IOP SAFE CONFERENCE AYAM RARANG

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Quality Profile of Canned *Ayam Rarang* at Various Sterilization Duration

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Abstract

Ayam rarang is one of the legendary cuisines of West Nusa Tenggara, which has a short shelf life at room temperature. Hence, it needs sterilization treatment to extend its shelf life while maintaining its quality. This study aimed to determine the quality profile of *ayam rarang* treated with different lengths of sterilization. This study used an experimental method with a single-factor randomized block design (RBD), namely 3, 6, 9, 12, 15, and 18 minutes of sterilization time. The quality observed was protein content, pH, TBA level, and hardness/texture level (physically). Observational data were analyzed by analysis of variance with a significant level of 5% using the Co-stat application. Significantly different data were tested further with the Honest Significant Difference (HSD) test. The results showed that the duration of sterilization had a significantly different effect on protein content, pH value, and texture but did not affect the rancid value of *ayam rarang*. Sterilization of *ayam rarang* for 12 minutes fulfilled the F_0 value and was not significantly different from the quality of chicken without sterilization on protein content, pH, rancidity, and level of hardness/textural value.

Keywords: *canned chicken, cuisine, quality profile, sterilization, Lombok*

1. Introduction

West Nusa Tenggara (NTB) province is well-known as a natural and culinary tourist destination. One of the famous dishes is *ayam Rarang*, a typical East Lombok dish made from grilled local chicken seasoned with *pelecing*, it has a spicy and savory taste [1]. *Ayam Rarang* is usually served with *pelecing kangkung*, *sayur bening*, cucumber, and chili sauce. The seasonings used in *ayam Rarang* consist of spice with high water and oil or fat content, so they pose a risk of spoilage. An oxidation process causes damage to foodstuffs with oil or fat levels. Based on the results of a survey at UMKM *Ayam Rarang*, these products can only last one day at room temperature. This is because the high water content of 70-75% in spices and meat. It allows microbes to grow. Pathogenic microbes commonly contaminating meat include *Escherichia coli*, *Salmonella* sp., and *Staphylococcus* sp. [2]. Commercial sterilization by conventional canning is one effort to increase Ayam Rarang's shelf life.

Canning is a way of storing and preserving food ingredients using sterilization techniques so that food products are obtained that are durable and are not easily damaged physically, chemically, or biologically. [3] states that canned chicken products sterilized at 121°C for 15 minutes could last for two months in room temperature storage. [4] reported that sterilizing canned *kalio daging sapi* (*beef kalio*) performed at 121°C with a value of F_0 = 3 minutes was the most efficient process because it was enough to reduce 13 log cycles of Clostridium botulinum. [5] reported that canned *rawon*, *kuah gandul* and *empal gentong* sterilized at 121°C for 60 minutes had F_0 values of 4.02-10, as well as had metal contamination of lead, cadmium, tin, mercury and arsenic below the threshold of the Indonesian National Standard (SNI) and the regulations of the Food and Drug Supervisory Agency of the Republic of Indonesia.

[6] reported that canned mangut lele sterilized at 121°C for 20 minutes had an F_0 value of 10.48 minutes showed negative of *Salmonella*, *Staphylococcus aureus*, and *Clostridium*. [7] reported that the sterilization treatment of 121°C for 15-25 minutes resulted in total microbes and total mold by the SNI 2717.1: 2009 standard, was able to maintain organoleptic quality and shelf life of *pindang ikan bumbu kuning* (*yellow seasoned pindang*) from mold growth for storage duration of 42 days. [8] states that sterilizing canned wood-dried tuna with tuna bone flour substitution was carried out at a temperature of 120°C and a pressure of 0.55 kg/cm^3, for 15 minutes. The F_0 test team from the National Research and Innovation Agency (BRIN) reported that the F_0 value of canned *ayam rarang* produced by the Lesehan Rarang East Lombok Restaurant was 10 minutes. *Ayam raring* canning in NTB has been carried out by UKM Lesehan Ayam Rarang, a MSMEs located in East Lombok. However, quality assessment of canned *ayam rarang* has not been reported by many, hence; study of the quality of canned *ayam rarang* at various sterilization duration is needed.

