PROCEEDING

International Food Conference 2011 "Life Improvement through Food Technology" Surabaya, October 28th - 29th, 2011

Editors Prof. Dr. Ir. Endang S. Rahayu Prof. Dr. Ir. Yustinus Marsono

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Auditorium Benedictus Widya Mandala Catholic University Surabaya

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Agricultural Technology Faculty Widya Mandala Catholic University

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LIST OF PAPER

PAPER OF ORAL PRESENTATION

NO	AUTHOR	TITLE	PAGE
1	Umi Purwandari, Galih	Textural Properties Of Dioscorea Tubers Flour, Its	1-8
	Suprianto, Dian Milanita,	Effect On Bread Quality And Its Improvement	
	Supriyanto And Burhan	Using Hydrocolloid	
2	Kitiya Suhem, Narumol Matan,	The Effects Of Low Pressure Rf Plasma On The	9-13
	Mudtorlep Nisoa, and Nirundorn	Mineral Content And Other Quality Parameters	
	Matan	Of A Brown Rice Snack Bar	
3	Santi Dwi Astuti and Rifda	Formulation and Characterization of Functional	14-21
	Naufalin	Biscuits Consisting of Canna Edulis, Kerr	
		Resistant Starch Type III, Granulated Palm Sugar,	
		and Soy Protein Concentrate	
4	Pudji Hastuti, Lukita	Roasting Effects of Indonesian Sesame Seed	22-26
	Purnamayati, Siswanti, and	(Sesamum Indicum L.) on Oil Yield, Antioxidant	
	Supriyanto	Activity And Compounds in the Oil	
5	Somayeh Ghandehari, Sayed	Qualitative Evaluation Of Frying Oil Enriched By	27-31
	Amir Hossein Goli, Mahdi	Conjugated Linoleic Acid (CLA)	
6	Kadivar Mariyati Bilang	Study of Formanta d Carry Mills Tafa (Freel	22.20
0	Manyati Bhang	Cheese) by Using Lastobasillus Lastis and	32-39
		Soaked in Brine	
7	Chuspul Hidavat Dudii Hastuti	Characterization of Nations I (40.40
/	Vulius Bayu Prastowo	Protein Isolates	40-48
8	Marvam Jafari Mahdi Kadiyar	Optimization of chemical synthesis of Cis-9 trans-	10-51
-	Saved Amir Hossein Goli	11-Octadecadienoic acid through KOH-catalyzed	77-77
		dehydration of castor oil by response surface	
		method (RSM)	
9	Siti Tamaroh	Production of Instant Rice Arrowroot Low	55-60
		Glycemic Index and Protein Quality	
10	Sri Luwihana	Beras Oyek Made from Various Tubers and Their	61-65
11		Acceptability	
11	Angelia Dwi Lestiyani, Thomas	Effect of Soybean And Sweet Corn Ratio on The	66-72
	Indarto P S., Ignatius Srianta	Vogurt	
12	Tvas Utami, Palupi Melati	Acid production and antioxidant activity in peanut	73_79
	Pangastuti, Endang S. Rahayu	milk fermented with Lactobacillus paracasei	1517
		SNP2 and Lactobacillus plantarum Dad 13	
13	Thitikorn Mahideanan Piyawan	Effect of Freeze drying and maltodextrin on Poly-	80-85
	Gasaluck	Î ³ -glutamic acid (Î ³ -PGA) production ability of	
1.4		Bacillus subtilis starter powder	
14	Balogun, I.O; Otunla, E.T;	Effect of Fermentation with Rhizopus Species on	86-95
	Overoro O A	Some Physico-chemical Properties of Starch	۵.
15	Meta Mahendratta Abu Bakar	Optimizing Production Process of Seasoning	06 102
1.5	Tawali, Februadi Bastian and	Powder Made From Fermented Fish Products	90-102
	Mulyadi Tahir	a strate triade i foni i efficited i isii i foquels	
16	Chatarina Wariyah and Riyanto	Effect of Drying Temperature on Antioxidant	103-109
		Activity and Acceptability of Aloe vera (Aloe	
		vera var. Chinensis) Powder	

