1. Submitted to Journal (6-10-2015)
2. Revise process (13-10-2015)
   - Template manuscript
3. Revise process (22-10-2015)
   - Corrected manuscript
4. Correction from reviewer (6-11-2015)
   - Merekomendasikan untuk dipublish
   - Komentar hanya seputar format penulisan satuan dan referensi sementara materi sudah dinilai baik
5. Correction from reviewer (3-12-2015)
6. Status manuscript (4-12-2015)
7. Status manuscript (18-12-2015)
8. Final check (12-1-2016)
9. Correction from reviewer (4-2-2016)
10. Status manuscript (26-2-2016)
11. Proof-read submitted (8-4-2016)
12. Notification of publication Jurnal Teknologi (18-4-2016)

Naskah UTM J Teknologi 2015 10 13 an Fronthea

Dari: Monika Nur Utami Prihastyanti, S.TP, M.Nat.Sc (monika.nur@machung.ac.id)

Kepada: fronthea_thp@yahoo.co.id

Tanggal: Selasa, 13 Oktober 2015 16.37 WIB

yth. Bu Thea,

Mohon maaf atas keterlambatan membalas email Ibu. Berikut saya lampirkan hasil koreksi template paper Ibu. Mohon dapat diperbaiki sesuai komentar yang tercantum dalam naskah. Mohon berkenan mengembalikan naskah kepada saya selambatnya tanggal 16 Oktober.

Demikian yang dapat saya sampaikan. Terima kasih atas perhatiannya.

Salam,

Monika

From: Fronthea Swastawati <fronthea_thp@yahoo.co.id>
Sent: Tuesday, October 6, 2015 11:04 AM
To: Monika Nur Utami Prihastyanti, S.TP, M.Nat.Sc
Subject: Mohon Komentar Paper

Yth. Mbak Monika
Selamat pagi mbak monika, saya mau minta komentar tentang paper saya Artikel Enzim (Fundamental) yang akan dimuat dijurnal UTM. apakah paper saya layak untuk dipublish di jurnal UTM. Atas perhatian dan kerjasamanya yang baik saya ucapkan terima kasih.

Salam.

Fronthea Swastawati
Laboratory of Fisheries Processing Technology
Faculty of Fisheries and Marine Sciences, Diponegoro University
Jl. Prof. Sudarto, SH., Tembalang, Semarang 50275
Phone Office +6224 7474698
Phone +6281 225 191 989
+6285 626 816 13

Fronthea_10.16_koreksi10.13.doc
1.2MB

[Type text]

Jurnal
Teknologi

Full Paper

CRUDE CATHEPSIN ACTIVITY AND QUALITY CHARACTERISTIC OF SMOKED CATFISH (*PANGASIUS PANGASIUS*) PROCESSED BY DIFFERENT SMOKING TEMPERATURE

Article history

Received

6 October 2015

Received in revised form

……..

Accepted

……..

Comment [MNU1]: Mohon perbaiki kata-kata yang berwarna merah sesuai koreksian pada kotak comment.

Fronthea Swastawati[a]* , Ahmad Ni'matullah Al Baarri[b], Eko Nurcahya Dewi[a], Ima Wijayanti[a], Dwi Yanuar Budi Prasetyo[c]

*Corresponding author

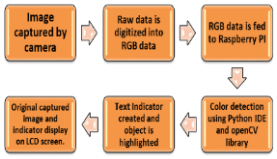
fronthea_thp@undip.ac.id

[a]Laboratory of Fish Processing Technology, Faculty of Fisheries and Marine Science, Diponegoro University, Jl. Prof Soedarto, SH, Tembalang, Semarang – 50275, Indonesia

[b]Laboratory of Chemistry and Food Nutrition, Faculty of Animal and Agriculture, Diponegoro University, Semarang – 50275, Indonesia

[c]Magister Coastal Resource Management, Faculty of Fisheries and Marine Science, Diponegoro University, Jl. Imam Bardjo, SH, Semarang – 50241, Indonesia

Graphical abstract



Abstract

Effect of smoking temperature related to the crude cathepsin activity and quality characteristic of smoked catfish (*Pangasius pangasius*) were investigated. Different smoking temperature had significant effect on crude cathepsin activity, texture, pH, moisture content, salt content and solubility of protein. The enzyme had optimum activity at 40-50°C (0.146±0.02 U/mL) but decreasing at 60-70°C (0.114±0.02 U/mL) and 80°C (0.098±001U/mL) respectively. The quality parameters such as textural of smoked catfish were 4591.37±27.12 gforce at 40-50°C; 4241.93±56.82 gforce at 60-70°C; 3881.29±26.75 gforce at 80°C, pH value were 7.42±0.02; 7.72±0.01; 8.01±0.04 respectively, moisture content were 77.42±0.02%; 74.72±0.01%; 72.04±0.04% respectively, salt content were 2.62±0.19%; 3.88±0.33%; 5.83±0.28% respectively and protein solubility were 11.66±0.12%; 8.32±0.30%; 5.80±0.19% respectively. Many factors were correlated to the textural changes of smoked catfish such as changes of crude cathepsin activity, reduction of protein solubility and pH value.

Keywords : Crude cathepsin activity, smoking temperature, quality characteristic, catfish (Pangasius pangasius)

1.0 INTRODUCTION

Catfish (*Pangasius pangasius*) is one of the economic aquaculture fish species in Indonesia of which the production was increasing by 37% in 2008-2012 [1]. From the nutrition aspect, catfish contains a high nutrition value to support human health. Catfish contains 35% of protein and 10.1% of lipid with dominant fatty acids profile were lauric acid (13.36%), palmitic acid (26.15%), oleic acid (46.07%) and stearic acid (14.40%) which contributes to human health [2]. Texture is an important quality characteristic and acceptability factor for consumer to consume catfish. The texture of catfish is influenced by several factors such as size, age, macro nutrients composition (protein and lipid content), handling and processing condition. Catfish is one of many aquatic products which is highly perishable, in which after the post mortem the enzymatic decomposition rapidly breaks down the texture of fish components like myofibril and connective tissue. [3], cathepsin enzyme activity could change the structure and firmness. Cathepsin B, L and D were able to decrease α-actinin which is responsible to the fish firmness. A significant correlation was observed between enzymatic activity of cathepsin B and L and muscle degradation of Atlantic salmon [4].

1. Smoking process could inhibit the enzymatic decomposition. Brinning, pre drying, chemical composition of smoke and heating in smoking process could change the optimum condition of cathepsin to be active. Cathepsin needs a certain condition to optimize their activity, such as temperature, pH, substrate concentration and the presence of metal inhibitor [5]. Nowadays smoking is not only a preservative method but it also gives a specific flavour and taste on smoked fish to increase the consumer acceptability. This role could be obtained using liquid smoke which is easier to applly and is environmentally safe [6]. The aim of this research was to investigate the effects of smoking temperature to crude cathepsin activity

Comment [MNU2]: Abstrak dilengkapi dengan 'Graphical Abstract' (sesuai contoh di bagian kiri halaman pertama) yang pada dasarnya adalah 'abstrak dalam bentuk gambar'. Graphical abstract dapat berupa diagram alir penelitian ataupun gambar yang representatif.

Comment [MNU3]: towards

Comment [MNU4]: protein solubility

Comment [MNU5]: 40 °C to 50 °C

*penulisan satuan diberi spasi dari besaran di depannya
*gunakan 'to' untuk menyatakan range/jarak (bukan dengan tanda '-')

*perbaiki kesalahan lain yang serupa (warna merah)

Comment [MNU6]: 0.146 U · mL^{-1} ± 0.02 U · mL^{-1}

*satuan selalu dituliskan setelah besaran (penulisannya diberi spasi)
*penulisan tanda matematika diberi spasi dari angka di depannya
*penulisan dengan tanda '/' diubah seperti contoh di atas (menggunakan simbol middle dot ' ·', bisa dicari di Symbol)

*perbaiki kesalahan lain yang serupa (warna merah)

Comment [MNU7]: Ubah ke satuan sesuai SI

Comment [MNU8]: 77.42 % ± 0.02 %

*perbaiki kesalahan lain yang serupa (warna merah)

Comment [MNU9]: italik

Comment [MNU10]: Diurutkan sesuai abjad

which affects textural changes and quality characteristic of smoked catfish.

2.0 EXPERIMENTAL

2.1 Smoking process

Smoking method of catfish was performed with some modification [7]. Fillets of catfish were separated into four groups. Each group dipped into 5% brine and 5% liquid smoke for 30 minutes. Pre-drying in room temperature for about 60 minutes and then smoked in the electrical oven at 40-50°C (P1), 60-70°C (P2) and 80°C (P3) for 1 hour each. Then it was chilled in the room temperature and then packed with poliethylene bag before analysis in the laboratory.

2.2 Crude cathepsin activity analysis

Proteolytic activity assay was performed with some modificiation [8]. One g of fillet was mixed with 1 mL of aquadest and then it was homogenized using centrifuge 600 x g for 10 minutes at 4°C. The supernatant then homogenized again using centrifuge 10.000 x g for 10 minutes at 4°C. Then the extract was dissolved into 1 mL 0,1 M buffer Tris-HCl (Aplichem) pH 7.4, continued with centrifugation at 4.000 x g for 10 minutes at 4°C. Proteolytic activity was analyzed with hemoglobin 2% pH 2 (Oxoid) for the substrate. Substrate solution (0.5 mL) was incubated with 0.1 mL enzyme solution in 37°C for 10 minutes. 2 mL TCA 5% was added and then filltered. The solution gained was filtrated, and then 1 mL Folin reaction was added. Final solution was read in spectrophotometry on 750nm, blanco and standard solutions (Tirosin) were read in the same wavelength.

2.3 Quality characteristic analysis

2.3.1 *Texture analysis*

The fillet texture were measured using Texture analyzer TA – TX2. The probe was pressed into the fillet at a constant speed of 2 mm/s until it reached 60% of the sample height. The maximum force obtained during compression (gforce) was recorded.

2.3.2 *pH, moisture content and salt content*

The 10 g of samples were homogenized with 90mL aquadest for 1 min. The electrode of pH meter (pH meter Hanna Instrument) was inserted into the slurry while being stirred vigorously. After stabilization, the observed value was recorded. Moisture content of samples were measured at 105°C according to the gravimetric test. The salt content was determined using Silver Nitrite Method.

2.3.3 *Solubility protein analysis*

Protein content in supernatant was divided into two groups of experiment, i.e. set I and set II. Set I was performed with Biuret reaction and set II was using alkaline cooper sulphate reagent. Color was measured using spectrophotometer at 540 nm. Bovine serum albumin was used as the standard solution. All the analysis were run in duplicate.

2.4 *Statistical Analysis*

Group Randomly Design was used in this research and analysis was performed using ANOVA with significant level of 95% and 99%. The computer software for helping this project is SPSS ver 20.

3 RESULTS AND DISCUSSION

3.1 Crude cathepsin acticity

Crude cathepsin activity on raw catfish was 0,144 and it is comparable with previous experiment [5], which showed that crude chatepsin activity on catfish after post rigor was 0.278 U/mL. Different results indicated that activity of crude cathepsin in the same species was not the same due to several factors such as sexual maturity level. The highest cathepsin value is at sexual maturity level [9]. The statistical analysis showed that smoking temperature gave significant different for crude cathepsin activity. Based on Tukey and LSD test each smoking temperature did not gave significant different than the other. The results (0,146 – 0,098 U/mL) showed that different smoking temperature reduce crude

Comment [MNU27]: *ukuran font = 9 * tidak italik

Comment [MNU28]: Ten

Comment [MNU11]: min

*perbaiki kesalahan lain yang serupa (warna merah)

Comment [MNU12]: h

*perbaiki kesalahan lain yang serupa (warna merah)

Comment [MNU29]: *ukuran font = 9

Comment [MNU13]: Perlakuan sentrifugasi ini fungsinya

Comment [MNU14]: centrifugation at

Comment [MNU15]: Gunakan simbol '×' (cari di Symbo

Comment [MNU16]: italik

Comment [MNU17]: Perlakuan sentrifugasi ini fungsinya

Comment [MNU18]: centrifugation at

Comment [MNU19]: 10 000

Comment [MNU30]: *ukuran font = 9

Comment [MNU20]: at

Comment [MNU21]: Bila angka di depan kalimat, mak

Comment [MNU22]: Tuliskan kepanjangannya baru

Comment [MNU31]: *ukuran font = 9

Comment [MNU23]: 750 nm

Comment [MNU24]: blank

Comment [MNU25]: *ukuran font = 9

Comment [MNU32]: Apakah ada levelnya? Bila ada, bisa disebutka

Comment [MNU26]: Cek penulisan satuan yang

Comment [MNU33]: 0.146 U $\cdot mL^{-1}$ to 0.098 U $\cdot mL^{-1}$

chatepshin activity on smoked catfish fillets (Table 1).

2. Crude cathepsin activity was decreasing with the increasing of smoking temperature. The highest value of crude cathepsin activity was on smoked catfish at P1 (40-50°C) then decreasing at 60-70°C and 80°C for P2 and P3 respectively. The reducing activity of crude cathepsin was caused by combination of salt, heat and smoke in catfish smoking process by changing the optimum condition of enzyme to be active (See Table 2). Similar with previous experiment [5], the optimum condition to optimalize activity of crude cathepsin are temperature, pH and metals inhibitor. The optimum temperatures were 40-50°C and decreasing rapidly with increasing temperature in 60-70°C. Optimum pH for crude cathepsin activity are 6-7, the metals inhibitor like Na have 85% relative activity to inhibit the cathepsin activity. Gross Proteolytic Activity of smoked salmon which smoked at 20-30°C was 0,535 mg peptides/mg [10].

Table 1. Crude cathepsin activity (U/mL)

Treatment	Value
P0 (Control)	0,144±0,01^{d}
P1	0,146±0,02^{ab}
P2	0,114±0,02^{abc}
P3	0,098±0,01^{abc}

*Note: Value from average of duplicate ± deviaton standar

**Value following with same small superscript letters were no significantly different (p>0.05)

3.2 Texture

Texture analysis were shown in Table 2, based on Analysis of Varian, different smoking temperature gave significant effect (p<0.05) to the texture of smoked catfish.

In this study the textural changes of smoked catfish caused by smoking temperature and protein solubiity (see solubility protein analysis) were collected. The textural value (Table 2) were decreasing while the smoking temperature was increasing. Heat treatments lead to denaturation on protein muscle, long heat treatment will form aggregation [11]. The textural change was caused by denaturation of protein muscle, then the water soluble protein became semisolid gel structure and it hardened the fish texture.