2. Materials and Methods

2.1 Materials and Tools

The materials used included local chickens aged 4-5 months with a net weight of ± 500 g per chicken obtained from suppliers, the spices used were cayenne pepper, dried red chilies, large red chilies, garlic, shrimp paste, candlenut, water, sugar, salt, MSG, cooking oil, K_2SO_4, $CuSO_4$, 1.25% H_2SO_4 solution, 3.2% NaOH solution, H_3BO_3, HCl, TBA reagent (0.02 M thiobarbituric acid solution in 90% glacial acetic acid), Plate Count Agar (PCA) medium, phosphate buffer solution, distilled water, and 96% alcohol. All spices used were obtained from suppliers.

The tools used were oven, chopper, measuring cup, 300 g cans capacity (dimensions: d = 7 cm, t = 9 cm), 1 mL micro pipette, volume pipette, autoclave, incubator, laminar air flow, vortex, seamer, erlenmeyer, analytical balance, pH meter, spectrophotometer, waterbath, thermometer, stopwatch, beaker glass, distillation flask, distillator, Kjeldahl flask, gloves and Bunsen lamp.

2.2 Method

The method used was an experimental method carried out in the laboratory. The experimental design was a randomized block design (RBD) with a single factor of sterilization duration with the following 6 treatments: 3, 6, 9, 12, 15, and 18 minutes. Each treatment was tested in triplicates to obtain 18 experimental units. The parameters tested included protein content [9], pH value [10], TBA or rancidity values [11], and texture tests [12]. Observational data were analyzed using analysis of variance (*Analysis of Variance*). While, the microbiological results used descriptive methods.

2.3 Ayam Rarang Production

Ayam rarang was made by modifying recipe given by Lesehan Rarang Restaurant in East Lombok with the following stages: prepare chicken aged 4-5 months with a net weight of ±500 grams per chicken, wash under running water and drain, and grill using an oven at 180°C for 23 minutes until brownish yellow color obtained [2], cut into ±10 pieces with a weight of ±30-50 g per piece. Then, mix with spices (cayenne pepper (4%), dried red

chili (11.6%), large red chili (21.2%), garlic (4%), candlenut (4%), shrimp paste (1.2%), sugar (10%), and salt (3%) which has been previously sautéed. Ready to consume *ayam rarang* is shown in Figure 1 below:

Figure 1. *Ayam Rarang*

2.4 Ayam Rarang Canning

The canning of *ayam rarang* referred to [13], as follows: fill still warm *ayam rarang* (70-80°C) of ±250 g into cans with 9 cm height dimensions and 7 cm diameter with ± 2 cm headspace; exhausting was done by heating the can and its contents at 80°C for 10 minutes with the can lid still open; can was hermetically closed after exhausting process; sterilization than was carried out as quickly as possible after closing the cans using an autoclave. The temperature used for sterilization was 121°C with different time intervals of 3, 6, 9, 12, 15 and 18 minutes; cool rapidly to prevent the re-growth of thermophilic bacteria and prevent overcooking. The water temperature was ±26°C for ±20 minutes.

3. Results and Discussion

3.1 Chemical Quality

3.1.1 Protein content

Proteins are abundant macromolecules in living cells and composed of amino acids, which are synthesized based on the code carried by genetic information in nucleotide sequences. Based on their biological function, proteins can be classified into enzyme catalysts, structural proteins, contractile proteins (myosin, actin, tubulin), hormones (insulin, growth hormone), transfer proteins (serum albumin, transferrin, hemoglobin), antibodies (immunoglobulin), storage proteins (egg albumin, seed protein), and protective proteins (toxins and allergens) [14]. The protein content of canned *ayam rarang* at various sterilization duration is shown in Figure 2. Figure 2 shows that the protein content of canned *ayam rarang* produced is affected by sterilization duration. Protein heating can cause reactions such as denaturation, loss of enzyme activity, changes in solubility and hydration, color changes, cross-linking, breaking of peptide bonds, and forming active sensory compounds [15]. The reaction is influenced by temperature and duration of heating, pH, presence of oxidizing agents, antioxidants, radicals, and other active compounds. The reaction during protein heating causes the breakdown of protein polymer bonds into short-chain proteins and amino acids. The longer the sterilization the higher the protein value based on total N (AOAC). According to [16], chicken meat contains 18,20 g of protein per 100 g. The longer the sterilization increases the N value/protein content of ayam rarang due to high temperature which denature the protein. This is supported by [17], which state that heating causes the protein to degrade, producing free amino acids. As confirmed by [18], heating can cause the fat content to melt, causing fat component breakdown into volatile products such as acids and hydrocarbons, leading to a pH decrease.