PAPER OF ORAL PRESENTATION (Cont'd)

NO	AUTHOR	TITLE	PAGE
17	Gatot Priyanto, Kiki Yuliati and	Nitrogen Gas Application for Packaging of Nila	110-117
	Lucyana	Chips on Various Storage Times and	
1.0	-Secol	Temperatures	110 100
18	Misnawi, Ariza Budi Tunjung	Process of Producing Polyphenol from	118-122
	Sari and Shinta Setiadevi	Extracting Solvents	
19	Junaedi Muhidong and Kartika	Volumetric-Shrinkage Model of Cocoa Beans	123-128
20	Ariestya Arlene A., Anastasia	Red Food Coloring Extraction From Rosella	129-133
	Prima K., Tisadona Mulyanto	(Hibiscus sabdariffa)	
	and Cynthia Suriya		
21	Andri Cahyo Kumoro	Preliminary Investigation on the Preparation of	139-144
		Wanang From Jackfruit (Artocarpus heterophyllus	
	Tang IVH Izenty BI	Lam) Juce Using Succharomyces cerevisede	
22	Nur'Izzati, A.J., Rahmah, S.M.,	Survival of Vibrio Cholerae O1 in Cooked Rice,	145-152
	Roslan, A. and Abu Bakar, C.A.	Coffee and Tea	
23	Budi Sustriawan, Rahma	Study of lead contaminant on seafood at seafood	153_150
23	Purnama Sari	restaurants in Purwokerto	155-157
	Laksmi Widajanti, Dina R.	Hygiene and sanitation of warung makan in	1 (0, 1 (0)
24	Pangestuti	Tembalang Sub-district, Semarang City, Central	160-163
	Sabajanah Bachok, Chemah	Java, muonesta	
	Tamby Chik, Maaruf Abd Ghani	The Impac of Halal Logo Implementation on	
25	Â, Aliffaizi ArsatÂ, Jazziana	Malaysian Restaurant Operators	164-167
	Jamil & Suria Sulaiman		
	Siti Nur Afifah Jaafar, Margaret	The Role of Food Quality in Determining	
26	Lumbers and Anita Eves	Consumer Satisfaction, Post-purchase Attitudes	168-176
		Strategies of Market Based on Customer Loyalty	
27	Hasnelly	of Green Food Products in Indonesia	177-186
20	Baiq Rien Handayani And	Antibacterial Activity Of Coffee Berry Pulp	107 104
28	Stanley E. Gilliland	Fractions And Their Phenolics Content	18/-194
29	Harsoio	The Effect of Irradiation And Storage On Chicken	195-201
		Processed Food	190 201
30	Nurhayati, B. Sri Laksmi Jenie,	Low glycemic index modified plantain flour as	202 208
50	Kusumaningrum	functional foods	202-208
		Anti-diabetic Activities of Ethanolic Extract of	
31	Jayus, Nuri and Andri Tilaqza	Merremia mammosa (Lour.) Hall. f. Tuber in	209-213
		Diabetic Rats by in vivo Glucose Tolerance Test	
22	Taiagari and Ali Santaga	Health Effects of Nutrafosin Beverage on Lipid	214 222
32	Tejasari and Ali Santoso	Profile of Patient with Dislipidemia	214-223
	Dudi Lakaana Hadicaasta	The Influence of Phylanthus Niruri Extract on	
22	Subarvo' Suwandono A ' and	The Progression of HIV/AIDS Infection as	224-233
55	Gasem MH	Indicated by Monitoring of CD4 and TNF Alpha	44T-43J
		Levels	
3.1	Kio Jan Kusuma, Sri Lestari, Finotia Astari, Fadbila	rianting a nope from factic acid bacteria: reducing	234 240
JT	Pratamasari, and Susetvowati	failure with black soygurt	234-240