Table 2. Texture (gforce), pH, moisture content (wet basis %), salt content (wet basis %) and protein solubility (%) of smoked fillets catfish.

beri keterangan di kolom ini	P0	P1	P2	P3
Texture	5482.43±93.45^{a}	4591.37±27.12^{b}	4241.93±56.82^{c}	3881.29±26.75^{d}
pH	7.22±0.04^{a}	7.42±0.02^{b}	7.72±0.01^{c}	8,01±0.04^{d}
Moisture content	79.66±0.04^{a}	77.42±0.02^{b}	74.72±0.01^{c}	72.04±0.04^{d}
Salt content	1.43±0.10^{a}	2.62±0.19^{b}	3.88±0.33^{c}	5.83±0.28^{d}
Protein Solubility	14.37±0.42^{a}	11.66±0.12^{b}	8.32±0.30^{c}	5.80±0.19^{d}

Note : Value from average of duplicate ± deviaton standar

Value following with same small superscript letters were no significantly different (p>0.05).

Comment [MNU38]: Subjek kalimat ini membingungkan. Apakah yang diambil adalah teksturnya? Atau daging ikannya? Atau data perubahan tekstur?

Alternatif kalimat:

The textural changes of bla bla bla were measured

Atau

Data of textural changes of bla bla bla were collected

Silakan dipertimbangkan

Comment [MNU39]: Alternatif kalimat:

With increasing temperature, textural value decreased (see Table 2).

Silakan dipertimbangkan

Comment [MNU34]: bold

Comment [MNU35]: hitam

Comment [MNU36]: judul kolom bold

Comment [MNU37]: diberi spasi

The textural changes of smoked catfish were caused by crude cathepsin activity, although little effect, it all was caused by cathepsin activity. Many proteins which correlates to firmness were affected by cathepsins and make textural changes on rainbow trout [12]. This enzyme was responsible for tissue degradation. The range of fibre densities (85 – 140 fibre mm^{-2}) were observed more "chewiness" and "firmness" in texture charteristics of smoked salmon. The high fibre densities contribute to a firmer texture in fish muscle, and the variety of fibre densities in fish is affected by sexual maturity.

3.3 pH

The pH values of smoked catfish were shown in Table 2. The fresh catfish had pH values of 7.22±0.04, and increased after smoking process. pH values of smoked fish from this study were 7.42-8.01. According to previous research on smoked stingray, pH values of smoked stingray using cocconut shell and corn cob liquid smoke respectively were 7.30 and 8.20 [6]. pH changes on smoked fish is affected by chemical composition of liquid smoke [13]. pH is an important parameter to determine enzyme activity in which pH affects the ionization condition which need the bounding between substrate and enzyme. The catalysis reaction depends on interaction between substrate with side chains amino acid which compile the active side of enzyme [14]. The cathepsin were optimum at pH 6 with the cathepsin activity value of 0.271 U/mL, but in pH 7 or above the value of the cathepsin activity decreased with the value of 0.167 U/mL [5].

3.4 Moisture content

The results of moisture content of smoked catfish were 72.04 – 77.33%, while the moisture content of raw fish was 79.66%. Smoking process could reduce the moisture content of smoked fish due to combination of salting, pre drying and heating process which could evaporate the moisture in fish muscle. Previous research showed that moisture content of smoked milkfish processed by corn cob liquid smoke and then heated in electrical oven and mechanical oven for 3 hours were 58.33% and 63.37% [7].

3.5 Salt content

The salt content of smoked catfish was 2.62 – 5.83%. There was a slight increase in the value of salt content with the increasing of smoking temperature ($p<0.05$). While smoking temperature increased, moisture evaporated and then the salt penetrated into fish flesh because of the osmosis effect from salt. In other experiment, salt content of smoked salmon were 4.0 – 7.2 g per 100 g mositure. While salt content of smoked sea bass which was processed by spray with liquid smoke for 30 minutes and added with NaCl (0.110; 0.150; 0.200; 0.220; 0.270 (g solution of NaCl / g dry material) showed that the salt content were 2.05; 4.46; 4.83; 9.40 dan 17.76 [10, 15].

3.6 Solubility Protein

The solubility protein of smoked catfish decreased as a result of increasing smoking temperature, the heating process indicated the changes on protein solubility. The denaturation of protein was related to protein solubility, the tersier or secondary structure of protein damaged into primary structure by heat treatments. In the primary structure both of the water or salt soluble protein were released easier than in tersier or secundary structure. The decreasing solubility of protein happens as well as by the increasing of smoking temperature. [10], the protein solubility value of smoked salmon which smoked at 29.9°C were significantly lower than smoked salmon smoked at 21.5°C. Another study showed that by applying different process on mullets fillet with high temperature until lower temperature heating i.e. frying (150°C for 10 mins), grilling (100°C for 20 min, 10 min on each side) and steaming (98°C for 20 min), showed that the higest solubility of protein at frying process, grilling and steaming respectively [16].

Comment [MNU40]:
*ukuran font = 9
* tidak italik

Comment [MNU41]:
*ukuran font = 9
* tidak italik

Comment [MNU42]:
*ukuran font = 9
* tidak italik

Comment [MNU43]:
w/w

Comment [MNU44]:
satuan

Comment [MNU45]:
protein solubility

*ukuran font = 9
* tidak italik

Comment [MNU46]:
Frasa ini membingungkan.

Alternatifnya:

protein solubility decreased as temperature decrease

4 CONCLUSION

Inceasing smoking temperature could inhibit the crude cathepsin enzyme activity, reduced the texture, moisture content, and protein solubility of smoked catfish. The information from this study could be a reference for producing the quality smoked fish in particular on characteristic of protein nutritive aspect.

Acknowledgements

The authors would like to acknowledge the financial support provided by Directorate General of Research and Public Services, Ministry of Research, Technology and Higher Education with contract number DIPA-023.04.1.673453/2015, November 14th2014 revised on DIPA March 1st 2015.

References

[1] Ministry of Marine Affairs and Fisheries. 2013. *Marine and Fisheries in Figures 2013*. Jakarta: Centre of Data, Statistic and Information.

[2] Islam R, Paul DK, Rahman A, Parvin T, Islam D, Sattar A. 2012. Comparative characteristic of lipids and nutrient contents of *Pangasius pangasius* and *Pangasius Sutchi* available in Bangladesh. *Journal Nutrition & Food Science*. 2:2. 2012.

[3] Ladrat C, Verrez-Bagins V, Noel J, and Fleurence J. 2003. In vitro proteolysis of myofibrillar and sarcoplasmic proteins of white muscle of sea bass (*Dicentrachus labrax* L) : Effects of chatepsins B, D and L. *Food Chemistry*. 81 : 517 – 525.

[4] Bahuaud D, Morkore T, Langsrud O, Sinnes K, Veiseth E, Ofstad R, 2008. Effects of-1.5°C super chilling on quality of Atlantic salmon (*Salmosalar*) pre-rigor fillets : cathepsin activity, muscle histology, texture and liquid leakage. *Food Chemistry*. 111. 329-339.

[5] Fikri MZ, Nurhayati T and Salamah E. 2012. Ekstraksi dan Karakterisasi Parsial Ekstrak Kasar Enzim Katepsin Dari Ikan Patin. *J. Teknol. Dan Industri Pangan*. Vol 25 No 1 Th 2014.

[6] Swastawati F, Susanto E, Cahyono B, and Trilaksono WA. 2012. Sensory evaluation and chemical characterictics of smoked Stingray (Dasyatisblekeery) processed by two different liquid smoke. *International Journal of Bioscience, Biochemistry and Bioinformatics.* 2012, 2 (3): 212-216.

[7] Swastawati F, DarmantoYS, Sya'rani L, RahayuKK, and Anthony TaylorKD. 2014. Quality characteristic of smoked Skipjack (Katsuwonus pelamis) using different liquid smoke. *International Journal of Bioscience, Biochemistry and Bioinformatics.* Vol. 4 No 2 March 2014. 94-99.

[8] Dinu D, Dumitru IF, and Nichifor MT. 2002. Isolation and Characterization of Two Chatepsin From Muscle of *Carasiussauratusgibelio*. *Roum Biotechnology*. 7 : 753 – 758.

[9] Johnston AI, Alderson R, Sandham C, Dingwall A, Mitchell D, Selkirk C, Nickell D, Baker R, Robertson B, Whyt D, Springate J. 2000. Muscle fibre density in relation to the colour and texture of smoked Atlantic salmon (*Salmosalar* L). *Aquaculture*. Vol 189, Issues 3-4, 2 October 2000. Pages 335 – 349.

[10] Lisbeth H., Anna Maria Bencze Rora. Ingelin Steinsland. Torstein Skara. Turid Rustad. 2004. Proteolytic Activity and Properties of Proteins in Smoked Salmon (Salmo salar) - Effects of Smoking Temperature. *Food Chemistry* 85: 377-387.

[11] Kajak-Siemaszko K, Aubry L, Peyrin F, BaxM-L, Gatellier P, Astruc T, Przybylski W, Jaworska D, Gaillard Martine B and Sante Lhoutellier V. Characterization of protein aggregates following a heating and freezing process. *Food Research International* 44 (2011) 3160-3166.

[12] Godiksen H, Morzel M, Hyldig G and Jessen F. 2008. Contribution of chatepsin B, L and D to muscle protein profiles correlated with texture in rainbow trout (*Oncorhynchusmykiss*). *Food Chemistry*. Vol 113, Issue 4 15 April 2009. Pp 889-896.

[13] Martines O. 2007. Textural and physicochemical changes in salmon (salmo salar) treated with commercial liquid smoke flavourings. *Food Chemistry* 100 (2007). 498-503.

[14] Bender DA. 2002. *Introduction to Nutrition and Metabolism*. Vol. 1. New York: Taylor & Francis Inc.

[15] Fuentes A, Fernandez-Segvovia I, Serr JA, Barat JM. 2010. Development of a smoked sea bass product with partial sodium replacement. *LWT - Food Science and Technology*. 43 (2010) 1426 – 1433.

[16] Ghelichpour M and Shabanpour B. 2011. The investigation of proximate composition and protein solubility in processed mullet fillets. *International Food Research Journal* 18 (4) : 1343 – 1347.

Comment [MNU47]:
ukuran font = 11

Comment [MNU48]:
ukuran font = 7.5

Comment [MNU49]:
Penulisan referensi dari jurnal yang benar:

Islam, R., Paul, D.K., Rahman, A., Parvin. T., Islam, D., Sattar, A. 2012. Comparative Characteristic of Lipids and Nutrient Contents of *Pangasius pangasius* and *Pangasius sutchi* Available in Bangladesh. *Journal Nutrition & Food Science*. 2(2): 130–135.

*pemisah antara nama author, tahun, judul paper, nama jurnal dan volume menggunakan tanda titik

*nama author
nama belakang diikuti tanda koma, lalu nama depan diikuti titik; gunakan tanda titik untuk memisahkan nama author pertama dan nama author kedua dst

*tahun
ditulis setelah nama author

*judul paper
- huruf pertama pada setiap kata menggunakan huruf capital, kecuali pada kata depan (eg: in, on, of, and, dll ditulis huruf kecil)
- nama Latin italik

*nama jurnal
Italik; bila ada singkatannya sebaiknya disingkat

*volume:
volume(issue): halaman–halaman. Setelah titik dua, diberi spasi. Tanda pemisah antara halaman dengan halaman menggunakan tanda en dash '–' (bukan minus '-' atau em dash '—')

*perbaiki kesalahan serupa pada referensi

Re: Koreksian naskah a.n. Frontha Swastawati

Dari: Monika Nur Utami Prihastyanti, S.TP, M.Nat.Sc (monika.nur@machung.ac.id)
Kepada: fronthea_thp@yahoo.co.id
Tanggal: Jumat, 6 November 2015 14.30 WIB

yth. Bu Thea,

Saya melampirkan koreksian kembali. Tinggal sedikit koreksiannya, Bu.

Untuk komentar dari MB materi (Bu Kapti Rahayu) pada dasarnya merekomendasikan untuk dipublish. Komentar beliau hanya seputar format penulisan satuan dan referensi sementara dari materi sudah dinilai baik.

Lalu menanggapi pertanyaan Ibu, saya coba jawab sebagai berikut:

1. Untuk satuan gforce, kalau memang ada padanan SInya mungkin sebaiknya diganti Bu. Tapi saya cari juga sepertinya susah ya Bu. Mungkin kasus ini masih tidak apa-apa kalau tidak diganti Bu.

2. Maaf Bu Thea, untuk pH memang tidak ada satuannya. Sepertinya saya salah memberi coretan di naskah. Jadi untuk yang pH tidak ada masalah Bu.

Demikian dari saya. Mohon maaf agak lama merespon email Ibu. Saya tunggu revisinya kembali.

Terima kasih

Monika

From: Fronthea Swastawati <fronthea_thp@yahoo.co.id>
Sent: Monday, November 2, 2015 3:16 PM
To: Monika Nur Utami Prihastyanti, S.TP, M.Nat.Sc
Subject: Bls: Koreksian naskah a.n. Frontha Swastawati

Ybs. Mbak Monika

Bersama ini kami lampirkan paper yang sudah kami perbaiki berdasarkan koreksi dari mbak monika. Namun ada beberapa pertanyaan / mohon masukan dari Mbak Monika seperti :

1. Apakah satuan tekstur (gforce) jika diubah SI menjadi (Kgforce)? karena pada jurnal yang kami jadikan acuan (Godiksen, 2008) menyatakan "gforce".

2. Mohon masukannya untuk satuan pH apakah memang harus diberi satuan atau bagaimana? Karena pada jurnal yang kami jadikan acuan (Mohan, 2007) besarnya nilai pH hanya dituliskan angka tanpa ada satuan dibelakangnya.

Atas perhatian dan kerjasamanya yang baik saya ucapkan terima kasih.

salam,
Fronthea Swastawati

Pada Kamis, 29 Oktober 2015 14:32, "Monika Nur Utami Prihastyanti, S.TP, M.Nat.Sc" <monika.nur@machung.ac.id> menulis:

yth. Ibu Fronthea,

Saya melampirkan naskah Ibu kembali yang telah saya koreksi lagi format penulisannya. Mungkin sekalian dengan templatenya supaya bisa dijadikan acuan ya Bu. Mohon berkenan menyelesaikan revisian dan mengirimkan kembali kepada saya selambatnya tanggal 3 November 2015.

Berkenaan dengan data baru yang Ibu tambahkan di naskah, maka saya kembali mengirimkan naskah Ibu kepada Ibu Kapti Rahayu untuk diperiksa sekali lagi.

Demikian yang dapat saya sampaikan. Terima kasih atas perhatiannya.

Salam,

Monika

From: Fronthea Swastawati <fronthea_thp@yahoo.co.id>
Sent: Thursday, October 22, 2015 12:25 PM
To: Monika Nur Utami Prihastyanti, S.TP, M.Nat.Sc
Subject: Jurnal_Enzyme_Dr.Fronthea_221015

Yth. Mbak Monika
Selamat siang mbak monika, bersama ini saya kirimkan junal enzyme yang sudah saya perbaiki dan ada tambahan data mengenai SEM. mohon sekiranya bisa dikoreksi kembali. Atas perhatian dan kerjasamanya yang baik saya ucapkan terima kasih.

Salam.