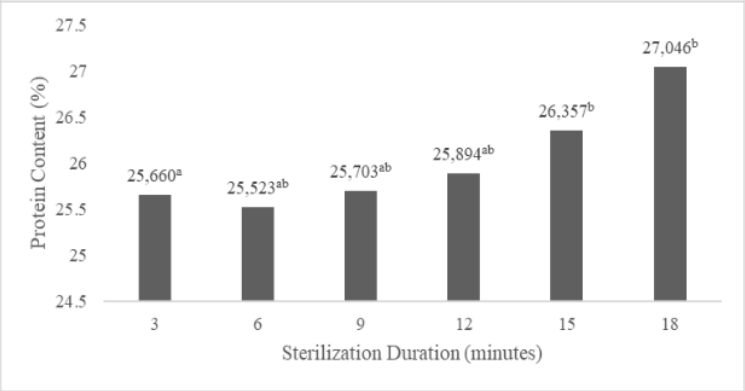

Figure 2. The protein content of canned *ayam rarang* at various sterilization duration

3.1.2 pH value

The pH (degree of acidity) is important in determining a food product's quality and shelf life. The pH is one of the requirements to determine the quality of meat. The pH value corresponds to the pH standard for chicken meat, which ranges from 5.4 to 5.8. The high and low pH values in meat are influenced by the glycogen content found in meat, bacterial activity, and storage time [19]. The effect of sterilization time on the pH value of canned *ayam rarang* can be seen in Figure 3.

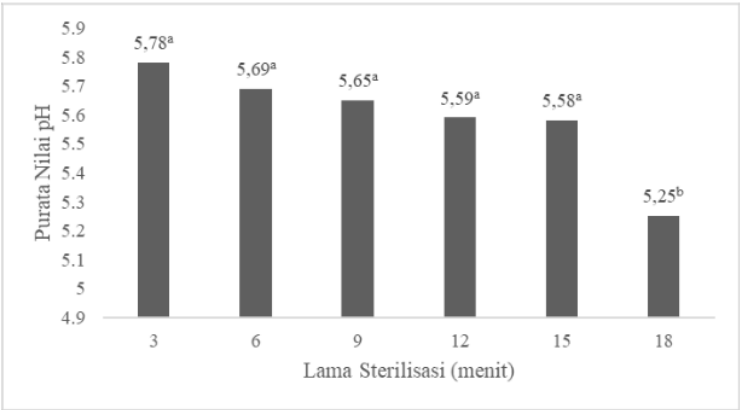

Figure 3. The pH value of canned *ayam rarang* at various sterilization duration

Based on Figure 3, sterilization duration significantly affects the pH value of canned ayam rarang. Decreased pH can occur due to protein degradation which produces free amino acids [17]. Changed pH are related to the degradation of organic acids in foodstuffs into various components, thus decreasing pH [20]. According to [18], heating can cause the fat content to melt, resulting in fat component breakdown into volatile products such as acids and hydrocarbons, which affect the decrease in pH. Canned *ayam rarang* is dominantly seasoned with large and dried red chilies. The tendency of the pH to decrease along with the length of heating time is thought to be caused by the increase in the heat energy contained in the solvent, which dissolves the chemical components in the acidic chilies continuously. This increased the concentration of H+ in canned *ayam rarang* and decreased pH.

The pH value of canned *ayam rarang* ranged from 5.25-5.78. The pH value of canned *ayam rarang* was highest in the 3-minute sterilization treatment, 5.78. While, the lowest pH was obtained by 18-minute sterilization with 5.25. The pH value tended to decrease with sterilization time. This result was similar to [7]; the pH of yellow-seasoned pindang decreases along with the longer sterilization. [21] states that the longer the sterilization duration, the lower the pH of mussel curry. A similar result was shown by [22]; the longer the sterilization, the lower the pH of "ares" (ares is a soup of banana stem) due to fat decomposition into fatty acids.

3.1.3 TBA value (rancidity)

Rancidity is resulted from fat oxidation, which reduces food ingredient quality [23]. A food ingredient's rancidity level can be tested using the TBA number method (*2-thiobarbituric acid*) by reacting samples containing malonaldehyde with a TBA reagent [24]. The effect of sterilization duration on TBA levels of canned *ayam rarang* can be seen in Figure 4.

