ISSN: 2338-1345 – Vol. (5) 2. 9-13 2017 Journal online http://journal.bakrie.ac.id/index.php/APJSAFE

Asia Pacific Journal of Sustainable Agriculture Food and Energy (APJSAFE)

Sensory quality of brown rice Inpari 24 after 3 months of storage

Putri Amelia, Ardiansyah, Wahyudi David*

Department of Food Science and Technology, Universitas Bakrie, Jakarta, Indonesia
**Corresponding author's Email address: wahyudi.david@bakrie.ac.id*

Abstract- Brown rice contributes to high bioactive content for human health however rancidity was the obstacle to store it properly. This research aims to estimate shelf life of brown rice Inpari 24 with polyethylene and polyethylene vacuum packaging by sensory analysis method. The shelf life test based on the ISO 16779: 2015 by using 10 panelists. Brown rice was store under non-vacuum packaging treatment (PE) and vacuum packaging (PEV) for 3 months. The results show, in the preference plot, there was decreasing of acceptance of the panelist on PE and PEV from 0-3 month. In hazard function, panelists recognize that sensory changes in PE faster than PEV. There is no significant different of moisture content for both PE and PEV during 3 months evaluation. Free fatty acids in PE are increasing over three month meanwhile PEV remain stable. Overall evaluation, PEV shows better performance for storage mode in term of preference and perception of panelist.

Keywords- brown rice, sensory analysis, panelist, shelf life, non-vacuum, vacuum, Inpari 24

INTRODUCTION

Brown rice is paddy rice from rice milling process which is the husk only has been removed that consist of bran, endosperm and embryo. Brown rice contains 1.9% fat, dietary fiber, vitamins, minerals and some vitamin B complexes (Marimuthu et al., 2014). On the other hand rice bran contains vitamin E (α tocopherol and tocotrienol) and α oryzanol (Imsanguan et al., 2007). The main component of vitamin E in bran is tocopherol which is have an antioxidant compound, a compound that can reduce the risk of cancer formation and coronary heart disease (Zhimin, Na & Samuel, 2001).

Brown rice processing requires less energy than processing of white rice; this is due to the elimination of polishing and grinding processes (Cuyno, 2003). Despite having nutritional and economic benefits, brown rice has not been widely consumed and marketed because of susceptibility to rancidity (Bergonio et al., 2016). Rancidity occurs due to the release of lipase enzymes in the outer layer of rice (Zhout et al., 2001). This process produces free fatty acids (FFA) that cause rancidity and unpleasant odor (Chrastil, 1990).

Fat is affected by two processes during storage involving FFA (Piggott, J.R., Morrison & Clyne, 1991). First, the production of FFA is involving lipase enzymes. Second, the process of oxidation of fat into hyperoxide which is produces FFA as well (Zhout et al., 2003). The oxidation process occurs in fats containing double bonds (Varshini et al, 2013). Oxidation often occurs because the fat contacts with oxygen.

FFA results in rancidity that will affect during storage. Factors influencing the storage life of brown rice are varieties, storage and packaging conditions. Different varieties result in different the shelf life of rice as well (Garcia, 2013). Storage conditions such as refrigerators or freezers can significantly extend the storage life of brown rice (Sinija et al., 2017). Therefore, storage and packaging conditions are an important aspect of brown rice storage to improve brown rice quality.

The shelf life information becomes an important factor that should be given to the consumer before the product is marketed and consumed. This information can only be determined by a review of the degradation of the quality of food products. The calculation of shelf life of a product is done by observing of the product during storage until there is a change that consumers cannot be accepted.

According to ISO 16779: 2015, the determination of shelf life can be done by sensory evaluation. Sensory characteristics evaluated in the form of changes in appearance of color, aroma, taste and texture. Sensory testing is one of the most cost-effective; it can determines

the consumer response directly as panelist and it is fast testing methods compared to other testing methods in estimating shelf life, such as: accelerated shelf life testing and Arhenius methods. In order to determine the shelf life of foodstuffs, one of the temperature conditions used to estimate shelf life is the storage temperature of 40 ^{0}C which is expected to last up to 5 months (ISO 16779: 2015). Thus, in this study we evaluated sensory quality of brown rice Inpari 24 with polyethylene and polyethylene vacuum packaging in order to determine its shelf life.

MATERIALS AND METHODS

A. Materials

Sample was use Inpari 24. The chemicals used were KOH 0.035 N, oxalic acid 0.025 N, 95% alcohol, phenolphtalein and toluene. The equipment used is wood incubator, 5 watt lamp, refrigerator, rice cooker, space temperature measuring device (HTC-1), vacuum machine, analytical scale (ABJ 320-4NM), desiccator and oven.