Fronthea Swastawati
Laboratory of Fisheries Processing Technology
Faculty of Fisheries and Marine Sciences, Diponegoro University
Jl. Prof. Sudarto, SH., Tembalang, Semarang 50275
Phone Office +6224 7474698
Phone +6281 225 191 989
+6285 626 816 13

Fronthea_10.16_k10.13_r10.16_k10.29_r11.02_k11.06.docx
1.9MB

Jurnal

Teknologi

Full Paper

CRUDE CATHEPSIN ACTIVITY AND QUALITY CHARACTERISTIC OF SMOKED CATFISH (*PANGASIUS PANGASIUS*) PROCESSED BY DIFFERENT SMOKING TEMPERATURE

Article history

Received

6 October 2015

Received in revised form

……..

Accepted

……..

Fronthea Swastawati[a]* , Ahmad Ni'matullah Al Baarri[b], Tri Winarni Agustini[a] , Eko Nurcahya Dewi[a], Ima Wijayanti[a], Dwi Yanuar Budi Prasetyo[c]

*Corresponding author

fronthea_thp@undip.ac.id

[a]Laboratory of Fish Processing Technology, Faculty of Fisheries and Marine Science, Diponegoro University, Jl. Prof Soedarto, SH, Tembalang, Semarang – 50275, Indonesia

[b]Laboratory of Chemistry and Food Nutrition, Faculty of Animal and Agriculture, Diponegoro University, Semarang – 50275, Indonesia

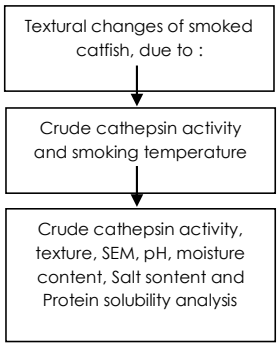
[c]Magister Coastal Resource Management, Faculty of Fisheries and Marine Science, Diponegoro University, Jl. Imam Bardjo, SH, Semarang – 50241, Indonesia

Comment [MNU50]: 1.Mohon perbaiki kata-kata yang berwarna merah sesuai koreksian pada kotak comment

2. Mohon tidak menghapus kotak comment supaya memudahkan editor untuk memeriksa revisi.

3.File disimpan dalam format MsWord 97-2003-

Graphical abstract



Abstract

The aim of this research were to investigate the effect of smoking temperature towards crude cathepsin activity and quality characteristic of smoked catfish (*Pangasius pangasius*). Different smoking temperature had significant effect ($p < 0.05$) on crude cathepsin activity, texture, pH, moisture content, salt content and protein solubility. The significant decreasing (30.13 %) of crude cathepsin activity at P3 (80 °C) from P1 (40 °C to 50 °C). Many factors were correlated to the textural changes of smoked catfish such as changes of crude cathepsin activity, reduction of protein solubility and pH value.

Keywords : Catfish (*Pangasius pangasius*), crude cathepsin activity, quality characteristic, smoking temperature

Comment [MNU51]: Mungkin bisa dibuat berwarna supaya lebih menarik

3.0 INTRODUCTION

Catfish (*Pangasius pangasius*) is one of the economic aquaculture fish species that can be found in Indonesia's waters. Its production was increasing by 37 % during 2008 to 2012 [1]. In terms of its nutrition aspect, catfish contains about 35 % of protein and 10.1 % of lipid with dominant fatty acids profile were lauric acid (13.36 %), palmitic acid (26.15 %), oleic acid (46.07 %) and stearic acid (14.40 %) which contribute to human health [2]. Texture is an important quality characteristic and acceptability factor for consumer. The texture of catfish is influenced by several factors such as size, age, macro nutrients composition (protein and lipid content), handling and processing condition. Catfish is one of many aquatic products which is highly perishable, in which after the post mortem the enzymatic decomposition rapidly breaks down the texture of fish components like myofibril and connective tissue. [3], cathepsin enzyme activity could change the structure and firmness. Cathepsin B, L and D were able to decrease α-actinin which is responsible to the fish firmness. A significant correlation was observed between enzymatic activity of cathepsin B and L and muscle degradation of Atlantic salmon [4].

Smoking process could inhibit the enzymatic decomposition. Brinning, pre drying, chemical composition of smoke and heating in smoking process could change the optimum condition of cathepsin to be active. Cathepsinneedsa certain condition to optimiz their activity, such as temperature, pH, substrate concentration and the presence of metal inhibitor [5]. Nowadays smoking is not only a preservative method but it also givesa specific flavour and taste on smoked fish to increase the consumer acceptability. This role could be obtained using liquid smoke, which is easier to apply and is environmentally safe [6]. The aim of this research was to investigated the effects of smoking temperature to crude cathepsin activity which affect textural changes and quality characteristic of smoked catfish.

4.0 EXPERIMENTAL

2.1 Smoking Process

Smoking method of catfish was performed with some modification [7]. Fillets of catfish were separated into four groups. Each group dipped into 5 % brine and 5 % liquid smoke for 30 min. Pre-drying in room temperature for about 60 min and then smoked in the electrical oven at 40 °C to 50 °C (P1), 60 °C to 70 °C (P2) and 80 °C (P3) for 1 h each. Then it was chilled in the room temperature and then packed with poliethylene bag before analysis in the laboratory.

3.2 Crude Cathepsin Activity Analysis

Proteolytic activity assays was performed with some modification [8]. One g of fillet was mixed with 1 mL of aquadest and then it was separated using centrifugation at 600 × g for 10 min at 4 °C. The supernatant was then separated again using centrifugation at 10.000 × g for 10 min at 4 °C. Then the extract was dissolved into 1 mL 0,1 M Tris-HCl buffer (Aplichem) pH 7.4, continued with centrifugation at 4.000 × g for 10 min at 4 °C. Proteolytic activity was analyzed with hemoglobin 2 % pH 2 (Oxoid) for the substrate. Substrate solution (0.5 mL) was incubated with 0.1 mL enzyme solution at 37 °C for 10 min. Two mL Trichloro Acetid Acid (TCA) 5% was added and then filltered. The solution gained was filtrated, and then 1 mL Folin reaction was added. Final solution was read in spectrophotometry on 750 nm, blank and standard solutions (Tirosin) were read in the same wave length.

3.3 Quality Characteristic Analysis

3.3.1 Texture Analysis

Texture were measured using Texture analyzer TA – TX2. The probe was pressed into the fillet at a constant speed of 2 mm $\cdot s^{-1}$ until it reached 60 % of the sample height. The maximum force obtained during compression (gf) was recorded.

3.3.2 pH, Moisture Content and Salt Content

Ten g of samples were homogenized with 90 mL aquadest for 1 min. The electrode of pH meter (pH meter Hanna Instrument) was inserted into the slurry while being stirred vigorously. After stabilization, the observed value was recorded. Moisture content of samples were measured at 105 °C according to the gravimetric test. The salt content was determined using Silver Nitrite Method.

3.3.3 Protein Solubility Analysis

Protein content in supernatant was divided into two groups of experiment, i.e. set I and set II. Set I was performed with Biuret reaction and set II was using alkaline cooper sulphate reagent. Color was measured using spectrophotometer at 540 nm. Bovine serum albumin was used as the standard solution. All the analysis were run in duplicate.

3.4 Statistical Analysis

Group Randomly Design was used in this research and analyzed using ANOVA with significant level of 95 %. The computer software for helping this project was SPSS ver 20.

5.0 RESULTS AND DISCUSSION

5.1 Crude Cathepsin Activity

Crude cathepsin activity on raw catfish was 0.860 $U \cdot ml^{-1}$ and it is comparable with previous experiment [5], which showed that crude chatepsin activity on cat fish after post rigor was 0.278 $U \cdot m^{-1}$. The various results might be influenced by several factors such as sexual maturity level. The highest cathepsin value was reached at sexual maturity season [9]. The statistical analysis showed that smoking temperature gave significant differences for crude cathepsin activity. Based on LSD test the smoking temperature give significant different for crude cathepsin activity. The results showed that P0 and P1 did not significant different, P1 significant different with P2 and P3 but P2 did not significant different with P3 (Table 1). Reduction of crude cathepsin activity showed significant at P3 (31.98 %) from P0; 21.16 % from P0 to P2 and 13.72 % from P2 to P3.

Table 1 Crude cathepsin activity ($U \cdot mL^{-1}$)

Treatment	Value
P0 (Control)	0.860 ± 0.06^{a}
P1	$0.880 \pm 0,03^{a}$
P2	$0.678 \pm 0,00^{b}$

P3	0.585 ± 0,02[b]

Note: Average value of duplicate ± standard deviaton

Value following with same small superscript letters were no significantly different (p > 0.05).

Crude cathepsin activity was decreasing with the increasing of smoking temperature. The highest value of crude cathepsin activity was on smoked catfish at P1 (40 °C to 50 °C) then followed by P2 (60 °C to 70 °C) and P3 (80 °C) The reduction of crude cathepsin activity may be affected by combination of salt, heat and smoke in catfish smoking process by changing the optimum condition of enzyme to be active (Table 2). It was similar with previous experiment [5] that, the optimum condition to optimalize activity of crude cathepsin were temperature, pH and metals inhibitor. The optimum temperatures were 40 °C to 50 °C and decreasing rapidly with increasing temperature in 60 °C to 70 °C. The value of optimum pH for crude cathepsin activity was recorded in the range 6 to 7, the metals such as Na could inhibit 85 % relative cathepsin activity. Gross Proteolytic Activity of smoked salmon which smoked at 20 °C to 30 °C was 0.535 mg peptides $\cdot mg^{-1}$ [10].

3.2 Texture

Based on the data that was shown at Table 2 smoking temperature and protein solubility caused the changes on smoked catfish texture. The increase of smoking temperature affected the decrease in the textural value. Heat treatments lead to denaturation on protein muscle, long heat treatment will form aggregation [11]. The textural change caused by denaturation of protein muscle, then the water soluble protein and the texture tended to semisolid gel structure resulting in the hard texture.

Table 2 Texture (gf), pH, moisture content (wet basis %), salt content (wet basis %) and protein solubility (%) of smoked fillets catfish

Parameters	P0	P1	P2	P3
Texture	5482.43 ± 93.45[a]	4591.37 ± 27.12[b]	4241.93 ± 56.82[c]	3881.29 ± 26.75[d]
pH	7.22 ± 0.04[a]	7.42 ± 0.02[b]	7.72 ± 0.01[c]	8,01 ± 0.04[d]
Moisture content	79.66 ± 0.04[a]	77.42 ± 0.02[b]	74.72 ± 0.01[c]	72.04 ± 0.04[d]
Salt content	1.43 ± 0.10[a]	2.62 ± 0.19[b]	3.88 ± 0.33[c]	5.83 ± 0.28[d]
Protein Solubility	14.37 ± 0.42[a]	11.66 ± 0.12[b]	8.32 ± 0.30[c]	5.80 ± 0.19[d]

Note : Average value of of duplicate measurement ± standard deviaton.

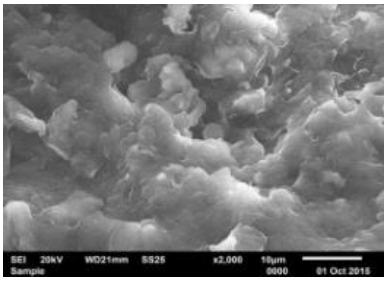
Value following with same small superscript letters were no significantly different (p>0.05).

The textural changes of smoked catfish were caused by crude cathepsin activity, even in small amount. Cathepsin activity was correlated to firmness and made textural changes on rainbow trout [12]. This enzyme was responsible for tissue degradation. The range of fibre densities from 85 fibre mm^{-2} to 140 fibre mm^{-2} indicates optimum "chewiness" and "firmness" in texture characteristics of smoked salmon. The high fibre densities contributed to a firmer texture in fish muscle, and the variety of fibre densities in fish was affected by sexual maturity [13].

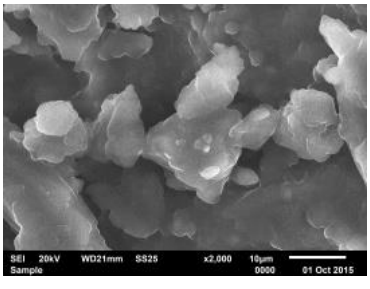
3.3 Scanning Electron Microscope (SEM)

Textural changes of smoked catfish were measured by Scanning Electron Microscope (SEM). SEM analysis was performed to describe structural changes in texture of smoked catfish. Figure 1(a) showed that the structure of texture smoked catfish still complex and solid. Figure 1 (b) showed that the texture molecules of smoked catfish more visible aggregate. Figure 1 (c) the clods more bigger concomitant with increasing time and smoking temperature. At the end of smoking process (Figure 1d) the clods of texture smoked catfish were destroyed and the structure became loose. In the previous research, the aggregate formation increased regularly in meat heated at 60 °C, whereas meat heated at higher temperature (100 °C and 140 °C) showed dramatic increase up to 5-fold the initial level. The temperature increase promote exposure the thiol group and interior hydrophobic residues of BSA, enabling the formation of hydrogen bonds and hydrophobic interactions. This reaction and interactions promoted protein aggregation via a non–native and expanded conformational state [11, 14].

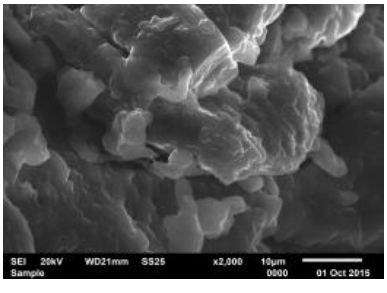
Comment [MNU52]: Kedua kalimat ini maknanya masih kurang jelas. Mungkin kalo ada kalimat bahasa Indonesianya mohon saya diberitahu supaya bisa saya bantu sedikit.



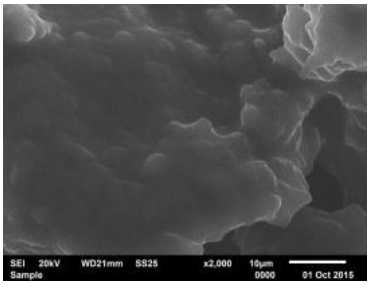
1 (a)



1 (b)



1 (c)



1 (d)

Figure 1. SEM image from smoked catfish with various treatments, i.e. (a) P0, (b) P1, (c) P2 and (d) P3

3.4 pH

The pH values of smoked catfish were shown in Table 2. The fresh catfish had pH values of 7.22 ± 0.04, and increased after smoking process. pH values of smoked fish from this study were 7.42 to 8.01. According to previous research on smoked stingray, pH values of smoked stingray using cocconut shell and corn cob liquid smoke were 7.30 and 8.20 respectively [6]. The changes on pH on smoked fish was affected by chemical composition of liquid smoke [15]. The value of pH is an important role to determine enzyme activity in which pH affects the ionization condition which needs the bounding between substrate and enzyme. The catalysis reaction depended on interaction between substrate with side chains amino acid which bound the active side of enzyme [16]. When pH of cathepsin was 6, cathepsin activity was 0.271 U $\cdot mL^{-1}$, but in pH 7 or above the value of the cathepsin activity decreased (0.167 U $\cdot mL^{-1}$) [5]. This irreversible enzyme was inactive at pH above 7 but generally highly active at acidic environment [17].