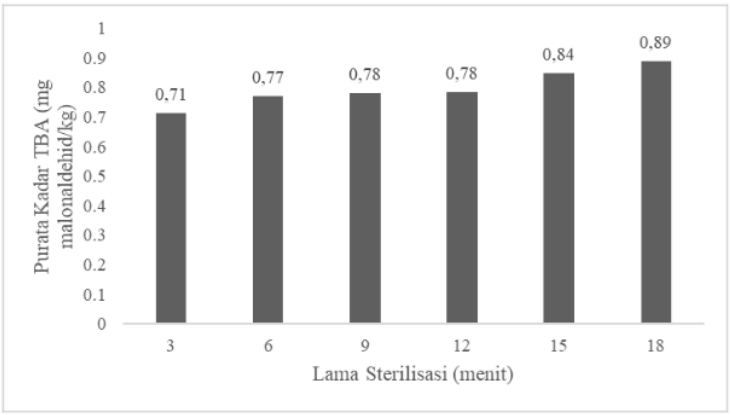

Figure 4. The rancidity value (Tio barbituric acid) of canned *ayam rarang* at various sterilization duration

Figure 4 shows that the rancidity value indicated by the TBA number is not affected by the sterilization duration. However, there is a tendency to increase as the sterilization process takes longer. [25] states that the increased TBA number aligns with increased temperature and heating frequency. Increased TBA value in *ayam rarang* caused by the length of sterilization can be due to the content of unsaturated fatty acids in cooking oil. The presence of unsaturated fatty acids and the continuous thermal oxidation process causes the formation of malonaldehyde resulting in an increase in the TBA value during heating [26]. Based on Figure 4, the 18-minute sterilization had the highest TBA value of 0.890 mg malonaldehyde/kg. The lowest TBA value was found in the 3-minute sterilization of 0.714 mg malonaldehyde/kg. [27] states that the maximum TBA value is around 0.5 mg malonaldehyde/kg material, while according to SNI 01-2352-1991, good products should contain less than 3 mg malonaldehyde/kg material. The highest TBA value produced by canned *ayam rarang* was 0.890 mg malonaldehyde/kg, below the maximum limit, which means canned *ayam rarang* has not experienced rancidity. Canned *ayam rarang* has not gone rancid because the condition of the cans is hermetically closed, so there is no chance of oxidation by oxygen.

3.2 Physical Quality

3.2.1 Texture

Thermal application on meat can cause changes in meat texture. The condition of meat protein influences changes in chicken meat texture [28]. Factors influencing meat texture include protein denaturation, shrinkage of

meat fibers, aggregation and gelation of sarcoplasmic proteins, and dissolution of collagen proteins [29]. The effect of sterilization duration on the texture of canned *ayam rarang* can be seen in Figure 5.

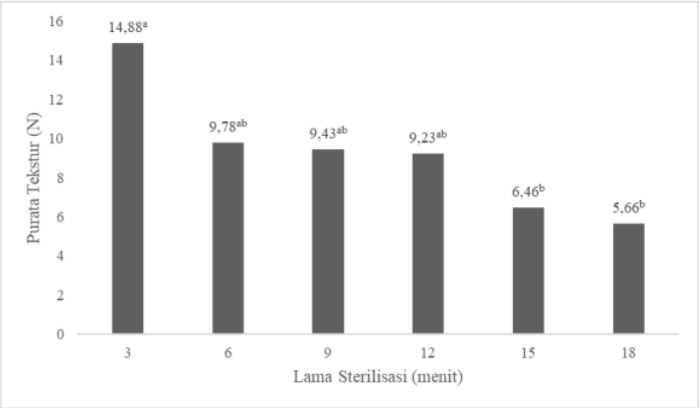

Figure 5. Texture value of canned *ayam rarang* at various sterilization duration

Figure 5 shows that sterilization duration significantly affected the texture value of canned *ayam rarang*. Based on the analysis results, the hardness value of canned *ayam rarang* decreased with the length of sterilization time. [28] reported that the texture of canned chicken curry decreases with the length of the sterilization process. According to [28], collagen protein undergoes denaturation at an internal temperature of 80°C. Collagen undergoes dissolution and gelation so that the network structure becomes more tenuous, causing the distance between the meat fibers to widen. After the thermal process, several changes occur in the meat, including denaturation and dissolution of collagen tissue, rupture of muscle cells, shrinkage of sarcomeres, widening of extracellular distances and intracellular cavities, and appearance of aggregated protein granules in the extracellular space [30]. Decreased hardness level can also be caused by prolonged heating that will break the protein bonds in the connective tissue so that the muscle meat becomes softer [20] which is indicated by an increased total protein (N value) shown in Figure 2.

