Digital Receipt

This receipt acknowledges that Turnitin received your paper. Below you will find the receipt information regarding your submission.

The first page of your submissions is displayed below.

Submission author:	Nur Aini
Assignment title:	Test
Submission title:	Quality Deterioration and Shelf Life Estimation of Corn Yogu...
File name:	ASL_yogurt.pdf
File size:	77.45K
Page count:	3
Word count:	2,569
Character count:	12,739
Submission date:	09-Feb-2022 07:42PM (UTC+0700)
Submission ID:	1758448062

RESEARCH ARTICLE

Advanced Science Letters
Vol. 23, 5796–5798, 2017

AMERICAN SCIENTIFIC PUBLISHERS

Quality Deterioration and Shelf Life Estimation of Corn Yogurt was Packaged by Glass Bottle

Nur Aini*, Vincentius Prihananto, Gunawan Wijonarko, Yuni Astuti, Melda Ruth Maulina, and Muthmainah

Department of Agricultural Technology, Jenderal Soedirman University, Purwokerto, 53123, Indonesia

Packaging is an important factor to controlling the process of deterioration of food products, including determining the shelf life. Glass bottles are often used to package liquid products such as yogurt as well its mechanical resistance. The objective of this paper are: (1) to determine the kinetics of quality deterioration yoghurt corn on the packaging of glass bottle; (2) to estimate the shelf life of yogurt corn stored in glass bottle packaging. Yogurt corn packaged using glass bottles stored at 5, 10 and 15 °C . Analysis of the chemical, physical and sensory carried out every 7th day of storage for 21 days of storage. Determination of shelf life is done using methods ASLT with Arrhenius models. Lactic acid bacteria decreased slightly during storage. Viscosity and protein levels decreased during the first week, then increased until the third week of storage. pH and total acid tertitrasi which tend to increase as well as the variable total dissolved solids tend constant during storage. For variable sensory panelists scoring average tends to decrease as the length of storage time Corn yoghurt stored in glass bottles have a shelf life of 5.9; 4.6 and 3.6 months at 5, 10 and 15 °C and long retention (3×10^4 s at 85 °C).

Keywords: Corn Yogurt, Packaged, Glass Bottle, Shelf Life.

1. INTRODUCTION

Dairy-based probiotic products were being circulated in the market, such as yogurt. For people who allergenic of milk proteins, it needs alternative materials to make yogurt. We have been developed a probiotic corn extract that has properties similar to yogurt that had a total of lactic acid bacteria (LAB) 8,74 log CFU/g. It shows that probiotic corn extract fulfill the requirements as food probiotics are lactic acid bacteria should have a 6 log CFU/g.[1]

Food packaging was essential to prevent the occurrence of changes in the quality of the product. Various food grade packaging were available on the market, one of which is glass bottle. Glass bottles are often used to package liquid products such as yogurt as well its mechanical resistance.

Information about shelf life of the product is very important for many stakeholders, including producers, consumers, sellers, and distributors. One way of fixing the shelf life of food is using the Accelerated Shelf-Life Testing (ASLT) with Arrhenius approach. The principle of the method ASLT was accelerate damage to physical-chemistry products with high temperature and then determined the actual shelf life by mathematical calculation.

The purpose of this paper are: (1) to determine the kinetics of quality deterioration yoghurt corn on the packaging of glass bottle; (2) to estimate the shelf life of yogurt corn stored in glass bottle packaging.

*Author to whom correspondence should be addressed.

2. EXPERIMENTAL DETAILS

2.1. Making of Corn Yogurt

Yogurt corn was made by method.[2] First, 150 ml of sweet potato extract was mixed with 1 l of sweet corn extract. Furthermore to the mixture was added 100 ml of mung bean juice, 150 ml of sugar and 100 g of skim milk. The next step is the inoculation materials using the mixed culture of *Lactobacillus bulgaricus* and *Streptococcus thermophilus*. Ingredients that have been inoculated subsequently incubated for 8 hours at 37 °C.

2.2. Analysis

Corn yogurt that has been incubated then packaged with glass bottle. The storage is done in the refrigerator 5 °C, 10 °C, and 15 °C for 21 days. Yogurt was analyzed every 7 days for 21 days. The variables measured in this study included a total of lactic acid bacteria,[3] pH measurements are performed with the potentiometric method using a pH meter, total dissolved solids (using a refractometer), lactic acid levels were determined by titration with a solution of alkali (Mann, s Acid Test), and total protein levels (micro Kjeldahl method).