3.5 Moisture Content

Moisture content of smoked catfish were 72.04 % to 77.33 %, while the moisture content of raw fish was 79.66 %. Smoking process caused the reduction in the moisture content of smoked fish and, the combination of salting, pre drying and heating process evaporated the moisture in fish muscle as well. Previous research showed that moisture content of smoked milkfish processed by corn cob liquid smoke was 58.33 % and 63.37 % respectively [7].

3.6 Salt Content

The salt content of smoked catfish was 2.62 % to 5.83 %. There was a slight increase in the value of salt content with the increasing of smoking temperature ($p < 0.05$). While smoking temperature increased, moisture evaporated and then the salt penetrated into fish flesh because of the osmosis effect from salt. In other experiment, salt content of smoked salmon were 4.0 g to 7.2 g per 100 g moisture [10]. While salt content of smoked sea bass which were processed by spray with liquid smoke for 30 min and added with NaCl (0.110 %; 0.150 %; 0.200 %; 0.220 %; 0.270 %) were 2.05 %; 4.46 %; 4.83 %; 9.40 % and 17.76 % respectively [18].

3.7 Protein Solubility

Protein solubility of smoked catfish decreased as a result of increasing smoking temperature, the heating process indicated the changes on protein solubility. The denaturation of protein relates to protein solubility, the tertiary or secondary structure of protein was damaged until the became primary structure due to heat treatments. In the primary structure, both water and salt soluble protein were released easier than in tertiary or secundary structure. The decreasing solubility of protein occurred because of increased smoking temperature. In the previous research, the protein solubility value of smoked salmon which was smoked at 29.9 °C were significantly lower than salmon smoked at 21.5 °C [10]. The changes of protein solubility was due to pH in which protein solubility increased at extremely acidic and alkaline environment. Previous research showed that at the extreme of pH, solubility increased to almost five times that of the original (pH 6.3), i.e. 125.73 ± 0.64 mg $\cdot g^{-1}$ at pH 2; 58.92 ± 1.10 mg $\cdot g^{-1}$ at pH 4; 21.42 ± 0.5 mg $\cdot g^{-1}$ at pH 6; 44.76 ± 0.95 mg $\cdot g^{-1}$ at pH 8 and 122.85 ± 1.2 mg $\cdot g^{-1}$ at pH 12 [19]. Another study showed that minimum protein solubility that called isoelectric point, in raw or cooked samples exhibited at pH 5 to 6. Protein solubility decreased with increasing pH to isoelectric point then increased again to high pH [20].

4.0 CONCLUSION

Inceasing smoking temperature could inhibit the crude cathepsin enzyme activity and reduced the texture, moisture content, and protein solubility of smoked catfish. The information from this study could be a reference to produce good quality smoked fish in particular protein nutritive aspect.

Acknowledgements

The authors would like to acknowledge the financial support provided by Directorate General of Research and Public Services, Ministry of Research, Technology and Higher Education with contract number DIPA-023.04.1.673453/2015, November 14th2014 revised on DIPA March 1st 2015.

References

[1] Ministry of Marine Affairs and Fisheries. 2013. Marine and Fisheries in Figures 2013. Jakarta: Centre of Data, Statistic and Information.

[2] Islam, R., Paul, D.K., Rahman, A., Parvin. T., Islam, D. and Sattar, A. 2012. Comparative Characteristic of Lipids and Nutrient Contents of *Pangasius pangasius* and *Pangasius sutchi* Available in Bangladesh. *Journal Nutrition & Food Science*. 2(2): 130–135.

[3] Ladrat, C., Verrez-Bagins, V., Noel, J. and Fleurence, J. 2003. In Vitro Proteolysis of Myofibrillar and Sarcoplasmic Proteins of White Muscle of Sea Bass (*Dicentrachus labrax* L) : Effects of Chatepsins B, D and L. *Food Chemistry*. 81: 517–525.

[4] Bahuaud, D., Morkore, T., Langsrud, O., Sinnes, K., Veiseth, E. and Ofstad, R. 2008. Effects of –1.5 °C Super Chilling on Quality of Atlantic Salmon (*Salmo salar*) Pre–Rigor Fillets : Cathepsin Activity, Muscle Histology, Texture and Liquid Leakage. *Food Chemistry*. 111: 329–339.

[5] Fikri, MZ., Nurhayati, T. and Salamah, E. 2014. Extraction and Partial Characterization of Crude Cathepsin From Catfish. *J. Teknol. dan Industri Pangan*. 25 (1) : 119–123.

[6] Swastawati, F., Susanto, E., Cahyono, B. and Trilaksono, WA. 2012. Sensory Evaluation and Chemical Characterictics of Smoked Stingray (*Dasyatis blekeery*) Processed by Two Different Liquid Smoke. *International Journal of Bioscience, Biochemistry and Bioinformatics.* 2(3): 212–216.

[7] Swastawati, F., Darmanto, Y.S., Sya'rani, L., Rahayu, KK. and Taylor, K.D.A. 2014. Quality Characteristic of Smoked Skipjack (*Katsuwonus pelamis*) Using Different Liquid Smoke. *International Journal of Bioscience, Biochemistry and Bioinformatics.* 4(2): 94–99.

[8] Dinu, D., Dumitru, IF. and Nichifor, MT. 2002. Isolation and Characterization of Two Chatepsin from Muscle of *Carasiuss auratus gibelio*. *Roum Biotechnology*. (7): 753–758.

[9] Johnston, A.I., Alderson, R., Sandham, C., Dingwall, A., Mitchell, D., Selkirk, C., Nickell, D., Baker, R., Robertson, B., Whyt D. and Springate, J. 2000. Muscle Fibre Density in Relation to the Colour and Texture of Smoked Atlantic Salmon (*Salmo salar* L). *Aquaculture*. 189(3–4): 335–349.

[10] Lisbeth, H., Rora, A.M.B., Steinsland, I., Skara, T. and Rustad, T. 2004. Proteolytic Activity and Properties of Proteins in Smoked Salmon (*Salmo salar*) – Effects of Smoking Temperature. *Food Chemistry*. 85: 377–387.

[11] Kajak-Siemaszko K., Aubry, L., Peyrin, F., Bax M-L., Gatellier, P., Astruc, T., Przybylski, W., Jaworska, D., Gaillard Martine, B. and Sante Lhoutellier V. 2011. Characterization of Protein Aggregates Following a Heating and Freezing Process. *Food Research International.* 44: 3160–3166.

[12] Godiksen, H., Morzel, M., Hyldig, G. and Jessen, F. 2008. Contribution of Chatepsin B, L and D to Muscle Protein Profiles Correlated with Texture in Rainbow Trout (*Oncorhynchus mykiss*). *Food Chemistry*. 113(4): 889–896.

[13] Johnston. I, A., Alderson. R., Sandham. C., Dingwall. A., Mitchell. D., Selkirk. C., Nickell. D., Baker. R., Robertson. B., Whyte. D. and Springate. J. 2000. Muscle Fibre Density in Relation to the Colour and Texture of Smoked Atlantic Salmon (*Salmo salar* L). *Aquaculture.* 189(3–4): 335–349.

[14] Su. R., Qi. W., He. Z., Zhang. Y. and Jin. F. 2008. Multilevel Structural Nature and Interactions of Bovine Serum Albumin during Heat Induced Aggregation Process. *Food Hydrocolloids*. 22: 995–1005.

[15] Martines, O. 2007. Textural and Physicochemical Changes in Salmon (*Salmo salar*) Treated With Commercial Liquid Smoke Flavourings. *Food Chemistry.* 100: 498–503.

[16] Bender, DA. 2002. *Introduction to Nutrition and Metabolism*. Vol. 1. New York: Taylor & Francis Inc.

[17] Ahmed. Z., Donkor. O., Street. W. A. and Vasiljevic, T. 2015. Calpains – and Cathepsins – Induced Myofibrillar Changes in Post–Mortem Fish : Impact on Structural Softening and Release of Bioactive Peptides. *Trends in Food Science & Technology*. 45: 130–146.

[18] Fuentes, A., Fernandez – Segvovia, I., Serr, J.A. and Barat, J.M. 2010. Development of a Smoked Sea Bass Product with Partial Sodium Replacement. *LWT – Food Science and Technology*. 43: 1426–1433.

[19] Mohan, M., Ramachandran, D., Sankar, T.V. and Anandan, R. 2007. Influence of pH on the Solubility and Conformational Characteristic of Muscle Proteins from Mullet (*Mugil cephalus*). *Process Biochemistry*. (42): 1056–1062.

[20] Ghelichpour, M. and Shabanpour, B. 2011. The Investigation of Proximate Composition and Protein Solubility in Processed Mullet Fillets. *International Food Research Journal*. 18(4): 1343–134.

Comment [MNU53]: Apakah ada judul yang berbahasa Indonesianya?

Bila iya, harus ditulis juga judulnya yang dalam bahasa Indonesia

Contoh:

Fikri, MZ., Nurhayati, T. and Salamah, E. 2014. Judul dalam Bahasa Indonesia [Extraction and Partial Characterization of Crude Cathepsin from Catfish]. *J. Teknol. dan Industri Pangan*. 25 (1) : 119–123 [Bahasa Indonesia]

Comment [MNU54]: Dicek lagi karena referensi no 13 ini sama dengan no 9. Mohon sitasi di teks naskah juga dicek.

Naskah a.n. Fronthe (2015.12.03)

Dari: Monika Nur Utami Prihastyanti, S.TP, M.Nat.Sc (monika.nur@machung.ac.id)
Kepada: fronthea_thp@yahoo.co.id
Tanggal: Kamis, 3 Desember 2015 10.17 WIB

yth. Ibu Fronthea,

Saya kembali melampirkan naskah Ibu yang telah saya koreksi. Saya langsung melakukan perbaikan pada naskah Ibu (dapat dicek pada bagian yang saya beri kotak komentar dan yang berwarna merah).

Mohon berkenan memberi tanggapan dalam waktu 3 x 24 jam. Apabila dalam kurun waktu tersebut belum ada tanggapan dari Ibu, maka akan saya anggap template sudah fix sehingga bisa saya proses ke editor selanjutnya.

Demikian yang dapat saya sampaikan. Terima kasih atas perhatiannya.

Salam,

Monika

From: Fronthea Swastawati <fronthea_thp@yahoo.co.id>
Sent: Wednesday, December 2, 2015 1:23 PM
To: Monika Nur Utami Prihastyanti, S.TP, M.Nat.Sc
Subject: Enzyme_Dr.Fronthea_02122015

Ysb. Mbak Monika
Selamat siang mbak monika, bersama ini saya kirimkan junal enzyme yang sudah saya perbaiki. Mohon sekiranya bisa dikoreksi kembali. Atas perhatian dan kerjasamanya yang baik saya ucapkan terima kasih.

Salam.

Fronthea Swastawati
Laboratory of Fisheries Processing Technology
Faculty of Fisheries and Marine Sciences, Diponegoro University
Jl. Prof. Sudarto, SH., Tembalang, Semarang 50275
Phone Office +6224 7474698
Phone +6281 225 191 989
+6285 626 816 13

Fronthea_10.16_k10.13_r10.16_k10.29_r11.02_k11.06_r12.2_k12.3.docx
1.9MB

Jurnal
Teknologi

Full Paper

CRUDE CATHEPSIN ACTIVITY AND QUALITY CHARACTERISTIC OF SMOKED CATFISH (*PANGASIUS PANGASIUS*) PROCESSED BY DIFFERENT SMOKING TEMPERATURE

Article history

Received

6 October 2015

Received in revised form

……..

Accepted

……..

Fronthea Swastawati[a]* , Ahmad Ni'matullah Al Baarri[b], Tri Winarni Agustini[a] , Eko Nurcahya Dewi[a], Ima Wijayanti[a], Dwi Yanuar Budi Prasetyo[c]

*Corresponding author

fronthea_thp@undip.ac.id

Tel. +6281225191989

[a]Laboratory of Fish Processing Technology, Faculty of Fisheries and Marine Science, Diponegoro University, Jl. Prof Soedarto, SH, Tembalang, Semarang – 50275, Indonesia

[b]Laboratory of Chemistry and Food Nutrition, Faculty of Animal and Agriculture, Diponegoro University, Semarang – 50275, Indonesia

[c]Magister Coastal Resource Management, Faculty of Fisheries and Marine Science, Diponegoro University, Jl. Imam Bardjo, SH, Semarang – 50241, Indonesia

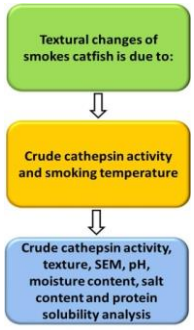
Comment [MNU55]: Naskah ini telah saya perbaiki. Silakan melihat kotak komentar dan tulisan yang berwarna merah.

Apabila masih ada tanggapan, silakan dituliskan pada kotak komentar.

Apabila dalam 3 x 24 jam tidak ada tanggapan lagi, maka saya anggap naskah ini templatenya sudah fix dan akan kami proses lebih lanjut ke MB materi (content reviewer).

Comment [MNU56]: Sesuai hasil pertemuan dengan Pak Roy, author perlu mencantumkan no HP. Saya tuliskan di sini.

Graphical abstract



Abstract

The aim of this research were to investigate the effect of smoking temperature towards crude cathepsin activity and quality characteristic of smoked catfish (*Pangasius pangasius*). Different smoking temperature had significant effect ($p < 0.05$) on crude cathepsin activity, texture, pH, moisture content, salt content and protein solubility. The significant decreasing (30.13 %) of crude cathepsin activity at P3 (80 °C) from P1 (40 °C to 50 °C). Many factors were correlated to the textural changes of smoked catfish such as changes of crude cathepsin activity, reduction of protein solubility and pH value.

Keywords : Catfish (*Pangasius pangasius*), crude cathepsin activity, quality characteristic, smoking temperature

Comment [MNU57]: Saya ubah seperti ini boleh??

6.0 INTRODUCTION

Catfish (*Pangasius pangasius*) is one of the economic aquaculture fish species that can be found in Indonesia's waters. Its production was increasing by 37 % during 2008 to 2012 [1]. In terms of its nutrition aspect, catfish contains about 35 % of protein and 10.1 % of lipid with dominant fatty acids profile were lauric acid (13.36 %), palmitic acid (26.15 %), oleic acid (46.07 %) and stearic acid (14.40 %) which contribute to human health [2]. Texture is an important quality characteristic and acceptability factor for consumer. The texture of catfish is influenced by several factors such as size, age, macro nutrients composition (protein and lipid content), handling and processing condition. Catfish is one of many aquatic products which is highly perishable, in which after the post mortem the enzymatic decomposition rapidly breaks down the texture of fish components like myofibril and connective tissue. [3], cathepsin enzyme activity could change the structure and firmness. Cathepsin B, L and D were able to decrease α-actinin which is responsible to the fish firmness. A significant correlation was observed between enzymatic activity of cathepsin B and L and muscle degradation of Atlantic salmon [4].