NITROGEN GAS APPLICATION FOR PACKAGING OF *NILA* CHIPS ON VARIOUS STORAGE TIMES AND TEMPERATURES

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ABSTRACT

Nila is a kind of traditional fish usually used as foodstuff at Indonesian society especially at South Sumatera area. The objective of this research was to study the nitrogen gas application for nila chips packaging. Polypropilene plastic with thickness of 0.6 mm was used as the packaging material, filled out with nitrogen gas at full volume, sealed and stored under various times (0, 20, 40 and 60 days) and temperatures (30 $^{\circ}C$ and 40 $^{\circ}C$). Control, without filling with nitrogen gas, was also performed to compare the result. The nila chips were analyzed for the moisture content, rancidity values, browning index and total microbes. The results showed that moisture content, peroxide value and browning index increased during storage, with linier correlation model of $Y_i = 0.0264 X_i + 5.198 (R^2 = 0.99)$, $P_{21} = 0.2277 + 0.2856t (R^2 = 0.97)$ and $B_{21} = 0.73 + 0.0033t$ $(R^2 = 0.56)$, respectively. The total microbes were also increased of about 1 log cycle during 60 days of storage. Nitrogen gas package could be able to decrease deterioration of nila chips during storage at ambient temperature. The rate of quality changes was decreased to 82-89 % when nitrogen applied in the package. The value of Q_{10} for all of quality parameters was higher when nitrogen applied in the package compare to control. It was found nitrogen in the package not only to be preservation agent but also increase temperature sensitivity of nila chips quality during storage.

Key words: nitrogen, nila chips, storage

INTRODUCTION

Fishery product, such as nila fish, is important protein resources for most of civil society at Sout Sumatera. It was traditionally culture in the village, but it was easy to deteriorate or decrease the perishable foods. quality to be Microbiological and chemical reaction was leading potential factor to destroy the quality. Postharvest technology was needed to solve that problem in order to save the economic and social value (Saptanto, Suryawati dan Koeshendrajana, 2005).

Nila fish was given name from Directorat General of Fishery- Indonesia at 1972 for species member of *Nilotika*. The fish has spesific taste and easy to be cultured, but the consumption was ristricted because of stinking-smelling fish. Nila chips is one of many ways for enhancing nila utilization with no stinking-smelling fish, but it was need carefully treatment to store any times and temperatures. Chips deterioration was signed by rancid smelling, uncrackling, abnormal texture, bacterial spot etc. Most of chips manufacturer was managed those quality by suitable packaging, but for nila chips it has not yet been observed which the best one. Kadoya (1990), reported that there are some advantages when plastic was used as packaging, for example it was easy performed, relatively cheaper, posible any design, not rusty and relatively lower water permeability. Murnivati (1999) had used poliethilene plastic for snack fish stored at ambient temperature, and showed that although it was packed by plastics the product was increased water activity value,

rancidity and microbilogical number. Therefore, it needed to find other method to pursue the quality decrease, at least decrease the rate of quality changes during storage.

Modified atmosphere storage has ben recomended to extent shelf life of fish product (Torry Research Station, 2009). Atmosphere of surounding material in the package, without treatment for changing, has same composition with outer space of package at initial start of packaging. It was naturally consited of gas such as nitrogen, oxygen, carbon dioxide, and water vapour.. The oxygen gas was not major component but it could pursue any chemical reactions (e.g. oxidation). It was important to restrict oxygen and water vapour contact to extend shelf life product in the package. Koseki and Itoh (2002) have reported the positive effect of nitrogen gas packaging on quality of vegetable. Modified atmosphere storage is one of many ways to implement that concept, and it was usually maintain by increasing proportion of nitrogen to decrease the portion of other gas in the package. Kadoya (1990) had reported the case of peanut butter packaging method, when it was increased nitrogen portion in the package it would extended shelf life product by smaller increasing of moisture content and peroxide value. It was recommended to maintain the oxygen less then one percent of atmospheric gas in the package.