The sensory analysis includes color, acid taste, flavor and preferences using the test scoring. Panelists used are 20 trained panelists. Scoring is expressed on a scale of 1 to 5. The data were analyzed using linear regression method and descriptive analysis.

1936-6612/2017/23/5796/003 doi:10.1166/asl.2017.8835

Quality Deterioration and Shelf Life Estimation of Corn Yogurt was Packaged by Glass Bottle

by Nur Aini

Submission date: 09-Feb-2022 07:42PM (UTC+0700)
Submission ID: 1758448062
File name: ASL_yogurt.pdf (77.45K)
Word count: 2569
Character count: 12739

RESEARCH ARTICLE

Advanced Science Letters
Vol. 23, 5796–5798, 2017

Quality Deterioration and Shelf Life Estimation of Corn Yogurt was Packaged by Glass Bottle

Nur Aini*, Vincentius Prihananto, Gunawan Wijonarko, Yuni Astuti, Melda Ruth Maulina, and Muthmainah

Department of Agricultural Technology, Jenderal Soedirman University, Purwokerto, 53123, Indonesia

Packaging is an important factor to controlling the process of deterioration of food products, including determining the shelf life. Glass bottles are often used to package liquid products such as yogurt as well its mechanical resistance. The objective of this paper are: (1) to determine the kinetics of quality deterioration yoghurt corn on the packaging of glass bottle; (2) to estimate the shelf life of yogurt corn stored in glass bottle packaging. Yogurt corn packaged using glass bottles stored at 5, 10 and 15 °C . Analysis of the chemical, physical and sensory carried out every 7th day of storage for 21 days of storage. Determination of shelf life is done using methods ASLT with Arrhenius models. Lactic acid bacteria decreased slightly during storage. Viscosity and protein levels decreased during the first week, then increased until the third week of storage. pH and total acid tertitrasi which tend to increase as well as the variable total dissolved solids tend constant during storage. For variable sensory panelists scoring average tends to decrease as the length of storage time Corn yoghurt stored in glass bottles have a shelf life of 5.9; 4.6 and 3.6 months at 5, 10 and 15 °C and long retention (3×10^4 s at 85 °C).

Keywords: Corn Yogurt, Packaged, Glass Bottle, Shelf Life.

1. INTRODUCTION

Dairy-based probiotic products were being circulated in the market, such as yogurt. For people who allergenic of milk proteins, it needs alternative materials to make yogurt. We have been developed a probiotic corn extract that has properties similar to yogurt that had a total of lactic acid bacteria (LAB) 8.74 log CFU/g. It shows that probiotic corn extract fulfill the requirements as food probiotics are lactic acid bacteria should have a 6 log CFU/g.[1]

Food packaging was essential to prevent the occurrence of changes in the quality of the product. Various food grade packaging were available on the market, one of which is glass bottle. Glass bottles are often used to package liquid products such as yogurt as well its mechanical resistance.

Information about shelf life of the product is very important for many stakeholders, including producers, consumers, sellers, and distributors. One way of fixing the shelf life of food is using the Accelerated Shelf-Life Testing (ASLT) with Arrhenius approach. The principle of the method ASLT was accelerate damage to physical–chemistry products with high temperature and then determined the actual shelf life by mathematical calculation.

The purpose of this paper are: (1) to determine the kinetics of quality deterioration yoghurt corn on the packaging of glass bottle; (2) to estimate the shelf life of yogurt corn stored in glass bottle packaging.

*Author to whom correspondence should be addressed.

2. EXPERIMENTAL DETAILS

2.1. Making of Corn Yogurt

Yogurt corn was made by method.[2] First, 150 ml of sweet potato extract was mixed with 1 l of sweet corn extract. Furthermore to the mixture was added 100 ml of mung bean juice, 150 ml of sugar and 100 g of skim milk. The next step is the inoculation materials using the mixed culture of *Lactobacillus bulgaricus* and *Streptococcus thermophilus*. Ingredients that have been inoculated subsequently incubated for 8 hours at 37 °C.