Smoking process could inhibit the enzymatic decomposition. Brinning, pre drying, chemical composition of smoke and heating in smoking process could change the optimum condition of cathepsin to be active. Cathepsinneedsa certain condition to optimiz their activity, such as temperature, pH, substrate concentration and the presence of metal inhibitor [5]. Nowadays smoking is not only a preservative method but it also givesa specific flavour and taste on smoked fish to increase the consumer acceptability. This role could be obtained using liquid smoke, which is easier to apply and is environmentally safe [6]. The aim of this research was to investigated the effects of smoking temperature to crude cathepsin activity which affect textural changes and quality characteristic of smoked catfish.

7.0 EXPERIMENTAL

2.1 Smoking Process

Smoking method of catfish was performed with some modification [7]. Fillets of catfish were separated into four groups. Each group dipped into 5 % brine and 5 % liquid smoke for 30 min. Pre-drying in room temperature for about 60 min and then smoked in the electrical oven at 40 °C to 50 °C (P1), 60 °C to 70 °C (P2) and 80 °C (P3) for 1 h each. Then it was chilled in the room temperature and then packed with poliethylene bag before analysis in the laboratory.

3.5 Crude Cathepsin Activity Analysis

Proteolytic activity assays was performed with some modification [8]. One g of fillet was mixed with 1 mL of aquadest and then it was separated using centrifugation at 600 × *g* for 10 min at 4 °C.

The supernatant was then separated again using centrifugation at 10.000 × *g* for 10 min at 4 °C. Then the extract was dissolved into 1 mL 0,1 M Tris-HCl buffer (Aplichem) pH 7.4, continued with centrifugation at 4.000 × *g* for 10 min at 4 °C. Proteolytic activity was analyzed with hemoglobin 2 % pH 2 (Oxoid) for the substrate. Substrate solution (0.5 mL) was incubated with 0.1 mL enzyme solution at 37 °C for 10 min. Two mL Trichloro Acetid Acid (TCA) 5% was added and then filltered. The solution gained was filtrated, and then 1 mL Folin reaction was added. Final solution was read in spectrophotometry on 750 nm, blank and standard solutions (Tirosin) were read in the same wave length.

3.6 Quality Characteristic Analysis

3.6.1 Texture Analysis

Texture were measured using Texture analyzer TA – TX2. The probe was pressed into the fillet at a constant speed of 2 mm · s^{-1} until it reached 60 % of the sample height. The maximum force obtained during compression (gf) was recorded.

3.6.2 pH, Moisture Content and Salt Content

Ten g of samples were homogenized with 90 mL aquadest for 1 min. The electrode of pH meter (pH meter Hanna Instrument) was inserted into the slurry while being stirred vigorously. After stabilization, the observed value was recorded. Moisture content of samples were measured at 105 °C according to the gravimetric test. The salt content was determined using Silver Nitrite Method.

3.6.3 Protein Solubility Analysis

Protein content in supernatant was divided into two groups of experiment, i.e. set I and set II. Set I was performed with Biuret reaction and set II was using alkaline cooper sulphate reagent. Color was measured using spectrophotometer at 540 nm. Bovine serum albumin was used as the standard solution. All the analysis were run in duplicate.

3.7 Statistical Analysis

Group Randomly Design was used in this research and analyzed using ANOVA with significant level of 95 %. The computer software for helping this project was SPSS ver 20.

8.0 RESULTS AND DISCUSSION

8.1 Crude Cathepsin Activity

Crude cathepsin activity on raw catfish was 0.860 U · ml^{-1} and it is comparable with previous experiment [5], which showed that crude chatepsin activity on cat fish after post rigor was 0.278 U · m^{-1}. The various results might be influenced by several factors such as sexual maturity level. The highest cathepsin value was reached at sexual maturity season [9]. The statistical analysis showed that smoking temperature gave significant differences for crude cathepsin activity. Based on LSD test the smoking temperature give significant different for crude cathepsin activity. The results showed that P0 and P1 did not significant different, P1 significant different with P2 and P3 but P2 did not significant different with P3 (Table 1). Reduction of crude cathepsin activity showed significant at P3 (31.98 %) from P0; 21.16 % from P0 to P2 and 13.72 % from P2 to P3.

Table 1 Crude cathepsin activity (U · mL^{-1})

Treatment	Value
P0 (Control)	0.860 ± 0.06^{a}
P1	0.880 ± 0,03^{a}
P2	0.678 ± 0,00^{b}
P3	0.585 ± 0,02^{b}

Note: Average value of duplicate ± standard deviaton

Value following with same small superscript letters were no significantly different ($p > 0.05$).

Crude cathepsin activity was decreasing with the increasing of smoking temperature. The highest value of crude cathepsin activity was on smoked catfish at P1 (40 °C to 50 °C) then followed by P2 (60 °C to 70 °C) and P3 (80 °C) The reduction of crude cathepsin activity may be

affected by combination of salt, heat and smoke in catfish smoking process by changing the optimum condition of enzyme to be active (Table 2). It was similar with previous experiment [5] that, the optimum condition to optimalize activity of crude cathepsin were temperature, pH and metals inhibitor. The optimum temperatures were 40 °C to 50 °C and decreasing rapidly with increasing temperature in 60 °C to 70 °C. The value of optimum pH for crude cathepsin activity was recorded in the range 6 to 7, the metals such as Na could inhibit 85 % relative cathepsin activity. Gross Proteolytic Activity of smoked salmon which smoked at 20 °C to 30 °C was 0.535 mg peptides ·mg^{-1} [10].

3.3 Texture

Based on the data that was shown at Table 2 smoking temperature and protein solubility caused the changes on smoked catfish texture. The increase of smoking temperature affected the decrease in the textural value. Heat treatments lead to denaturation on protein muscle, long heat treatment will form aggregation [11]. The textural change caused by denaturation of protein muscle, then the water soluble protein and the texture tended to semisolid gel structure resulting in the hard texture.

Table 2 Texture (gf), pH, moisture content (wet basis %), salt content (wet basis %) and protein solubility (%) of smoked fillets catfish

Parameters	P0	P1	P2	P3
Texture	5482.43 ± 93.45^{a}	4591.37 ± 27.12^{b}	4241.93 ± 56.82^{c}	3881.29 ± 26.75^{d}
pH	7.22 ± 0.04^{a}	7.42 ± 0.02^{b}	7.72 ± 0.01^{c}	8,01 ± 0.04^{d}
Moisture content	79.66 ± 0.04^{a}	77.42 ± 0.02^{b}	74.72 ± 0.01^{c}	72.04 ± 0.04^{d}
Salt content	1.43 ± 0.10^{a}	2.62 ± 0.19^{b}	3.88 ± 0.33^{c}	5.83 ± 0.28^{d}
Protein Solubility	14.37 ± 0.42^{a}	11.66 ± 0.12^{b}	8.32 ± 0.30^{c}	5.80 ± 0.19^{d}

Note : Average value of of duplicate measurement ± standard deviaton.

Value following with same small superscript letters were no significantly different (p>0.05).

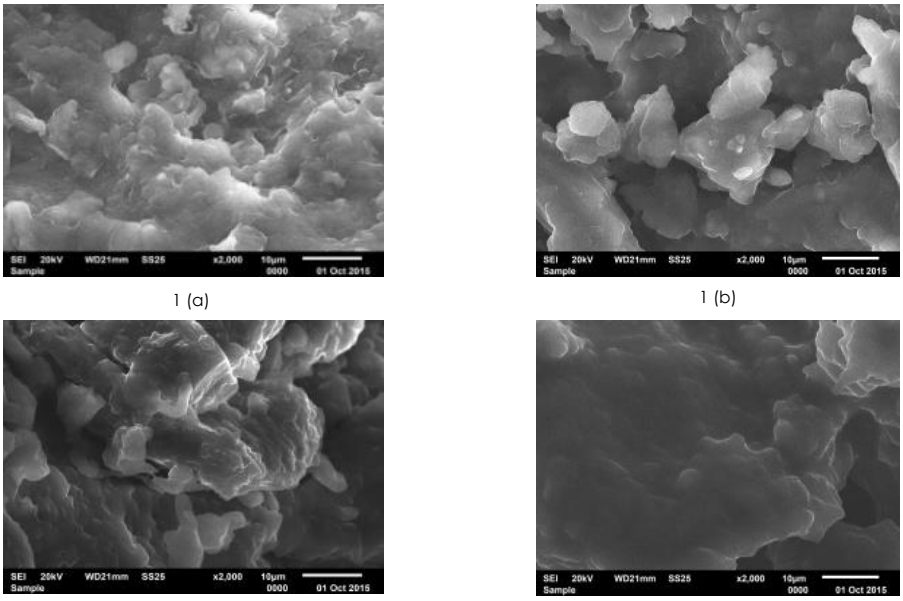
The textural changes of smoked catfish were caused by crude cathepsin activity, even in small amount. Cathepsin activity was correlated to firmness and made textural changes on rainbow trout [12]. This enzyme was responsible for tissue degradation. The range of fibre densities from 85 fibre mm^{-2} to 140 fibre mm^{-2} indicates optimum "chewiness" and "firmness" in texture characteristics of smoked salmon. The high fibre densities contributed to a firmer texture in fish muscle, and the variety of fibre densities in fish was affected by sexual maturity [9].

3.4 Scanning Electron Microscope (SEM)

Textural changes of smoked catfish were measured by Scanning Electron Microscope (SEM). SEM analysis was performed to describe structural changes in texture of smoked catfish. Figure 1(a) showed that the structure of texture smoked catfish still complex and solid. Figure 1 (b) shows aggregates in the texture of smoked catfish. Bigger aggregates were obtained from catfish which was processed in higher temperature and longer smoking time (Figure 1 (c)). Meanwhile. Figure 1 (d) shows that the texture became hardened and damaged. In the previous research, the aggregate formation increased regularly in meat heated at 60 °C, whereas meat heated at higher temperature (100 °C and 140 °C) showed dramatic increase

Comment [MNU58]: Saya ganti seperti ini. Tapi nanti keseluruhan naskah ini tetap akan dikoreksi oleh editor bahasa, jadi mohon memaklumi bila ada perubahan tata bahasa lagi.

up to 5-fold the initial level. The temperature increase promote exposure the thiol group and interior hydrophobic residues of BSA, enabling the formation of hydrogen bonds and hydrophobic interactions. This reaction and interactions promoted protein aggregation via a non–native and expanded conformational state [11,13].



1 (a) 1 (b)

1 (c) 1 (d)

Figure 1. SEM image from smoked catfish with various treatments, i.e. (a) P0, (b) P1, (c) P2 and (d) P3

3.8 pH

The pH values of smoked catfish were shown in Table 2. The fresh catfish had pH values of 7.22 ± 0.04, and increased after smoking process. pH values of smoked fish from this study were 7.42 to 8.01. According to previous research on smoked stingray, pH values of smoked stingray using cocconut shell and corn cob liquid smoke were 7.30 and 8.20 respectively [6]. The changes on pH on smoked fish was affected by chemical composition of liquid smoke [14]. The value of pH is an important role to determine enzyme activity in which pH affects the ionization condition which needs the bounding between substrate and enzyme. The catalysis reaction depended on interaction between substrate with side chains amino acid which bound the active side of enzyme [15]. When pH of cathepsin was 6, cathepsin activity was 0.271 U · mL^{-1}, but in pH 7 or above the value of the cathepsin activity decreased (0.167 U · mL^{-1}) [5]. This irreversible enzyme was inactive at pH above 7 but generally highly active at acidic environment [16].

3.9 Moisture Content

Moisture content of smoked catfish were 72.04 % to 77.33 %, while the moisture content of raw fish was 79.66 %. Smoking process caused the reduction in the moisture content of smoked fish and, the combination of salting, pre drying and heating process evaporated the moisture in fish muscle as well. Previous research showed that moisture content of smoked milkfish processed by corn cob liquid smoke was 58.33 % and 63.37 % respectively [7].

3.10 Salt Content

The salt content of smoked catfish was 2.62 % to 5.83 %. There was a slight increase in the value of salt content with the increasing of smoking temperature ($p < 0.05$). While smoking temperature increased, moisture evaporated and then the salt penetrated into fish flesh because of the osmosis effect from salt. In other experiment, salt content of smoked salmon were 4.0 g to 7.2 g per 100 g moisture [10]. While salt content of smoked sea bass which were processed by spray with liquid smoke for 30 min and added with NaCl (0.110 %; 0.150 %; 0.200 %; 0.220 %; 0.270 %) were 2.05 %; 4.46 %; 4.83 %; 9.40 % and 17.76 % respectively [17].

3.11 Protein Solubility

Protein solubility of smoked catfish decreased as a result of increasing smoking temperature, the heating process indicated the changes on protein solubility. The denaturation of protein relates to protein solubility, the tertiary or secondary structure of protein was damaged, thus, became primary structure due to heat treatments. In the primary structure, both water and salt soluble protein were released easier than in tertiary or secundary structure. The decreasing solubility of protein occurred because of increased smoking temperature. In the previous research, the protein solubility value of smoked salmon which was smoked at 29.9 °C were significantly lower than salmon smoked at 21.5 °C [10]. The changes of protein solubility was due to pH in which protein solubility increased at extremely acidic and alkaline environment. Previous research showed that at the extreme of pH, solubility increased to almost five times that of the original (pH 6.3), i.e. 125.73 ± 0.64 mg · g^{-1} at pH 2; 58.92 ± 1.10 mg · g^{-1} at pH 4; 21.42 ± 0.5 mg · g^{-1} at pH 6; 44.76 ± 0.95 mg · g^{-1} at pH 8 and 122.85 ± 1.2 mg · g^{-1} at pH 12 [18]. Another study showed that minimum protein solubility that called isoelectric point, in raw or cooked samples exhibited at pH 5 to 6. Protein solubility decreased with increasing pH to isoelectric point then increased again to high pH [19].

4.0 CONCLUSION

Inceasing smoking temperature could inhibit the crude cathepsin enzyme activity and reduced the texture, moisture content, and protein solubility of smoked catfish. The information from this study could be a reference to produce good quality smoked fish in particular protein nutritive aspect.

Acknowledgements

The authors would like to acknowledge the financial support provided by Directorate General of Research and Public Services, Ministry of Research, Technology and Higher Education with contract number DIPA-023.04.1.673453/2015, November 14th 2014 revised on DIPA March 1st 2015.