Temperature had been noted as signifcant factors influenced the product quality during storage (Potter and Hotchkiss, 1995; Bridge, 1992). The rate of chemical reaction in the foodstuff usually was increased when temperature was increased. Syarief and Halid (1993) recommended it to maintain the stabilization of temperature when product quality was needed. Temperature sensitivity of product in the package was varied depend on packaging method. It was need to be considered when we need to design packaging system and storage (Krochta, 2007). Arrhenius model approximation was widely used for expressing the dependency of rate on temperatures and characterized by activation energy. Q_{10} concept is another way to express the rate dependency on temperature, usually counted by ratio of rate value at temperatures difference 10 °C or relatively shelf life when it was stored at difference temperature at 10 °C.

Quality changes of food product during storage had been succesfully expressed by kinetics model approximation with various parameters, such misture content (Saguy, 1983), browing index (Priyanto, 1997), phisical texture, and biochemical characteristics (Labuza, 1980), etc. It is important thing to know the rate constant (k) of the quality changes during storage (Priyanto, 2009). There are no information the value of nila chips during storage when to applied modified nitrogen was atmosphere in the package. Therefore, research on this field is needed to conduct for studying the application of nitrogen gas for packaging of nila chips during storage at various times and temperatures.

MATERIALS AND METHOD

Main material of *Nila* fish was prepared from local market at Palembang, South Sumatera. Other material such as tapioca, salt, eggs, *food grade* oil and spices was also purchased from local market. Chemical reagent for analysis was bought from local chemical store, such as alcohol (96 %), kloroform, KI, Na₂S₂O₃ and aquadest. The apparatus for processing and analysis was available at the Agricultural Product Laboratory, Faculty of Agriculture, Sriwijaya University.

Nila chips was prepared from fresh fillet *nila* fish that was cleaned and separeted with others part usually omitted. Fillet was store at the freezer, and then it was chopped to be thin and small fillet. At about 600 g fillet was added 420 g tapioca, 25 g salt, 50

g onions, 25 g red onion, 5 g pepper, 15 g ginger, 50 g margarine and 70 eggs. Those are mixed and performed thin layer (c.a. 0.30 cm) to be raw *nila* chips. It was then to be fried by deep frying method at about three minutes, and made leak to ready *nila* chips for packaging.

Nila chips ready for packaging, at amount of 20 g packed in the polipropilene packaging and strighly sealed for the first treatment A_1 (none nitrogen modified), the other at the same amount of nila chips was packed in the polipropilene packaging inserting by nitrogen gas in the package and sealed as second treatment labelled by A2 code. Many unit samples were made for both two treatment $(A_1 \text{ and } A_2)$. Some samples from both treatment was then stored at first storage temperature treatment labelled by B_1 for ambient temperature (30 ± 2 °C) and the others was stored at 40 ± 2 $\overline{}^{0}C$ and lebelled by B₂ code. The quality was observed during storage times at 0, 20,40, dan 60 days.

The quality of *nila* chips was expressed by quality parameters consisted of moisture content, peroxide value, browning index microbiological number. and total content was measured bv Moisture (Sudarmadji gravimetric method et al., 1997), peroxide valued was measured by titimetric method (Sudarmadji et al, 1997), browning index was measured by spectrofotometric method (Cohen et al., 1994) and microbiological number by microbial total count spread plate method Experiment (Fardiaz, 1989). was conducted on completly factorial block design. Colected data was then used to performed kinetic models to find the rate value of deterioration and to evaluate the efectiveness of nitrogen gas application compare to normal condition for preserving nila chips on packaging during storage. Determination coeficient () was used as criteria for valid model (Ganjloo et.al., 2009) for expressing the realtionship between variables.