2.2. Analysis

Corn yogurt that has been incubated then packaged with glass bottle. The storage is done in the refrigerator 5 °C, 10 °C, and 15 °C for 21 days. Yogurt was analyzed every 7 days for 21 days. The variables measured in this study included a total of lactic acid bacteria,[3] pH measurements are performed with the potentiometric method using a pH meter, total dissolved solids (using a refractometer), lactic acid levels were determined by titration with a solution of alkali (Mann, s Acid Test), and total protein levels (micro Kjeldahl method).

The sensory analysis includes color, acid taste, flavor and preferences using the test scoring. Panelists used are 20 trained panelists. Scoring is expressed on a scale of 1 to 5. The data were analyzed using linear regression method and descriptive analysis.

 1936-6612/2017/23/5796/003 doi:10.1166/asl.2017.8835

2.3. Determination of Shelf Life

Determination of shelf life was using ASLT with Arrhenius models. The steps being taken include the establishment of parameters that become the critical point, temperature determination, forecasting the timing and frequency of data collection. ...ed on these parameters then plotted in Arrhenius models, namely:

$$\ln k = \ln k_o - (E_a/\mathrm{RT})$$

Based on the equation obtained value of the activation energy (E_a) of each parameter. The parameters were selected that has the smallest activation energy. The smaller the activation energy faster then the product will be damaged. The next step is determining the shelf life (t_s) using the equation order, namely.

$$t_s = \frac{A_0 - A_t}{k \cdot t} \quad \text{(Orde 0), and} \quad t_s = \frac{\ln(A_0/A_t)}{k_t} \text{(Orde 1)}$$

3. RESULTS AND DISCUSSION

3.1. Description Quality of Initial and the End

Yogurt is a fermented product that involves some friendly bacteria such as *Lactobacillus bulgaricus*, *Streptococcus* viability of the product. Initial and final characterization is an important factor in the shelf life estimating using Arrhenius models (Tab... I) *thermophillus* and *Lactobacillus acidophillus*. Therefore, shelf life of the product to be important in order to optimize the viability of the product. Initial and final characterization is an important factor in the shelf life estimating using Arrhenius models (Table I).

Quality of yogurt changes during storage (Table I) pH, viscosity, total acid, and protein increases on the 21st day of storage. According to Ref. [4], lactic acid is growing more if the storage is getting longer. Reference [5] stated that during storage yogurt increases the viscosity by increasing the production of lactic acid causes an increase in total acid resulting in a change in the structure of proteins (denaturation). Changing the structure of a protein causes the protein to total bacterial breakdown products also increased.

Lactic acid bacte... decrease during storage, from 7.573 to 6.893 log CFU/ml. At the end of storage, the amount of BAL st... fulfils the minimum requirements as probiotic food, at least 6 log CFU/ml. The decrease duri... storage is better than[6] that found in yogurt, LAB decrease of 2.34 log cycl... during 28 days of storage. According to Ref. [6], a decrease in viability ... lactic acid bacteria is caused by the more acid production, so the lactic acid bacteria will death. Meanwhile, according to Ref. [8], the more the total BAL present in a food, the increasingly competition between BAL. That means more of total BAL in a food, nutrient availability will be dwindling and survival of BAL is getting shorter, so the longer storage, an amount of BAL decreases.

Table I. Description of initial and final quality of corn yoghurt at a temperature of 5 °C

Quality parameters	Initial value (A_0)	Final value (A_1)
Lactic acid bacteria (log CFU/ml)	7,573	6,893
Protein (%)	2,18	2,67
Total acidity (%)	0,768	0,786
pH	4,4	4,5
Soluble solid (°Brix)	23	22
Viscosity (mPa/s)	160	190

Table II. Acceptance of the product during storage at 15 °C.

Day	A	B	C	D	Rejection (%)
0	4.97	3.45	3.23	3.98	0
7	4.15	2.95	4.05	2.9	25
14	3.95	3.05	4	2.8	30
21	2.2	2.05	3.55	1.85	40

The protein content slightly rises because of the increased metabolite produced by lactic acid bacteria. Reference [9] explains that the metabolite produced by LAB is bacteriocin. The longer the fermentation, the more lysine was formed. It also resulted in an increase in pH.