References

[1] Ministry of Marine Affairs and Fisheries. 2013. Marine and Fisheries in Figures 2013. Jakarta: Centre of Data, Statistic and Information.
[2] Islam, R., Paul, D. K., Rahman, A., Parvin. T., Islam, D. and Sattar, A. 2012. Comparative Characteristic of Lipids and Nutrient Contents of *Pangasius pangasius* and *Pangasius sutchi* Available in Bangladesh. *Journal Nutrition & Food Science*. 2(2): 130–135.
[3] Ladrat, C., Verrez–Bagins, V., Noel, J. and Fleurence, J. 2003. In Vitro Proteolysis of Myofibrillar and Sarcoplasmic Proteins of White Muscle of Sea Bass (*Dicentrachus labrax* L.) : Effects of Chatepsins B, D and L. *Food Chemistry*. 81: 517–525.
[4] Bahuaud, D., Morkore, T., Langsrud, O., Sinnes, K., Veiseth, E. and Ofstad, R. 2008. Effects of –1.5 °C Super Chilling on Quality of Atlantic Salmon (*Salmo salar*) Pre–Rigor Fillets : Cathepsin Activity, Muscle Histology, Texture and Liquid Leakage. *Food Chemistry*. 111: 329–339.
[5] Fikri, M. Z., Nurhayati, T. and Salamah, E. 2014. Ekstraksi dan Karakterisasi Parsial Ekstrak Kasar Enzim Katepsin dari Ikan Patin (Extraction and Partial Characterization of Crude Cathepsin from Catfish). *J. Teknologi dan Industri Pangan*. 25 (1) : 119–123. [in Bahasa Indonesia].
[6] Swastawati, F., Susanto, E., Cahyono, B. and Trilaksono, W. A. 2012. Sensory Evaluation and Chemical Characterictics of Smoked Stingray (*Dasyatis blekeery*) Processed by Two Different Liquid Smoke. *International Journal of Bioscience, Biochemistry and Bioinformatics.* 2(3): 212–216.
[7] Swastawati, F., Darmanto, Y. S., Sya'rani, L., Rahayu, K. K. and Taylor, K. D. A. 2014. Quality Characteristic of Smoked Skipjack (*Katsuwonus pelamis*) Using Different Liquid Smoke. *International Journal of Bioscience, Biochemistry and Bioinformatics.* 4(2): 94–99.
[8] Dinu, D., Dumitru, I. F. and Nichifor, M. T. 2002. Isolation and Characterization of Two Chatepsin from Muscle of *Carasiuss auratus gibelio*. *Roum Biotechnology*. (7): 753–758.
[9] Johnston, A. I., Alderson, R., Sandham, C., et al. 2000. Muscle Fibre Density in Relation to the Colour and Texture of Smoked Atlantic Salmon (*Salmo salar* L.). *Aquaculture*. 189(3–4): 335–349.
[10] Lisbeth, H., Rora, A. M. B., Steinsland, I., Skara, T. and Rustad, T. 2004. Proteolytic Activity and Properties of Proteins in Smoked Salmon (*Salmo salar*) – Effects of Smoking Temperature. *Food Chemistry*. 85: 377–387.
[11] Kajak–Siemaszko K., Aubry, L., Peyrin, F., et al. 2011. Characterization of Protein Aggregates Following a Heating and Freezing Process. *Food Research International.* 44: 3160–3166.
[12] Godiksen, H., Morzel, M., Hyldig, G. and Jessen, F. 2008. Contribution of Chatepsin B, L and D to Muscle Protein Profiles Correlated with Texture in Rainbow Trout (*Oncorhynchus mykiss*). *Food Chemistry*. 113(4): 889–896.

[13] Su, R., Qi, W., He, Z., Zhang, Y. and Jin, F. 2008. Multilevel Structural Nature and Interactions of Bovine Serum Albumin during Heat Induced Aggregation Process. *Food Hydrocolloids*. 22: 995–1005.
[14] Martines, O. 2007. Textural and Physicochemical Changes in Salmon (*Salmo salar*) Treated with Commercial Liquid Smoke Flavourings. *Food Chemistry*. 100: 498–503.
[15] Bender, D. A. 2002. *Introduction to Nutrition and Metabolism*. Vol. 1. New York: Taylor & Francis Inc.
[16] Ahmed, Z., Donkor, O., Street, W. A. and Vasiljevic, T. 2015. Calpains – and Cathepsins – Induced Myofibrillar Changes in Post–Mortem Fish : Impact on Structural Softening and Release of Bioactive Peptides. *Trends in Food Science & Technology*. 45: 130–146.
[17] Fuentes, A., Fernandez–Segvovia, I., Serr, J. A. and Barat, J. M. 2010. Development of a Smoked Sea Bass Product with Partial Sodium Replacement. *LWT – Food Science and Technology*. 43: 1426–1433.
[18] Mohan, M., Ramachandran, D., Sankar, T.V. and Anandan, R. 2007. Influence of pH on the Solubility and Conformational Characteristic of Muscle Proteins from Mullet (*Mugil cephalus*). *Process Biochemistry*. (42): 1056–1062.
[19] Ghelichpour, M. and Shabanpour, B. 2011. The Investigation of Proximate Composition and Protein Solubility in Processed Mullet Fillets. *International Food Research Journal*. 18(4): 1343–134.

Update database naskah JT-UTM tanggal 2015.12.04 SORE

Dari: Monika Nur Utami Prihastyanti, S.TP, M.Nat.Sc (monika.nur@machung.ac.id)

Kepada: roy_hendroko@hotmail.com; fronthea_thp@yahoo.co.id; fronthea_thp@undip.ac.id; laras_rianingsih@yahoo.com; lukita_anandito@yahoo.com; ekothp@live.undip.ac.id

Cc: katarina.purnomo@machung.ac.id; katarinapurnomo@gmail.com; rosita.dwi@machung.ac.id

Tanggal: Jumat, 4 Desember 2015 16.57 WIB

yth. Rekan-rekan,

Sekali lagi saya mengupdate database naskah yang telah kami terima.

Total naskah yang telah diterima dalam template JT-UTM hingga **tanggal 4 Des 2015 pukul 15.28 adalah 43 naskah**. Status naskah dapat dilihat pada file excel yang saya lampirkan. Data naskah yang telah dikirim UNDIP dan yang diterima tim Ma Chung saya rasa sudah sinkron. Mohon database terupdate ini **(tertanggal: 2015.12.04 SORE)** dapat digunakan untuk kroscek.

Demikian yang dapat saya sampaikan. Atas kerjasamanya, saya ucapkan terima kasih.

Salam,

Monika

Penerimaan naskah oleh MRCPP_2015.12.4 SORE.xlsx
22.5kB

Update perkembangan editing naskah (2015.12.18)

Dari: Monika Nur Utami Prihastyanti, S.TP, M.Nat.Sc (monika.nur@machung.ac.id)

Kepada: roy_hendroko@hotmail.com; fronthea_thp@yahoo.co.id; fronthea_thp@undip.ac.id; ekothp@live.undip.ac.id

Cc: laras_rianingsih@yahoo.com; lukita_anandito@yahoo.com; katarina.purnomo@machung.ac.id; rosita.dwi@machung.ac.id; 331410017@student.machung.ac.id

Tanggal: Jumat, 18 Desember 2015 16.09 WIB

yth. Rekan-rekan sekalian,

Saya kirimkan database naskah yang sedang diedit beserta statusnya, dapat dilihat pada file excel (sheet 1). Sebagian besar naskah sudah selesai diperiksa MB template walaupun tetap ada yang masih harus menunggu revisi dari author. Sebagian besar naskah juga sudah didistribusikan ke reviewer untuk diperiksa materinya. Lebih lengkapnya dapat dilihat pada database excel yang terlampir bersama email ini.

Ada satu kasus alamat email MB materi yang error. Sudah saya laporkan ke Pak Eko untuk ditanyakan lagi ke MB materi yang bersangkutan.

Demikian yang dapat saya sampaikan. Saya ucapkan terima kasih atas dukungannya.

Salam,

Monika

NB.
Menjelang akhir tahun, kampus kami akan non-aktif sejak tanggal 24 Des, dan aktif kembali tanggal 4 Jan.

Penerimaan naskah oleh MRCPP_2015.12.18 SORE.xlsx
43.3kB

Status naskah a.n. Fronthea

Dari: Monika Nur Utami Prihastyanti, S.TP, M.Nat.Sc (monika.nur@machung.ac.id)

Kepada: fronthea_thp@yahoo.co.id; fronthea_thp@undip.ac.id

Tanggal: Selasa, 12 Januari 2016 09.36 WIB

yth. Bu Thea,

Melalui email ini saya beritahukan bahwa naskah Ibu yang berjudul "**Crude Cathepsin Activity and Quality Characteristic of Smoked Catfish (Pangasius pangasius) Processed by Different Smoking Temperature**" saat ini telah kami proses untuk dilakukan penyelarasan akhir (final check) oleh editor in chief (Pak Roy).

Dalam proses final check, bila masih ada format penulisan yang mungkin saya terlewat mengkoreksi, maka akan dikoreksi lebih lanjut oleh Pak Roy. Oleh karena itu, dalam waktu dekat mungkin Ibu akan menerima email kembali untuk melakukan revisi.

Mohon maaf bila kurang berkenan dengan proses editing yang cukup panjang ini. Semoga proses ke depan bisa lancar.

Demikian yang dapat saya sampaikan. Saya ucapkan terima kasih atas perhatiannya.

Salam,

Monika

Koreksian naskah a.n. Fronthea Swastawati (2016.02.04)

Dari: Monika Nur Utami Prihastyanti, S.TP, M.Nat.Sc (monika.nur@machung.ac.id)

Kepada: fronthea_thp@yahoo.co.id; fronthea_thp@undip.ac.id

Tanggal: Kamis, 4 Februari 2016 16.19 WIB

yth. Bu Thea,

Saya lampirkan naskah yang telah diperiksa oleh Pak Roy. Untuk saran-saran yang sudah bertuliskan 'OK' itu sudah saya betulkan. Sementara yang tidak ada tulisan 'OK' belum saya betulkan. Mohon dukungannya untuk memeriksa naskah sesuai saran yang diberikan.

Bila memungkinkan, saya harapkan naskah dapat segera kembali ke saya dalam waktu 1 x 24 jam.

Terima kasih atas perhatiannya.

Salam,

Monika

FC 1_Fronthea_01.12_Edit-Roy020216_k02.04.doc
978.5kB

Jurnal
Teknologi

Full Paper

CRUDE CATHEPSIN ACTIVITY AND QUALITY CHARACTERISTIC OF SMOKED CATFISH (*PANGASIUS PANGASIUS*) PROCESSED BY DIFFERENT SMOKING TEMPERATURE

Article history

Received

6 October 2015

Received in revised form

30 October 2015

Accepted

……..

Frontheа Swastawati[a]* , Ahmad Ni'matullah Al Baarri[b], Tri Winarni Agustini[a] , Eko Nurcahya Dewi[a], Ima Wijayanti[a], Dwi Yanuar Budi Prasetyo[c]

*Corresponding author

fronthea_thp@undip.ac.id

Tel. +6281225191989

[a]Laboratory of Fish Processing Technology, Faculty of Fisheries and Marine Science, Diponegoro University, Jl. Prof Soedarto, SH, Tembalang, Semarang – 50275, Indonesia

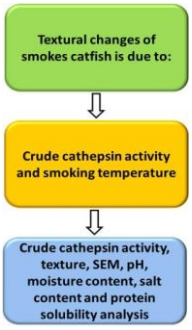
[b]Laboratory of Chemistry and Food Nutrition, Faculty of Animal and Agriculture, Diponegoro University, Semarang – 50275, Indonesia

[c]Magister Coastal Resource Management, Faculty of Fisheries and Marine Science, Diponegoro University, Jl. Imam Bardjo, SH, Semarang – 50241, Indonesia

Comment [R59]: Mhn font disesuaikan dengan checking list JT
OK

Comment [R60]: Met berkenalan dan jumpa. Saya Roy (dan dibantu Prapti), editor in chief n bertindak sbg penyeleras akhir dlm publikasi ini. Sy ucapkan selamat krn Anda telah melewati tahap review template & SI, review content, (dan review bahasa Inggris). Anda msh harus melewati dua tahap review lagi. Smg dua tahap tsb dpt kita melewatinya dgn baik dan sukses. Mhn semua komentar dlm balon di paper ini JANGAN DIHAPUS. Semua perbaikan dan komentar balik agar berkenan dilakukan di paper ini. Krn tengat waktu kita amat terbatas, saya mhn kesediaan Anda menaati skedul yang kami menetapkan.

Graphical abstract



Abstract

The aim of this research were to investigate the effect of smoking temperature towards crude cathepsin activity and quality characteristic of smoked catfish (*Pangasius pangasius*). Different smoking temperature had significant effect ($p < 0.05$) on crude cathepsin activity, texture, pH, moisture content, salt content and protein solubility. The significant decreasing (30.13 %) of crude cathepsin activity at P3 (80 °C) from P1 (40 °C to 50 °C). Many factors were correlated to the textural changes of smoked catfish such as changes of crude cathepsin activity, reduction of protein solubility and pH value.

Keywords : Catfish (*Pangasius pangasius*), crude cathepsin activity, quality characteristic, smoking temperature

9.0 INTRODUCTION

Catfish (*Pangasius pangasius* (Hamilton, 1882)) is one of the economic aquaculture fish species that can be found in Indonesia's waters. Its production was increasing by 37 % during 2008 to 2012 [1]. In terms of its nutrition aspect, catfish contains about 35 % of protein and 10.1 % of lipid with dominant fatty acids profile were lauric acid (13.36 %), palmitic acid (26.15 %), oleic acid (46.07 %) and stearic acid (14.40 %) which contribute to human health [2]. Texture is an important quality characteristic and acceptability factor for consumer. The texture of catfish is influenced by several factors such as size, age, macro nutrients composition (protein and lipid content), handling and processing condition. Catfish is one of many aquatic products which is highly perishable, in which after the post mortem the enzymatic decomposition rapidly breaks down the texture of fish components like myofibril and connective tissue. [3], cathepsin enzyme activity could change the structure and firmness. Cathepsin B, L and D were able to decrease α-actinin which is responsible to the fish firmness. A significant correlation was observed between enzymatic activity of cathepsin B and L and muscle degradation of Atlantic salmon [4].

Smoking process could inhibit the enzymatic decomposition. Brinning, pre drying, chemical composition of smoke and heating in smoking process could change the optimum condition of cathepsin to be active. Cathepsinneedsa certain condition to optimiz their activity, such as temperature, pH, substrate concentration and the presence of metal inhibitor [5]. Nowadays smoking is not only a preservative method but it also givesa specific flavour and taste on smoked fish to increase the consumer acceptability. This role could be obtained using liquid smoke, which is easier to apply and is environmentally safe [6]. The aim of this research was to investigated the effects of smoking temperature to crude cathepsin activity which affect textural changes and quality characteristic of smoked catfish.

Comment [R61]: Sebagai penghormatan kepada sesama ilmuwan. Sebaiknya scientific name ini dilengkapi otoritas
OK

10.0 EXPERIMENTAL

2.1 Smoking Process

Smoking method of catfish was performed with some modification [7]. Fillets of catfish were separated into four groups. Each group dipped into 5 % brine and 5 % liquid smoke for 30 min. Pre-drying in room temperature for about 60 min and then smoked in the electrical oven at 40 °C to 50 °C (P1), 60 °C to 70 °C (P2) and 80 °C (P3) for 1 h each. Then it was chilled in the room temperature and then packed with poliethylene bag before analysis in the laboratory.