RESULTS AND DISCUSSION

The result show that nitrogen gas package could be able to decrease deterioration of nila chips during storage at ambient temperature. The rate of quality changes was decreased to 82-89 % when nitrogen applied in the package. The value of Q_{10} for all of quality parameters was higher when nitrogen applied in the package compare to control. It was found nitrogen in the package not only to be preservation agent but also increase temperature sensitivity of nila chips quality during storage. The phenomenon was slightly difference when product was stored at higher temperature (40 °C). It was shown the rate of changes of moisture content and microbe number of nila chips in nitrogen gas package was higher than normally package (no nitrogen treatment). The other quality parameters i.e. peroxide value and browning index was still same as shown phenomena by storage at ambient temperatures.

Moisture Content

Moisture content of *nila* chips was ranged from 4.3 percent to 8.85 percent, with average value of 6.54 percent. It was increased during storage. At the end of storage (60 days) at ambient temperatures, the average moisture content of *nila* chips in nitrogen gas packaging was 6.78 percent, while control product was 6.99 percent. When the product stored at higher temperature (40 °C), the moisture content about 8.48 percent for nila chips in nitrogen packaging, while the other one was 8.29 percent.

The moisture content of *nila* chips during storage could be expressed by linier model approximated by polynomial orthogonal method, where moisture content and storage time was represented, respectively, by Y and X. The linier equation founded on ambient temperature storage is $Y_i = 0.0264$ $X_i + 5.198$, $R^2 = 0.99$, for *nila* chips on nitrogen gas packaging and $Y_i = 0.0305X_i$ + 5.330, $R^2 = 0.91$, for control *nila* chips. While for higher temperature storage (40 ^oC) for those treatment, respectively, $Y_k =$ 0.0418x + 5.785, $R^2 = 0.93$ and $Y_1 =$ 0.0531x + 5.296, $R^2 = 0.99$. The index, i and j, was respectively indicated for nila chip stored at ambient temperature with nitrogen gas packaging and control (none nitrogen gas treatment), while k and l was respectively indicated for nila chip stored at higher temperature (40 °C) with nitrogen gas packaging and control (none nitrogen gas treatment). Those models tell us that moisture content of nila chips was increased during storage. It means there are mass transfer from outer side package to the inner one, and addition of amount water to the product. The increasing moisture content would increase the water activity value that indicated more water could be used by microbial substance and also pursue hidrolysis process. Therefore, it leads to deteriorate or decrease the product quality.

The above models was justified that moisture content of nila fish was changes following the zeroth order kinetics model, which was expressed by linier model supporting by higher value of determination coeficient Based on zeroth order kinetics model as dQ/dt = k, by spesific integration method was found out linier model as $Q=Q_0 + k(t)$ where Q: quality, t: storage time and k: rate constant of quality changes (van Boekel, 1996). Those above equation then shown us the rate value of moisture content change as stated in the table and also ratio of the rate value when temperatures storage was at difference of 10 $^{\circ}$ C that usually called Q₁₀. It was shown that nitrogen application increased the sensitivity moisture change the temperature, where the change of temperature would change the rate constant significantly.

Table 1. The face of moisture content changes of <i>nua</i> chips during storage					
Rate (k)	Rate (k)	Q ₁₀			
at 30 °C	at 40 °C				
0.0264	0.0531	2.011			
0.0305	0.0418	1.371			
	Rate (k) at 30 °C 0.0264 0.0305	Rate (k) Rate (k) $at 30 \degree C$ $at 40 \degree C$ 0.0264 0.0531 0.0305 0.0418			

 Table 1. The rate of moisture content changes of *nila* chips during storage

Peroxide Value

Peroxide value was measured for expressing the quality of nila chips especially in relation with rancidity, taste and role of oil or fat component of product during storage. At start of storage time (zero days), the rancidity was undetectable given by zero peroxide value. This fact was tell us that product was healty and in good contition after packaging. Futher analysis at another storage time showed that peroxide value was increased during storage. Nila chips treatment by nitrogen gas packaging consistenly showed lower peroxide value than control at ambient temperature storage, but it was not happenned on higher temperature (40 °C) storage. The average of peroxide value at the end of storage (60 days) in ambient temperatures was 16.61

for *nila* chip with nitrogen gas packaging where as control about 18.59, and at higher temperature (40 °C) storage, respectively, 19.55 and 19.94 meq/kg fat.