Table II shows the mean of the product acceptance test by panelists during storage at the critical temperature (15 °C). In estimating the shelf life of the product, sensory test carried out more than 50% of panelists rejected th... product. Corn yoghurt was rejected by 50% of the panelists after 21 days of of storage at 15 °C, especially in the assessment of aroma and preference. Reference [7] states that the typical yoghurt flavor derived from lactic acid, acetaldehyde, acetic acid and diacetyl. On the 21st day of storage, yoghurt volatile compounds evaporate and are replaced with other compounds that cause off the odor or loss of the typical yoghurt aroma.

3.2. Determining Parameter and Critical Point

Quality attributes associated with the yoghurt fermentation by lactic acid bacteria. Other quality attributes is the stability of the yoghurt, seen from yoghurt damage occurs in the form of wheying off or syneresis. This can occur marked a clumps that split. parameter selection criteria shelf life of a product, namely:
(1) the quality parameters of the fastest decline during storage, sho... with the greatest R squared,
(2) quality parameters most sensitive to temperature changes, the views from the activation energy (E_a) is lower.

To determine critical point, first we should be determine ordo of each parameter. According Ref. [7], a critical factors in yogurt are a total acid, coliforms, and sensory properties. According to Ref. [6], on a dairy beverage products, the parameters that have the highest R^2 value and the activation energy (E_a) is the lowest pH. In this study, the critical parameters used are pH and total acid.

pH and total acid corn yoghurt plotted against time to obtain three regression equations on a particular storage te...perature. Determination of the reaction order using the chart zero order and the first order. From the equation will get the highest R^2 is selected as the reaction order. Order selected then plotted on the Arrh...us equation. Arrhenius equation is a plot between the value of $1/T(K...1)$ and $\ln k$. Then created a linear regression to obtain a linear equation $\ln k = \ln k0 - (E/R)(1/T)$, with $\ln k_0$ is the intercept and E/R is the slope. E_a is the activation energy and R is the ideal gas constant is 1.986 cal/mol. The parameters

Table III. The linear regression of lactic acid bacteria.

Temperature (°C)	Linear regression		R^2	
	Zero ordo	First ordo	Zero ordo	First ordo
5	$y = -0.041x + 7.55$	$y = -0.006x + 2.02$	0.991	0.993
10	$y = -0.041x + 7.53$	$y = -0.006x + 2.02$	0.984	0.988
15	$y = -0.029x + 7.44$	$y = -0.004x + 2.01$	0.777	0.783

Table IV. The activation energy of each parameter.

Parameter	Arrhenius equations	R^2	Activation energy (cal/mol°K)
Lactic acid bacteria	$y = 2849x - 15.4$	0.699	5641
Protein	$y = -19748x + 66.4$	0.943	391101
pH	$y = -3265x + 6.6$	0,750	6464
Total acid	$y = -9647x + 29$	0.828	19101
Soluble solid	$y = 2355x - 12$	0.178	4663
Viscosity	$y = -5620x + 14.8$	0,399	11126
Color	$y = -2530x + 2.7$	0.898	5007
Acid taste	$y = -3925x + 9.9$	0.697	7772
Flavor	$y = -21153x + 68$	0.667	41883
Preference	$y = -4806x + 12$	0.279	9516

Table V. The result of the calculation of the shelf life of corn yogurt was packaged glass bottle.

Temperature (°C)	k value	Shelf life (months)
5	0.0049	4.4
10	0.0061	3.6
15	0.0075	2.9

that most influence deterioration during of storage were selected based on the lowest value of the activation energy.

Every parameter plotted against time to obtain three regression equations on each of the storage temperature. Determination of the reaction order using the chart zero order and the first order. From the equation will get the highest R^2 is selected as the reaction order. Table III shows one example of the selection order of the reaction. R square of first ordo has greater than zero ordo, so we choose the first ordo. Ordo selected then plotted on the Arrhenius equation, so we get the value of activation energy (Table IV).

The parameters that most influence deterioration during of storage were selected based on the lowest value of the activation energy. This is because the lower the activation energy of a reaction, degradation will run faster. In this study, the soluble solid has the lowest activation energy is 4663 cal/mol°K.

3.3. Determining Shelf Life

Based on the Arrhenius equation, it can be calculated the value k of each critical point. The value of k is a constant deterioration, associated with shelf life. The higher k, degradation will be greater, so it will shorten the shelf life. Value of $\ln k_o$ and $-E/R$ on the Arrhenius equation is a constant number, so that the equation can be written as $\ln k = A + Bx(1/T)$. Thus, the value $\ln k_o = A$ and value $-E/R = B$. Based on these equations can be specified shelf life (T).

