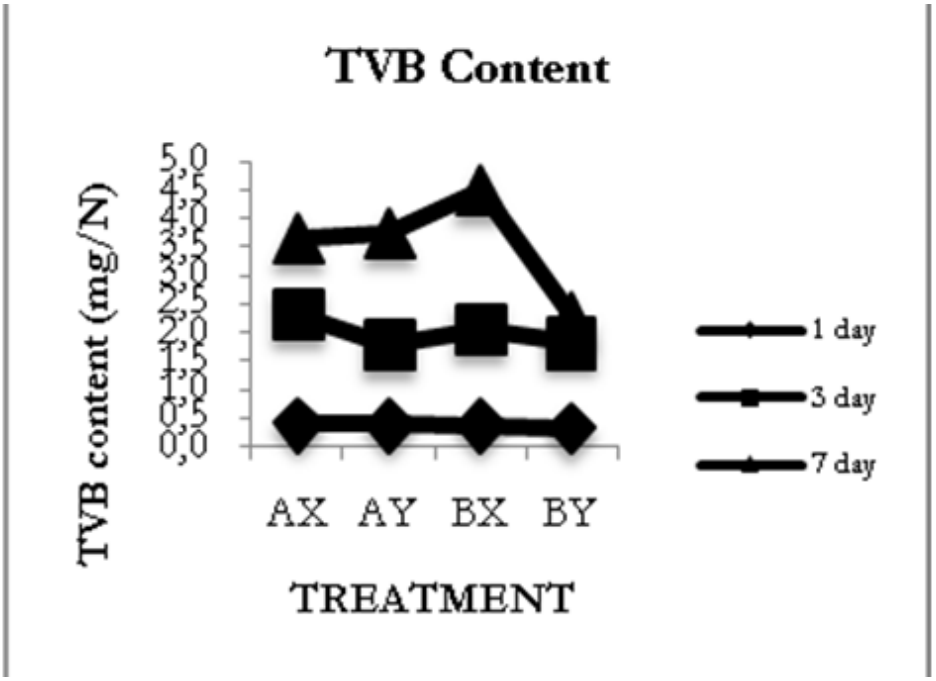

Figure 2. The Comparison Graphic on the Application of Chitosan on the Tuna Fish Fillet toward the TVB Content

TBA Content: The analysis result of TBA content (Thiobarbituric acid) can be observed in the figure 3. Based on the figure 4, the highest TBA content occurs on the seventh day of treatment which accounts for 1,800% and the lowest TBA content occurs on the first day which accounts for 0,156%. Figure 4 shows that the longer storage period under the room temperature is, the higher TBA content on the fish. It is caused by the fat decay on the tuna fish fillet due to the oxidation process within the PP plastic. The upper limit for TBA content to be properly consumed by humans is less than 3 mg malonaldehid/kg [9]. Hence, the tuna fish fillet up to the seventh-day-treatment on this research is still proper to be consumed.

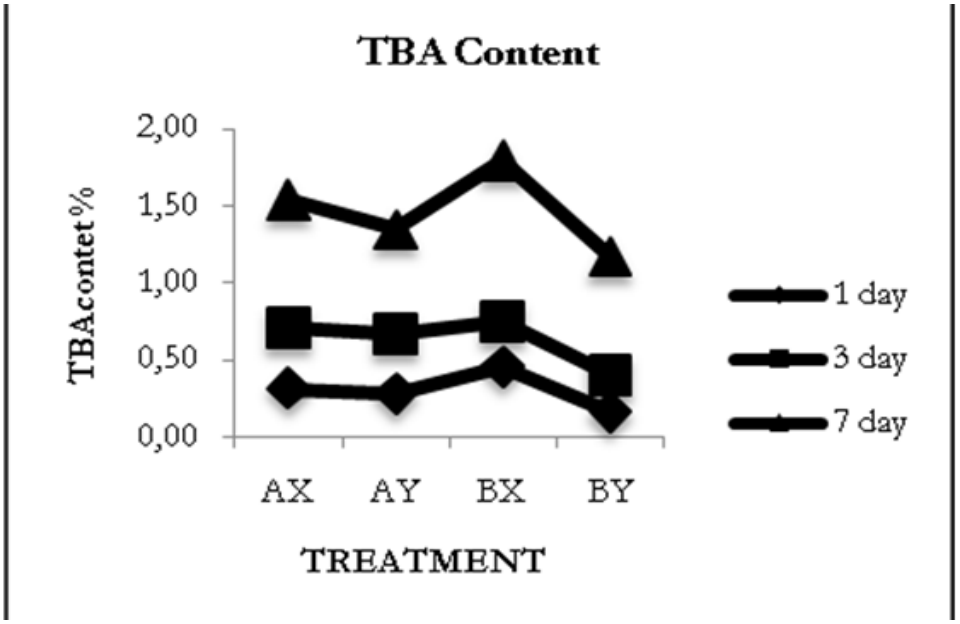

Figure 3. The Comparison Graphic on the Application of Chitosan on the Tuna Fish Fillet toward the TBA Content

DISCUSSION

The process of tuna fish fillet oxidation can be inhibited by applying chitosan (DMPA) from modified process 1,5% with acetic acid solvent 1%. The hindrance of chitosan is indicated by the chemical parameter analysis which is far below the standard limit of food to be properly consumed, which is on the seventh-day-treatment with TVB content is as much as TBA content, which is 1,800% and the highest fat content.

Suggestion

Further research should be conducted to determine what organic acid solvent should be used to dissolve chitosan as natual preservatives.

REFERENCES

1. Mulyono, A.H. 2003. Aplikasi rempah mobe (Ficus sp.) dan antarasa (Litseacubeba) sebagai bahan pengawet alami pada fillet ikan kakap merah (Lutjanuserythropterus). Institut Pertanian Bogor. Bogor.
2. Arbia, W., Arbia,L.& Amrane, A. 2012. Chitin extraction from crustacean shells by biological methods a review. Universite Europe de Bretagne. France.
3. Lin, W.F., Shiau, C.Y. Hwang, D.F.2005. Identification of four thunnus tuna species using mitochondrial cytochrome b gene sequence and PCR-RFLP analysis. J Food and Drug Analysis, 13, 13: 382-287.
4. Palpandi, C., Shanmugam,V.& Shanmugam, A. 2009. Extraction of chitin and chitosan from shell and operculum of mangrove gastropod nerita (Dostia) crepidularia Lamarck). Int J Medicine and Medical Sciences 1, 5: 198-205.
5. Brugnerotto, J., Lizardi,J. Goycoolea,F.M. Arguelles-Monal,W. Desbriere,J.&Rinaudo, M. 2001. An Infrared investigation in relation with chitin and chitosan characterization. Polymer, 42: 3569-3580.
6. Wardaniati, R.A & Setyaningsih, S. 2012. Pembuatan chitosan dari kulit udang dan aplikasinya untuk pengawetan bakso. Jurusan Teknik Kimia Fakultas Teknik Universitas Diponegoro. Semarang.
7. Afrianto, E & Liviawaty, E. 2010. Penanganan ikanSegar. Widya Padjajaran. Bandung.
8. Suptijah, P., Gushagia,Y.&Sukarsa, D.R. 2008. Kajian efek daya hambat kitosan terhadap kemunduran Mutu fillet ikan patin (Pangasius hypopthalmus) pada penyimpanan suhu ruang. Buletin Hasil PerikananVol XI Nomor 2 Tahun 2008.
9. Dawson, S.P. 1978. Acids in different site in blue macharel (Scomberaus tralasius Fillets). J Food Science.