Futher analysis data by polynomial orthogonal method was founded that the relationship of peroxide value of nila chip with storage time, as shown in above figure, was valid and significant described by linier model, otherwise not significant for square or kuadratic models. Based on those facts, by adopting the kinetics models for chemical reaction, the zeroth order reaction kinetics model was the most suitable for describing deterioration process of nila fish. When P_{ii} was defined as peroxide value of *nila* chip with packaging method i (i=1: control, no treatment; I=2 :

Proceeding of IFC 2011

with nitrogen gas packaging) and storage temperature j (j=1: ambient temperature; j=2: 40 °C), and t was storage time (days), the kinetics model for peroxide value of *nila* chips are: $P_{11} = 0.3833 + 0.3186t$, $R^2 =$ 0.92; $P_{12} = -1.3357 + 0.3323t$, $R^2 = 0.98$; P_{21} =0.2277+0.2856t, R² = 0.97; P₂₂ = 0.6473+ 0.3150t, $R^2 = 0.97$. The slope value of those linier equation, reffered to zeroth order kinetic model in linier format Q=Q + k(t), was represented the rate constant for peroxide value (kp) changes during storage as shown in Table 2. It was founded that rate constant on peroxide value for nila chips with nitrogen gas in packaging was consistently lower than control where as at ambient temperature storage about 89

Surabaya, October 28th – 29th 2011

percent and at 40 °C storage about 95 persen. This fact indicated that nitrogen decrease able to was application significantly below 90 percent the rate of nila chips deterioration based on peroxide value parameters during storage at ambient temperature. The lower value when storage temperature was higher indicated that nitrogen application was not effective on higher temperature. The Q₁₀ of peroxide value of nila chips with nitrogen gas application was calculated about 1.103, that is higher than control about 1.043 as shown at Table 2. Based on this phenomenon, it is recommended that nitrogen application in packaging of nila chips was done at ambient temperature or the lower one.

Table 2	The rate of perox	ide value	changes of	of nila	chips	during s	storage
							the second s

Nila chip	Constant rate $(1 - 1)$ at 20 °C	Constant rate (k) at 40 °C	Q ₁₀
treatment packaging	0.2856	0.3150	1.103
Control (no treatment)	0.3186	0.3323	1.043

Browning Index

Nila chips after packaging at initialy start of storage (zero day storage) has been measured the average value of browning index about 0.215 A_{420nm} . At the end of storage (60 days), browning index of *nila* chips with nitrogen gas packaging was 0.39 and 0.48 for storage ambient temperature and 40 °C, respectively, while the control was 0.42 and 0.57 A_{420nm} . It was observed that browning index of *nila* chips was increased during storage both with nitrogen gas packaging or control under ambient temperature or higher.

Futher analysis data by polynomial orthogonal method was found that the relationship of brwoning index of *nila* chip with storage time, as shown in above figure, was significantly valid described in a linier model, otherwise not significant for others. This analysis was lead to adopt the zeroth order kinetics models, in linier format $Q=Q_0 + k(t)$, that was applied before for describing the change of moisture content and peroxide value of *nila* chip during storage. It was supported by many researcher previously as reported by Priyanto (1997) that zeroth order kinetic models had been used and valid for describing browning index development on foodstuf during storage.