The shelf life of yogurt at 5, 10 and 15 °C was 4.4; 3.6 and 2.9 months. This is in line with Ref. [5] that the yogurts sold in the market have a shelf life of about 2 to 3 months at refrigerator temperature (34–40 °F), or about 1 to 5 °C. Good storage temperature for the yogurt is usually done in the refrigerator temperature ±4 °C.

4. CONCLUSION

The decline of the quality of yoghurt corn is in the first week of viscosity and total protein levels decreased and then increased until the third week of storage. pH, lactic acid bacteria and total acids that tend to increase as well as the variable total dissolved solids tend constan during storage. For variable sensory panelists assessment tends to decrease as the length of storage time. Corn yoghurt stored in glass bottles has a shelf life of 4.4; 3.6 and 2.9 months at 5, 10 and 15 °C

Acknowledgments: This research was supported by Directorate of Higher Education, Ministry of Education of Republic Indonesia in the program National Strategic Research in 2016.

References and Notes

1. A. Y. Tamime, M. Saarela, A. K. Sondergaard, V. V. Mistry, and N. P. Shah, *Probiotic Dairy Products* 3, 39 **(2005)**.
2. N. Aini, V. Prihananto, G. Wijonarko, A. Arimah, and M. Syaifudin, *Agritech* 37 **(2017)**, (in press).
3. M. Y. Ha, S. W. Kim, Y. W. Lee, M. Y. Kim, and S. J. Kim, *Journal Biosience and Bioengenering* 96, 134 **(2003)**.
4. N. Layadi, P. Sedyandini, Aylianawati, and F. E. Soetaredjo, *Widya Teknik* 8, 1 **(2009)**.
5. D. M. Saccaro, A. Y. Tamime, A. L. O. P. S. Pillegigi, and M. N. Oliveira, *International Journal of Dairy Technology* 62, 397 **(2009)**.
6. M. R. Damin, E. Minowai, M. R. Alcantara, and M. N. Oliveira, *Journal of Texture Studies* 39, 40 **(2008)**.
7. L. C. Allgeyer, M. J. Miller, and S. Y. Lee, *Journal Dairy Science* 93, 4471 **(2010)**.
8. M. Gurses, B. Cetin, and M. Sengu, *Asian Journal of Chemistry* 21, 4097 **(2009)**.
9. C. A. Van-Reenen and L. M. T. Dicks, *Archives of Microbiology* 193, 157 **(2011)**.

Received: 12 December 2016. Accepted: 19 December 2016.

Quality Deterioration and Shelf Life Estimation of Corn Yogurt was Packaged by Glass Bottle

ORIGINALITY REPORT

14%	8%	9%	%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Nur Aini, V Prihananto, B Sustriawan, Y Astuti, M R Maulina. "Quality evaluation of polypropylene packaged corn yogurt during storage", IOP Conference Series: Earth and Environmental Science, 2018 Publication	4%
2	Vivi Amanda, Ismail Sulaiman, Dewi Yunita. "Variety of packaging and estimated shelf life of Acehnese traditional food (pliek u)", IOP Conference Series: Materials Science and Engineering, 2019 Publication	2%
3	eprints.upnjatim.ac.id Internet Source	1%
4	www.instm.it Internet Source	1%
5	sinta.ristekbrin.go.id Internet Source	1%

6	"Novel Food Fermentation Technologies", Springer Science and Business Media LLC, 2016 Publication	1 %
7	www.hindawi.com Internet Source	1 %
8	www.myfoodresearch.com Internet Source	1 %
9	ccrjournal.com Internet Source	1 %
10	www.ifrj.upm.edu.my Internet Source	1 %
11	www.mdpi.com Internet Source	<1 %
12	eic.ft.unnes.ac.id Internet Source	<1 %
13	www.e3s-conferences.org Internet Source	<1 %
14	Salsabila Noorannisa, Nurfitri Ekantari. " Stability Of Ice Cream and Shelf Life Prediction Using Accelerated Shelf Life Test Method Based On Physical and Antioxidant Analysis ", E3S Web of Conferences, 2020 Publication	<1 %

Exclude quotes	On	Exclude matches	Off
Exclude bibliography	On		