4. Conclusion

The prolonged sterilization treatment of canned *ayam rarang* significantly affected the pH value, protein content, and texture but did not significantly affect the rancidity/TBA value. Sterilization of *ayam rarang* for 12 minutes fulfilled the F_0 value. However, it was not significantly different from the quality of chicken without sterilization on protein content, pH, rancidity and hardness/textural value.

Acknowledgements

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References

[1] Murdiasih, H., 2019. Pesona Pulau Lombok. Bandung: Penerbit Duta.

[2] Werdiningsih, W., S. Widyastuti, Nazaruddin, dan B. R. Handayani, 2014. Kajian Penggunaan Asap Cair terhadap Mutu Ayam Bakar Taliwang. Jurnal Ilmiah Rekayasa Pertanian dan Biosistem. 2(1): 29-35.

[3] Jayakody, J. A. S. S., M. K. Ranasinghe dan P. D. C. Dissanayake, 2015. Development of a Canned Chicken Product. Journal of Agricultural Engineering and Food Technology. 2(1): 67-67.

[4] Sholihah, A., 2011. Proses Pengalengan Kalio Daging Sapi dan Kajian Pengaruh Sterilisasi (F0) Pemanasan pada Berbagai Suhu terhadap Perubahan Sifat Fisiknya. Skripsi. Fakultas Teknologi Pertanian. Institut Pertanian Bogor. Bogor.

[5] Kusumaningrum, A., dkk., 2021. Thermal Processing and Chemical Characteristics of Canned Traditional Foods Based on Beef: Rawon, Kuah Gandul and Empal Gentong. Advances in Biological Sciences Research. 16: 1-6.

[6] Herawati, E. R. N., A. Susanto, A. Nurhikmat, dan M. Kurniadi., 2020. Kelayakan Usaha Serta Karakteristik Kimia dan Mikrobiologi Mangut Lele Kaleng. Jurnal Riset Teknologi Industri. 14(2): 156-166.

[7] Jannah, M., B. R. Handayani, B. Dipokusumo dan W. Werdiningsih, 2018. Peningkatan Mutu dan Daya Simpan Ikan Pindang Kuning "Pindang Rumbuk" dengan Perlakuan Lama Sterilisasi. Jurnal Ilmu dan Teknologi Pangan. 4(1): 311-323.

[8] Tangke, U., B. Katiandagho dan R. Rochmady, 2020. Angka Kecukupan Gizi (AKG) dan Informasi Nilai Gizi (ING) Ikan Kaleng Tuna Kering Kayu dengan Subtitusi Tepung Tulang Ikan Tuna. Jurnal Agribisnis Perikanan (AGRIKAN). 13(2): 352-357.

[9] AOAC, 2001. Protein (Crudle) in Animal Feed, Forag (Plant Tissue), Grain, and Oilseed. J. AOAC Int.

[10] Badan Standarisasi Nasional (BSN), 2019. Cara Uji Derajat Keasaman (pH) dengan Menggunakan pH Meter. SNI 6989.11:2019. Badan Standar Nasional. Jakarta.

[11] Kusrahayu, H. Rizqiati dan S. Mulyani, 2009. Pengaruh Lama Penyimpanan Krim Susu yang Ditambah Ekstrak Kecambah Kacang Hijau terhadap Angka Thiobarbituric Acid (TBA), Kadar Lemak dan Kadar Protein. Seminar Nasional Kebangkitan Peternakan. 534-540.

[12] Agustia, N., R. Agustina, dan Ratna, 2016. Pengaruh Kemasan Plastik dan Suhu Penyimpanan terhadap Masa Simpan Buah Manggis (Garcinia mangostana L). Jurnal Ilmiah Mahasiswa Pertanian Unsyiah. 1(1): 977-984.