3.8 Crude Cathepsin Activity Analysis

Proteolytic activity assays was performed with some modification [8]. The sample was prepared by mixing 1 g of fillet with 1 mL of aquadest and

Comment [R62]: Saya menyarankan kalimat dikit diubah.Angka yakni one TIDAK di awal kalimat; agar Ibu dapat menulis dengan prinsip SI yang benar yakni 1 g.
OK

then it was separated using centrifugation at 2 315 rpm (1 rpm = 1/60 Hz) for 10 min at 4 °C. The supernatant was then separated again using centrifugation at 5 976 rpm for 10 min at 4 °C. Then the extract was dissolved into 1 mL 0,1 M Tris-HCl buffer (Aplichem) pH 7.4, continued with centrifugation at 9 449 rpm for 10 min at 4 °C. Proteolytic activity was analyzed with hemoglobin 2 % pH 2 (Oxoid) for the substrate. Substrate solution (0.5 mL) was incubated with 0.1 mL enzyme solution at 37 °C for 10 min. Subsequently, 2 mL Trichloro Acetid Acid (TCA) 5 % was added and then filltered. The solution gained was filtrated, and then 1 mL Folin reaction was added. Final solution was read in spectrophotometry on 750 nm, blank and standard solutions (Tirosin) were read in the same wave length.

3.9 Quality Characteristic Analysis

3.9.1 Texture Analysis

Texture were measured using Texture analyzer TA – TX2. The probe was pressed into the fillet at a constant speed of 2 mm · s^{-1} until it reached 60 % of the sample height. The maximum force obtained during compression (gf) was recorded.

3.9.2 pH, Moisture Content and Salt Content

For analysis preparation, 10 g of samples were homogenized with 90 mL aquadest for 1 min. The electrode of pH meter (pH meter Hanna Instrument) was inserted into the slurry while being stirred vigorously. After stabilization, the observed value was recorded. Moisture content of samples were measured at 105 °C according to the gravimetric test. The salt content was determined using Silver Nitrite Method.

3.9.3 Protein Solubility Analysis

Protein content in supernatant was divided into two groups of experiment, i.e. set I and set II. Set I was performed with Biuret reaction and set II was using alkaline cooper sulphate reagent. Color was measured using spectrophotometer at 540 nm. Bovine serum albumin was used as the standard solution. All the analysis were run in duplicate.

3.10Statistical Analysis

Randomized Block Design was used in this research and analyzed using ANOVA with significant level of 95 %. The computer software for helping this project was SPSS ver 20.

11.0 RESULTS AND DISCUSSION

11.1 Crude Cathepsin Activity

Crude cathepsin activity on raw catfish was 0.860 U · mL^{-1} and it is comparable with previous experiment [5], which showed that crude chatepsin activity on cat fish after post rigor was 0.278 U · mL^{-1}. The various results might be influenced by several factors such as sexual maturity level. The highest cathepsin value was reached at sexual maturity season [9]. The statistical analysis showed that smoking temperature gave significant differences for crude cathepsin activity. Based on LSD test the smoking temperature give significant different for crude cathepsin activity. The results showed that P0 and P1 did not significant different, P1 significant different with P2 and P3 but P2 did not significant different with P3 (Table 1). Reduction of crude cathepsin activity showed significant at P3 (31.98 %) from P0; 21.16 % from P0 to P2 and 13.72 % from P2 to P3.

Table 1 Crude cathepsin activity (U · mL^{-1})

Treatment	Value
P0 (Control)	0.860 ± 0.06[a]
P1	0.880 ± 0,03[a]
P2	0.678 ± 0,00[b]
P3	0.585 ± 0,02[b]

Note: Average value of duplicate ± standard deviaton

Value following with same small superscript letters were no significantly different (p > 0.05).

Crude cathepsin activity was decreasing with the increasing of smoking temperature. The highest value of crude cathepsin activity was on smoked catfish at P1 (40 °C to 50 °C) then

Comment [R63]: Mhn konfirmasi, ini simbol apa ya? Apakah maksud Ibu adalah RPM krn terkait centifuge?
Bila ya, maka silahkan, dpt gunakan RPM. Meski RPM bukanlah SI yang menerapkan simbol Hz untuk rotation. Namun bisa dicantumkan kesetaraannya yakni 1 rpm adalah 1/60 Hz
OK

Comment [R64]: Sesuai email Bu Thea, diganti 2 315 rpm (1 rpm = 1/60 Hz)
OK

Comment [R70]: Apakah yang dimaksud ini adalah Rancangan Acak Kelompok? Bila ya, sebaiknya menggunakan istilah Randomized Block Design
OK

Comment [R65]: Diganti 5 976 rpm
OK

Comment [R66]: Diganti 9 449 rpm
OK

Comment [R67]: seyogianya kalimat diubah agar tdk di awal kalimat sehingga dpt ditulis sesuai SI yakni 2 mL

OK

Comment [R68]: SI : beri spasi
OK

Comment [R71]: mhn konfirmasi, ini simbol apa agar sy dpt check ketepatannya di SI unit. Apakah microgram?
Sesuai WA dan email Bu Thea maka adalah microgram. **Simbol di SI adalah µg.**
Bukan U karena U kapital adalah simbol thermal conductance (heat flow)

Comment [R72]: Seharusnya 1 kapital! Yakni mL
OK

Comment [R73]: Apa tidak salah simbol atau notasi ini?
OK

Comment [R69]: Saya menyarankan kalimat dikit diubah sehingga angka yakni Ten TIDAK di awal kalimat. Dg perubahan tsb, Ibu dapat menulis dengan prinsip SI yang benar yakni 10 g.
OK

followed by P2 (60 °C to 70 °C) and P3 (80 °C) The reduction of crude cathepsin activity may be affected by combination of salt, heat and smoke in catfish smoking process by changing the optimum condition of enzyme to be active (Table 2). It was similar with previous experiment [5] that, the optimum condition to optimalize activity of crude cathepsin were temperature, pH and metals inhibitor. The optimum temperatures were 40 °C to 50 °C and decreasing rapidly with increasing temperature in 60 °C to 70 °C. The value of optimum pH for crude cathepsin activity was recorded in the range 6 to 7, the metals such as Na could inhibit 85 % relative cathepsin activity. Gross Proteolytic Activity of smoked salmon which smoked at 20 °C to 30 °C was 0.535 mg peptides $\cdot mg^{-1}$ [10].

3.4 Texture

Based on the data that was shown at Table 2 smoking temperature and protein solubility caused the changes on smoked catfish texture. The increase of smoking temperature affected the decrease in the textural value. Heat treatments lead to denaturation on protein muscle, long heat treatment will form aggregation [11]. The textural change caused by denaturation of protein muscle, then the water soluble protein and the texture tended to semisolid gel structure resulting in the hard texture.

Comment [R74]: Spasi\
OK

Table 2 Texture (gf), pH, moisture content (wet basis %), salt content (wet basis %) and protein solubility (%) of smoked fillets catfish

Parameters	P0	P1	P2	P3
Texture	5482.43 ± 93.45^{a}	4591.37 ± 27.12^{b}	4241.93 ± 56.82^{c}	3881.29 ± 26.75^{d}
pH	7.22 ± 0.04^{a}	7.42 ± 0.02^{b}	7.72 ± 0.01^{c}	8,01 ± 0.04^{d}
Moisture content	79.66 ± 0.04^{a}	77.42 ± 0.02^{b}	74.72 ± 0.01^{c}	72.04 ± 0.04^{d}
Salt content	1.43 ± 0.10^{a}	2.62 ± 0.19^{b}	3.88 ± 0.33^{c}	5.83 ± 0.28^{d}
Protein Solubility	14.37 ± 0.42^{a}	11.66 ± 0.12^{b}	8.32 ± 0.30^{c}	5.80 ± 0.19^{d}

Note : Average value of of duplicate measurement ± standard deviaton.

Value following with same small superscript letters were no significantly different ($p > 0.05$).

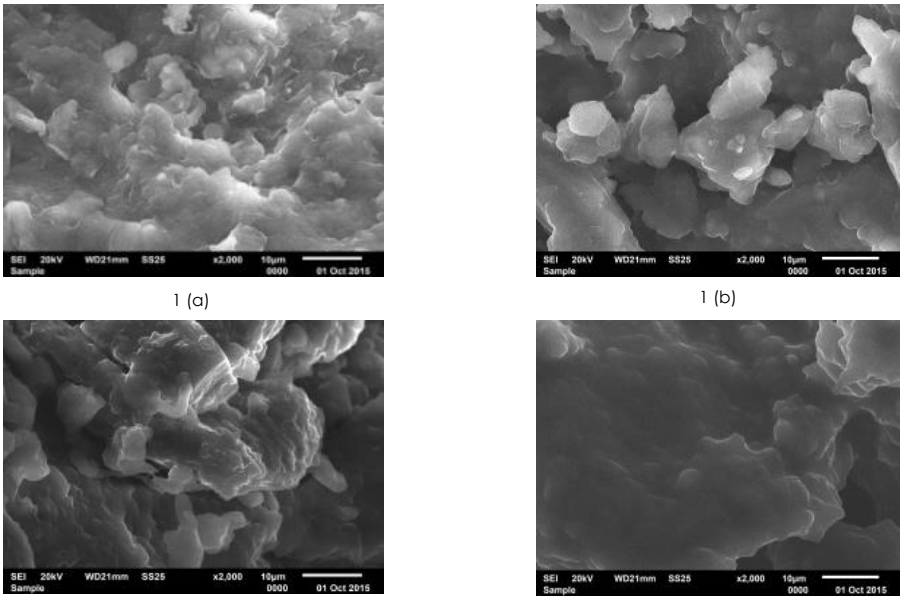
Comment [R75]: Spasi
OK

The textural changes of smoked catfish were caused by crude cathepsin activity, even in small amount. Cathepsin activity was correlated to firmness and made textural changes on rainbow trout [12]. This enzyme was responsible for tissue degradation. The range of fibre densities from 85 fibre mm^{-2} to 140 fibre mm^{-2} indicates optimum "chewiness" and "firmness" in texture characteristics of smoked salmon. The high fibre densities contributed to a firmer texture in fish muscle, and the variety of fibre densities in fish was affected by sexual maturity [9].

3.5 Scanning Electron Microscope (SEM)

Textural changes of smoked catfish were measured by Scanning Electron Microscope (SEM). SEM analysis was performed to describe structural changes in texture of smoked catfish. Figure 1(a) showed that the structure of texture smoked catfish still complex and solid. Figure 1 (b) shows aggregates in the texture of smoked catfish. Bigger aggregates were obtained from catfish which was processed in higher temperature and longer smoking time (Figure 1 (c)). Meanwhile. Figure 1 (d) shows that the texture became hardened and damaged. In the previous research, the aggregate formation increased regularly in meat heated at 60 °C, whereas meat heated at higher temperature

(100 °C and 140 °C) showed dramatic increase up to 5-fold the initial level. The temperature increase promote exposure the thiol group and interior hydrophobic residues of BSA, enabling the formation of hydrogen bonds and hydrophobic interactions. This reaction and interactions promoted protein aggregation via a non–native and expanded conformational state [11,13].



1 (a) 1 (b)

1 (c) 1 (d)

Figure 1. SEM image from smoked catfish with various treatments, i.e. (a) P0, (b) P1, (c) P2 and (d) P3

3.12pH

The pH values of smoked catfish were shown in Table 2. The fresh catfish had pH values of 7.22 ± 0.04, and increased after smoking process. pH values of smoked fish from this study were 7.42 to 8.01. According to previous research on smoked stingray, pH values of smoked stingray using cocconut shell and corn cob liquid smoke were 7.30 and 8.20 respectively [6]. The changes on pH on smoked fish was affected by chemical composition of liquid smoke [14]. The value of pH is an important role to determine enzyme activity in which pH affects the ionization condition which needs the bounding between substrate and enzyme. The catalysis reaction depended on interaction between substrate with side chains amino acid which bound the active side of enzyme [15]. When pH of cathepsin was 6, cathepsin activity was 0.271 U · mL^{-1}, but in pH 7 or above the value of the cathepsin activity decreased (0.167 U · mL^{-1}) [5]. This irreversible enzyme was inactive at pH above 7 but generally highly active at acidic environment [16].

Comment [R76]: mhn konfirmasi simbol ini. Microgram? Simbol/Notasi microgram adalah µg

Comment [R77]: mhn diubah

3.13Moisture Content

Moisture content of smoked catfish were 72.04 % to 77.33 %, while the moisture content of raw fish was 79.66 %. Smoking process caused the reduction in the moisture content of smoked fish and, the combination of salting, pre drying and heating process evaporated the moisture in fish muscle as well. Previous research showed that moisture content of smoked milkfish processed by corn cob liquid smoke was 58.33 % and 63.37 % respectively [7].

3.14 Salt Content

The salt content of smoked catfish was 2.62 % to 5.83 %. There was a slight increase in the value of salt content with the increasing of smoking temperature ($p < 0.05$). While smoking temperature increased, moisture evaporated and then the salt penetrated into fish flesh because of the osmosis effect from salt. In other experiment, salt content of smoked salmon were 4.0 g to 7.2 g per 100 g moisture [10]. While salt content of smoked sea bass which were processed by spray with liquid smoke for 30 min and added with NaCl (0.110 %; 0.150 %; 0.200 %; 0.220 %; 0.270 %) were 2.05 %; 4.46 %; 4.83 %; 9.40 % and 17.76 % respectively [17].

3.15 Protein Solubility

Protein solubility of smoked catfish decreased as a result of increasing smoking temperature, the heating process indicated the changes on protein solubility. The denaturation of protein relates to protein solubility, the tertiary or secondary structure of protein was damaged, thus, became primary structure due to heat treatments. In the primary structure, both water and salt soluble protein were released easier than in tertiary or secundary structure. The decreasing solubility of protein occurred because of increased smoking temperature. In the previous research, the protein solubility value of smoked salmon which was smoked at 29.9 °C were significantly lower than salmon smoked at 21.5 °C [10]. The changes of protein solubility was due to pH in which protein solubility increased at extremely acidic and alkaline environment. Previous research showed that at the extreme of pH, solubility increased to almost five times that of the original (pH 6.3), i.e. 125.73 ± 0.64 mg · g^{-1} at pH 2; 58.92 ± 1.10 mg · g^{-1} at pH 4; 21.42 ± 0.5 mg · g^{-1} at pH 6; 44.76 ± 0.95 mg · g^{-1} at pH 8 and 122.85 ± 1.2 mg · g^{-1} at pH 12 [18]. Another study showed that minimum protein solubility that called isoelectric point, in raw or cooked samples exhibited at pH 5 to 6. Protein solubility decreased with increasing pH to isoelectric point then increased again to high pH [19].

4.0 CONCLUSION

Inceasing smoking temperature could inhibit the crude cathepsin enzyme activity and reduced the texture, moisture content, and protein solubility of smoked catfish. The information from this study could be a reference to produce good quality smoked fish in particular protein nutritive aspect.