Based on zeroth order kinetic model, the formula of browning index development could be set as $B = B_0 + k_b(t)$, where k_b is rate constant of browning development. When B_{ij} was defined as browning index of nila chip with packaging method i (i=1: control, no treatment; I=2 : with nitrogen gas packaging) and storage temperature j (j=1: ambient temperature; j=2: 40 °C), and t was storage time (days), the kinetics model for browning index of nila chips are: $B_{11} = 0.190 + 0.0039t$, $R^2 = 0.92$; B_{12} $=0.211+ 0.0059t, R^2 = 0.93; B_{21} = 0.73+$ 0.0033t, $R^2 = 0.56$; $B_{22} = 0.195 + 0.0047t$, R^2 The rate constant of browning = 0.94. index development (kb) was shown as slope of the equation of those kinetic models and presented on Table 3.

11/

Table 3. The rate of browning index development of <i>mid</i> chips during storage					
Nila chip	rate constant	rate constant	Q10		
treatment packaging	(k_b) at 30 $^{\circ}C$	(k_b) at 40 °C			
Nitrogen gas application	0,0033	0,0047	1.405		
Control (no treatment)	0.0039	0.0059	1.509		

Table 3. The rate of browning index development of *nila* chips during storage

The rate contant of browning index development for nila chips with nitrogen gas packaging, as shown in above table which consistently lower than control, both at ambient temperature and 40 °C storage. Based on comparison of that rate constant, it is shown that aplication of nitrogen gas for nila chip packaging was able to decrease browning index development to 85 percent for ambient temperature and 80 percent at higher temperature (40 °C). Nitrogen gas in this case was kicked the role of water pavour and oxygen to promote browning precusor to be unusable. When atmosphere in the packaging were filled in full size by nitrogen gas, there are no space for water vapor and oxygen, and prevent accelerated reaction of browning formation. Browning reaction, especially in processed food product, during storage at ambient temperatures had been reported by many researcher that it was dominated by Maillard reaction. This reaction was not only contributed to color of product but also perform the odor and taste as whole quality of product. Browning reaction should be managed carefully in foodstuf to submit the best product performance.

Nitrogen gas application in packaging of nila chips to prevent browning reaction was faunded not more sensitive than control. It was shown by calculated Q₁₀ where presented on Table 3 above, that the Q_{10} value for nila chips with nitrogen gas in packaging is 1.405 which is lower than Q_{10} control as 1.509. Nila chip with nitrogen gas in packaging was more tolerable to the However this temperature change. pehenomena was one of the advatage where there are no quaranty of stable temperature during storage such as on traditional transportation from village to town and vice versa.

Microbial Plate Count

Microbiological aspect is an important factor of product quality such as *nila* chip because of its original fish composition where potentially resource for microbial It was investigated that after life. packaging when ready to store treatment, average microbial count of nila chip is still about of 10⁵ cfu/mL. The microbial number on 60 days storage was about 10⁶ cfu/mL During the storage, both on ambient temperature or at higher temperature (40 °C), the microbial count of nila chip was increased. The increasing of microbial count during storage was aproximated by logaritmic model as usually used by microbiologist to describe microbial growth stated by common equation: $N = N_0 \cdot 10^{dt}$ or in linier formula as $Log N = Log(N_o) + dt$ where d is the rate constant of microbial count increasing in log microbial count per time unit. Based on the obtained data, the model of microbial count increasing for nila chips during storage are: Log N11 =0.190+0.000745t, $R^2 = 0.89$; Log N₁₂ =0.211+ 0.000903t, $R^2 = 0.74$; Log N₂₁ =0.73+ 0.000613t, $R^2 = 0.82$; Log N₂₂ =0.195+ 0.00096t, $R^2 = 0.77$. Those equations show that *nila* chip with nitrogen gas in packaging come to be slower than control at ambient temperature, but at higher temperature (40 °C) the slope is greater indicated rapid growth than control. Calculated Q_{10} was founded that the Q_{10} of microbial count of nila chip was about 1.564, which was greater than control with O₁₀ about 1.213. This indicated that application of nitrogen gas in the packaging would increase the sensitivity of shelf life product during storage especially in point of view microbial count.