[13] Syah, D., 2012. Pengantar Teknologi Pangan. Bogor: IPB Press.

[14] Awwaly, K. U. A., 2017. Protein Pangan Hasil Ternak dan Aplikasinya. Malang: Univeristas Brawijaya Press.

[15] Sundari, D., Almasyhuri, dan A. Lamid, 2015. Pengaruh Proses Pemasakan terhadap Komposisi Zat Gizi Bahan Pangan Sumber Protein. Media Litbangkes. 25(4): 235-242.

[16] Direktorat Gizi Departemen Kesehatan. 2010. Daftar Komposisi Bahan Makanan. Jakarta: Penerbit Bhratara.

[17] Shah, M. A., S. J. D. Bosco, S. A. Mir, dan K. V. Sunooj, 2017. Evaluation of Shelf Life of Retort Pouch Packaged Rogan Josh, A Traditional Meat Curry of Kashmir, India. Food Packaging and Shelf Life. 76-82. https://doi.org/10.1016/j.fpsl.2017.04.0 01

[18] Nurmala, I., O. Rachmawan, dan L. Suryaningsih, 2014. Pengaruh Metode Pemasakan terhadap Komposisi Kimia Daging Itik Jantan Hasil Budidaya Secara Intensif. Students e-journal. 3(2).

[19] Soeparno, 2011. Ilmu Nutrisi dan Gizi Daging. Gajah Mada University Press. Yogyakarta.

[20] Mutma'innah, M. N., Maherawati, dan T. Rahayuni, 2022. Perubahan Nutrisi Ikan Asam Pedas dalam Retort Pouch dengan Variasi Waktu Sterilisasi. Jurnal Agrotek UMMAT. 9(2): 75-85.

[21] Fernandez, C. D. W., 2017. Pengaruh Lama Sterilisasi dalam Botol Gelas terhadap Mutu Gulai Remis (Corbicula javanica). Skripsi. Fakultas Teknologi Pangan dan Agroindustri. Universitas Mataram. Mataram.

[22] Wahyuni, Z. A., 2017. Pengaruh Lama Sterilisasi pada Proses Pengalengan terhadap Mutu dan Masa Simpan Ares. Skripsi. Fakultas Teknologi Pangan dan Agroindustri. Universitas Mataram. Mataram.

[23] Purnamasari, E., Nurhasni, dan W. N. H. Zain, 2012. Nilai Thiobarbituric Acid (TBA) dan Kadar Lemak Dendeng Daging Kambing yang Direndam dalam Jus Daun Sirih (Piper betle L.) pada Konsentrasi dan Lama Penyimpanan yang Berbeda. Jurnal Peternakan. 9(2): 46-54.

[24] Laila U., S. Indriani, dan R. Nurhayati, 2020. PENENTUAN TINGKAT KETENGIKAN SECARA SPEKTROFOTOMETRI PADA PRODUK PANGAN BERWARNA MELALUI METODE EKSTRAKSI ASAM CAIR. Journal of Industrial Technology Research. 12(1): 19-30.

[25] Karouw, S. dan C. Indrawanto, 2015. Perubahan Mutu Minyak Kelapa dan Minyak sawit Selama Penggorengan. Balai Penelitian Tanaman Palma. 16(1): 1-7.

[26] Dewi, N. P. S. D. P., 2019. Pengaruh Suhu dan Frekuensi Pemanasan Berulang Terhadap Kualitas Fisik dan Kimia Minyak Kelapa Sawit Komersial. Skripsi. Fakultas Teknologi Pertanian. Universitas Brawijaya. Malang.

[27] Raharjo, S., 2006. Kerusakan Oksidatif pada Makanan. Gadjah Mada University Press. Yogyakarta.

[28] Anugerah, M. P., 2016. Pengembangan Produk Gulai Ayam Kaleng sebagai Sumber Lemak dan Protein pada Pangan Darurat. Skripsi. Fakultas Teknologi Pertanian. Institut Pertanian Bogor. Bogor.

[29] Kong F., A. Oliveira, J. Tang, B. Rasco, C. Crapo, 2008. Salt effect on heat-induced physical and chemical changes of salmon fillet (O. gorbuscha). Food Chemistry 106 (2008) 957–966.

[30] Chang, R. dan J. Overby, 2011. General Chemistry The Essential Concepts 6th Edition. New York: The McGraw Hill Companies.

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