Acknowledgements

The authors would like to acknowledge the financial support provided by Directorate General of Research and Public Services, Ministry of Research, Technology and Higher Education with contract number DIPA-023.04.1.673453/2015, November 14th 2014 revised on DIPA March 1st 2015.

References

[1] Ministry of Marine Affairs and Fisheries. 2013. Marine and Fisheries in Figures 2013. Jakarta: Centre of Data, Statistic and Information.

[2] Islam, R., D. K. Paul, A. Rahman, T .Parvin, D. Islam, and A. Sattar. 2012. Comparative Characteristic of Lipids and Nutrient Contents of *Pangasius pangasius* and *Pangasius sutchi* Available in Bangladesh. *Journal Nutrition & Food Science*. 2(2): 130–135.

[3] Ladrat, C., V. Verrez–Bagins, J. Noel, and J. Fleurence. 2003. In Vitro Proteolysis of Myofibrillar and Sarcoplasmic Proteins of White Muscle of Sea Bass (*Dicentrachus labrax* L.) : Effects of Chatepsins B, D and L. *Food Chemistry*. 81: 517–525.

[4] Bahuaud, D., T. Morkore, O. Langsrud, K. Sinnes, E. Veiseth, and R. Ofstad. 2008. Effects of –1.5 °C Super Chilling on Quality of Atlantic Salmon (*Salmo salar*) Pre–Rigor Fillets : Cathepsin Activity, Muscle Histology, Texture and Liquid Leakage. *Food Chemistry*. 111: 329–339.

[5] Fikri, M. Z., T. Nurhayati, and E. Salamah. 2014. Ekstraksi dan Karakterisasi Parsial Ekstrak Kasar Enzim Katepsin dari Ikan Patin [Extraction and Partial Characterization of Crude Cathepsin from Catfish]. *J. Teknologi dan Industri Pangan*. 25 (1): 119–123. [Bahasa Indonesia].

[6] Swastawati, F., E. Susanto, B. Cahyono, and W. A. Trilaksono. 2012. Sensory Evaluation and Chemical Characterictics of Smoked Stingray (*Dasyatis blekeery*) Processed by Two Different Liquid Smoke. *International Journal of Bioscience, Biochemistry and Bioinformatics*. 2(3): 212–216.

[7] Swastawati, F., Y. S. Darmanto, L. Sya'rani, K. K. Rahayu, and K. D. A. Taylor. 2014. Quality Characteristic of Smoked Skipjack (*Katsuwonus pelamis*) Using Different Liquid Smoke. *International Journal of Bioscience, Biochemistry and Bioinformatics*. 4(2): 94–99.

[8] Dinu, D., I. F. Dumitru, and M. T. Nichifor, 2002. Isolation and Characterization of Two Chatepsin from Muscle of *Carasiuss auratus gibelio*. *Roum Biotechnology*. (7): 753–758.

[9] Johnston, A. I., R. Alderson, C. Sandham, et al. 2000. Muscle Fibre Density in Relation to the Colour and Texture of Smoked Atlantic Salmon (*Salmo salar* L.). *Aquaculture*. 189(3–4): 335–349.

[10] Lisbeth, H., A. M. B. Rora, I. Steinsland, T. Skara, and T. Rustad, 2004. Proteolytic Activity and Properties of Proteins in Smoked Salmon (*Salmo salar*) – Effects of Smoking Temperature. *Food Chemistry*. 85: 377–387.

[11] Kajak–Siemaszko K., L. Aubry, F. Peyrin, et al. 2011. Characterization of Protein Aggregates Following a Heating and Freezing Process. *Food Research International*. 44: 3160–3166.

[12] Godiksen, H., M. Morzel, G. Hyldig, and F. Jessen, 2008. Contribution of Chatepsin B, L and D to Muscle Protein Profiles Correlated with Texture in Rainbow Trout (*Oncorhynchus mykiss*). *Food Chemistry*. 113(4): 889–896.

Comment [R78]: Sesuai petunjuk JT-UTM tanggal 3 Peb 2016 jam 13.30, mohon berkenan mengubah tata tulis reference, khususnya pencantuman nama author. Singkatan nama author pertama di belakang nama. Namun singkatan nama author ke-2 dst diletakkan DI DEPAN nama author
OK

Comment [R79]: Italic
OK

[13] Su, R., W. Qi, Z. He, Y. Zhang, and F. Jin. 2008. Multilevel Structural Nature and Interactions of Bovine Serum Albumin during Heat Induced Aggregation Process. *Food Hydrocolloids*. 22: 995–1005.
[14] Martines, O. 2007. Textural and Physicochemical Changes in Salmon (*Salmo salar*) Treated with Commercial Liquid Smoke Flavourings. *Food Chemistry*. 100: 498–503.
[15] Bender, D. A. 2002. *Introduction to Nutrition and Metabolism*. Vol. 1. New York: Taylor & Francis Inc.
[16] Ahmed, Z., O. Donkor, W. A. Street, and T. Vasiljevic. 2015. Calpains – and Cathepsins – Induced Myofibrillar Changes in Post–Mortem Fish : Impact on Structural Softening and Release of Bioactive Peptides. *Trends in Food Science & Technology*. 45: 130–146.
[17] Fuentes, A., I. Fernandez–Segvovia, J. A.Serr, and J. M. Barat, 2010. Development of a Smoked Sea Bass Product with Partial Sodium Replacement. *LWT – Food Science and Technology*. 43: 1426–1433.
[18] Mohan, M., D. Ramachandran, T.V. Sankar, and R. Anandan, 2007. Influence of pH on the Solubility and Conformational Characteristic of Muscle Proteins from Mullet (*Mugil cephalus*). *Process Biochemistry*. (42): 1056–1062.
[19] Ghelichpour, M. and B. Shabanpour. 2011. The Investigation of Proximate Composition and Protein Solubility in Processed Mullet Fillets. *International Food Research Journal*. 18(4): 1343–134.

Update status naskah JT UTM

Dari: Monika Nur Utami Prihastyanti, S.TP, M.Nat.Sc (monika.nur@machung.ac.id)

Kepada: fronthea_thp@yahoo.co.id; fronthea_thp@undip.ac.id; roy_hendroko@hotmail.com; ekothp@live.undip.ac.id; katarina.purnomo@machung.ac.id; rosita.dwi@machung.ac.id; 331410017@student.machung.ac.id

Tanggal: Jumat, 26 Februari 2016 11.37 WIB

yth. Rekan-rekan sekalian,

Melalui email ini, saya lampirkan database naskah JT UTM. Total naskah yang sudah masuk final check adalah 40 naskah, detail status naskah ada pada lampiran yang saya kirimkan.

Hari ini kami akan selesaikan kelengkapan dokumen lain (seperti review form dan CTA) supaya siap kirim ke JT UTM.

Demikian yang dapat saya sampaikan. Mohon doanya supaya prosesnya berjalan dengan lancar.

Terima kasih

Salam,

Monika

Status Naskah JT-UTM (2016.02.26, 11.00 am).xlsx
68.3kB

FW: Submit manuscripts from ISAPPROSH-2015

Dari: roy hendroko (roy_hendroko@hotmail.com)
Kepada: fronthea_thp@yahoo.co.id
Tanggal: Rabu, 2 Maret 2016 12.14 WIB

Ysh Bu Thea
Di bawah adalah email dari JT-UTM. Mohon Ibu agar mempersiapkan dana sesuai kalimat di bawah yang **warna merah.**
Maturwun.

Wass
RHS

Date: Wed, 2 Mar 2016 12:44:28 +0800
Subject: Re: Submit manuscripts from ISAPPROSH-2015
From: norazmans@utm.my
To: roy_hendroko@hotmail.com
CC: piza@utm.my; hairunnisa@utm.my

Dear Roy,

We have downloaded from WeTransfer the following files :

a. wetransfer-15148a ~ 39 pdf files (Articles).

b. wetransfer-b7ca6a ~ 78 pdf files (Review Forms).

c. wetransfer-d5e862 ~ 39 word files (Articles).

d. wetransfer-f56c15 ~ 39 pdf files (Copyright Transfer Agreement).

Please give our internal committee to internally review the documents and send our feedback in 7 days or sooner. We will also prepare an invoice to enable you to make payment.

Thank you.

F

Revisi Tahap II Manuskrip ISAPPROSH2 untuk JT-UTM

Dari: roy hendroko (roy_hendroko@hotmail.com)

Kepada: rasyid.romadhony@gmail.com; susilowati_ragil@yahoo.com; istiyanto_samidjan@yahoo.com; Latifsahubawa2004@yahoo.com; fronthea_thp@yahoo.co.id; s_harsono@yahoo.com; suryantidr@gmail.com; tagustini@yahoo.com

Cc: fronthea_thp@yahoo.co.id; laras_rianingsih@yahoo.com; monika.nur@machung.ac.id; rosita.dwi@machung.ac.id; katarinapurnomo@gmail.com

Tanggal: Jumat, 8 April 2016 17.35 WIB

Ysh Para Author
Alhamdulillah, puji syukur publikasi JT-UTM telah sampai tahap prof-read oleh editorial board JT-UTM. Namun masih terdapat sejumlah permintaan revisi oleh mereka. Mbak Monika telah mengirim email ke Bapak dan Ibu tentang permintaan revisi manuskrip Anda. Saya mohon kerja sama Bapak dan Ibu untuk berkenan mematuhi tengat waktu yang telah kami menetapkan. Batas waktu perbaikan adalah **Senin, 11 April 2016, jam 12.00 WIB** telah diterima di **email Mbak Monika dengan cc ke Roy Hendroko.**
Apabila ada pertanyaan tentang instruksi revisi tsb, mohon dengan segera menghubungi Mbak Monika melalui email, dan/atau SMS-WA di 082139507456.
Kepada Bu Laras dan/atau Bu Thea, mohon bantuan berkenan untuk SMS atau WA para author di atas untuk *gentle reminder*
Semoga tahapan ini dapat kita melewatinya dengan sukses. Maturwun

Salam dan doa
RHS

JT-UTM Vol. 78 No4-2

Dari: roy hendroko (roy_hendroko@hotmail.com)
Kepada: fronthea_thp@yahoo.co.id; laras_rianingsih@yahoo.com; lukita_anandito@yahoo.com; ekothp@live.undip.ac.id
Cc: praptiningsih.ga@gmail.com; monika.nur@machung.ac.id; katarinapurnomo@gmail.com; rosita.dwi@machung.ac.id
Tanggal: Senin, 18 April 2016 10.24 WIB

Ysh Para Rekan.
Mohon doa agar proef Vol 78 No 4-2 yang saya unggah dapat segera on-line. Insya Allah dapat memenuhi deadline Rektor UNDIP, yakni sebelum 21 April 2016.
Maturwun.

Wass
RHS

Vol 78, No 4-2_ Sustaining Fish Processing Industry to Support Global Maritime Axis.pdf
307.7kB

Fw: Notification of Publication Jurnal Teknologi (Sciences & Eng.) Special Issue: Sustaining Fish Processing Industry to Support Global Maritime Axis

Dari: roy hendroko (roy_hendroko@hotmail.com)

Kepada: fronthea_thp@yahoo.co.id; laras_rianingsih@yahoo.com; lukita_anandito@yahoo.com; ekothp@live.undip.ac.id

Cc: monika.nur@machung.ac.id; katarinapurnomo@gmail.com; rosita.dwi@machung.ac.id; tatas.brotosudarmo@machung.ac.id; chatief.kunjaya@machung.ac.id

Tanggal: Senin, 18 April 2016 12.50 WIB

Ysh Ibu Dr. Fronthea Swastawati
UNDIP

Dengan ucapan Alhamdulillah, saya dengan gembira dan bangga melaporkan hasil kerja kita telah on-line di Jurnal-Tehnologi Vol. 78 No 4-2, seperti forward email di bawah ini, dan juga atach email. Puji syukur pula kami (saya + Bu Prapti dan Tim MRCPP) mampu menyelesaikan sebelum deadline tanggal Rektor UNDIP. Hari ini tanggal 18 April 2016, sedang tengat waktu adalah Hari Kartini, 21 April 2016.
Puji syukur, kita dapat mengatasi sejumlah "kendala birokrasi" di Malaysia. Seperti diketahui semula kita diberi jatah Vol. 78 No 3. Tetapi dengan alasan manuskrip ISAPPROSH membutuhkan sejumlah revisi maka Vol jatah kita "diberikan/ dipindahkan" ke conference/ issue yang lain. Namun berkat bantuan dan kerja keras Mbak Laras + Mbak Lukita yang membantu "mengejar" revisi 20 author, kita mampu menyelesaikan revisi maju dibanding skedul.
Demikian pula di revisi ke-2 terhadap 10 author, Mbak Monika, Mbak Rosita (bahkan Mbak Katrin di jelang pemberkatan pernikahannya) penuh semangat menyelesaikan revisi lebih maju dari skedul yang ditetapkan oleh editor JT-UTM.
Seperti Anda melihat di sini (http://www.jurnalteknologi.utm.my/index.php/jurnalteknologi/issue/archive) sampai hari ini (18 April 2016) ternyata Vol 78 No 2, Vol. 78 No 3 dan Vol 78 No. 4 yang mereka mencadangkan untuk sejumlah conference/ issue tersebut TIDAK/ Belum mampu submit untuk online.
Maturwun atas segala kerjasama yang baik sehingga JT-UTM dapat terselesaikan. Namun kita masih mempunyai PR tentang manuskrip ISAPPROSH yang lain.

Allah memberkati karya kita.
Roy Hendroko Setyobudi

From: HAPIZAH BINTI MOHMAD@MOHAMAD TNCPI <piza@utm.my>
Sent: Monday, April 18, 2016 10:54 AM
To: roy hendroko
Cc: ROSLI BIN MD. ILLIAS TNCPI; KASSIM BIN THUKIMAN TNCPI; UNGKU HALIZA BT UNGKU ZAHAR TNCPI; MD RAZIB BIN KARNO PSZ
Subject: Notification of Publication Jurnal Teknologi (Sciences & Eng.) Special Issue: Sustaining Fish Processing Industry to Support Global Maritime Axis

Dear Professor,

The Special Issue on Sustaining Fish Processing Industry to Support Global Maritime Axis **has been successfully uploaded. Kindly visit the following links:**

http://www.jurnalteknologi.utm.my/index.php/jurnalteknologi/issue/view/256

The inter-frame is attached. Any inquiries/corrections kindly let me know within two weeks time.

Please note that any request of adding or changing of authors/affiliations/contents will not be entertained except those mistakes occurred because of our negligence.

Thank you

Hapizah Mohamad
Publication Officer (Journal)

Penerbit UTM Press
Universiti Teknologi Malaysia
81310 UTM Johor Bahru
Johor, Malaysia

Office:07-5535684 | Mobile: -
Primary Email: piza@utm.my | Secondry Email: pizamohd@gmail.com| Site: www.penerbit.utm.my


Vol 78, No 4-2.pdf
214.9kB