CONCLUSION

The application of nitrogen gas promised many advantages, nila chip would be more satisfied in quality during storage. Nila chip stored under nitrogen treatment packaging was potentially to extend of its shelf life. Moisture content, peroxide value and browning index was changed during storage based on linier relationship model between its quality parameter with storage times, while microbial plate count number was suitable axpressed by logarithmic Nitrogen gas package could be model. able to decrease deterioration of nila chips during storage at ambient temperature. The rate of quality changes was decreased to 82-89 % when nitrogen applied in the package. The value of Q_{10} for all of quality parameters was higher when nitrogen applied in the package compare to control. Nitrogen in the package was not only to be preservation agent but also increase temperature sensitivity of nila chips quality during storage.

REFERENCES

- Bridge, F. 1992. Modern Microbiology Principle and Application. V.C. Brow Publisher, Arizona, US
- Cohen, E., Birk, Y., Mannheim, C.H. and Saguy, I.S. 1994. Kinetic parameter estimation for quality changes during continuous thermal processing of grape fruit juice. *Journal of Food Science* 59(1): 155-158.
- Fardiaz, S. 1989. Analisis Mikrobiologi Pangan. Raja Grafindo Persada, Jakarta
- Ganjloo, A., R.A. Rahman, J. Bakar, A. Osman and M. Bimaks. 2009. Modelling the kinetics of seedless guava (Psidium guajava L.) peroxidase ianctivation due to heat and thermosonification treatments. *International Journal of Engineering and Technolology* 1(4): 306-309.
- Kadoya. T. 1990. Food Packaging. Academic Press Inc. Harcourt Brace Javanovich Publisher. Kanogawa.
- Koseki, S and Itoh, K. 2002. Effect of nitrogen gas packaging on quality and

1 1

microbial growth of fresh-cut vegetable under low temperature. *Journal of Food Protection* 65(2): 326-332.

- Krochta, J.M. 2007. Food Packaging. In Handbook of Food Engineering, 2nd.Ed. (Edited by Heldman, D.R. and D.B. Lund), p.847. CRC Press. New York.
- Labuza, T.P. 1980. Entalphy entrophy compensation on food reaction. *Food Technology* (2): 67-77.
- Murniati. 1999. Pengaruh Jenis Ikan dan Pemberian Bumbu dalam Pembuatan Camilan Ikan serta Daya Awetnya pada Suhu Kamar. LP-IPB. Bogor.
- Potter, N. and J.H. Hotchkiss. 1995. Food Science. 5th.Ed. Chapman & Hall. New York.
- Priyanto, G. 1997. Kinetika Perubahan Mutu Saribuah Nenas dalam Proses Aseptik. Disertasi, IPB Bogor
- Priyanto, G. 2009. Application of kinetics model on new product development. *Dinamika Penelitian BIPA* 20(35): 1
- Saguy, I. 1983. Computer Aided Technique in Food Technology. Marchel Dekker Inc. New York. USA
- Saptanto, S., S.H. Suryawati, and S. Koeshendrajana. 2005. Assessment of level participation and fish consumption from the vie of regional aspect in Indonesia. *Jurnal Penelitian Perikanan Indonesia* 11(9):73
- Sudarmadji, S., B. Haryono dan Suhardi. 1997. Prosedur Analisa Bahan Makanan dan Pertanian. Liberty, Jakarta
- Syarief, R. and H. Halid. 1993. Teknologi Penyimpanan Pangan. Arcan, Jakarta
- Torry Research Station. 2009. Packing Fish in a Modified Atmosphere. FAO Coorporate Document repository. On line

http/://www.fao.org/wairdocs/tan/x595 6e01.htm diakses 26/10/2009

van Boekel, M.A.J.S. 1996. Statistical aspect of kinetic modelling for food science problem. Journal of Food Science 61(3): 477-486.