B. Methods

This research consists of two stages of testing, first sensory testing and second chemical testing (moisture content and free fatty acids). Sensory testing is performed on the brown rice that has been stored at ± 40^{0}C for three months. Sensory tests were conducted according to ISO 16779: 2015 on Sensory analysis - Assessment of shelf life of foodstuffs. Moisture content analysis and FFA was performed based on AOAC methods (2005). This research was conducted for 3 months.

$$\text{Moisture content (\% bb)} = \frac{(initial\ weight - contant\ weight)}{initial\ weight} \times 100\%$$

$$\textit{Fat Acidity} = \frac{\text{(T-B) x (N) x (56,10) x (100)}}{\text{Wt x (100-M)}} \times 100$$

T : volume of sample titration(ml)
B : volume of blank titration (ml)
N : normality of titrant (mmol/ml)
Wt : weight of sample (g)
M : moisture of sample (% bb)

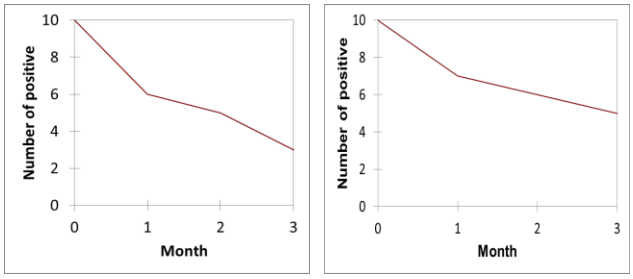
C. Statistical Analyses

The research data was processed using XLSTAT-Sensory on the sensory shelf life analysis menu section. Each test received by the panelist is positive or worth 1 and vice versa will be negative or 0. Then the data is processed with sensory data analysis on the sensory shelf life analysis. Data processed in XLSTAT-Sensory will produce data in the form of preference plot graph, preference distribution function and hazard. The analysis of moisture content and free fatty acid using analysis of variance and continued with Duncan test if the results obtained there are significant differences with 95% confidence level ($p < 0.05$).

RESULTS AND DISCUSSIONS

Preference Plot

The preference plot is a graph stating the panelist preference and acceptance of the Inpari 24 sample for 3 months of storage. The number of positives describes the number of panelists who express acceptance of the sensory aspect of the sample. The chart below will explain panelist acceptance of brown rice Inpari 24 for 3 months of storage.



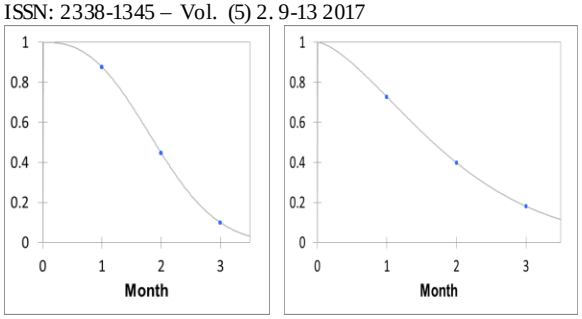
non vacuum (PE) **vacuum (PEV)**

Fig. 1 Preference plot of Inpari 24 with non-vacuum and vacuum packaging

Non vacuum (PE) and vacuum (PEV) are both decreasing on this graph. But in both have different decline. In the 3rd month, only 3 out of 10 panelists stated their acceptance of the sensory aspects of PE samples (see Fig 1). While PEV samples at month 3, 5 out of 10 panelists stated their overall acceptance of the sensory aspects of the sample. A 3rd month PEV sample is still acceptable by panelists at a real 5% level difference. PE samples are not acceptable to the sensory aspect compared to PEV samples that are acceptable to panelists as consumers. Wahid et al. (2003), brown rice can still be stored for 3 months at room temperature. However, brown rice stored at refrigerator temperatures has better sensory attributes than stored at room temperature, which are not rancid and off-odor (Ory et al., 1980).

Preference Distribution Function

Preference distribution function is a graph that describes the acceptance of the sample with the interpretation of the linear model.



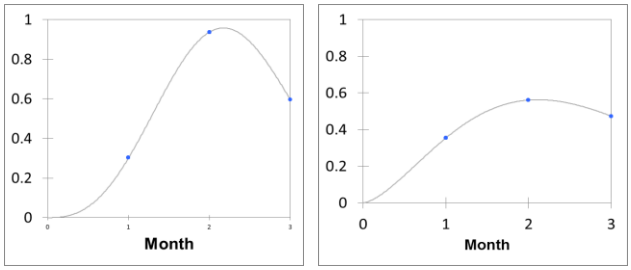
Non vacuum (PE) **Vacuum (PEV)**

Fig 2. Preference distribution function of Inpari 24 with non-vacuum and vacuum packaging

Month 3rd can be seen point down the PE chart at the value of 0.1 equivalents to 10%. This value is lower than the drop point value of the PEV sample of 0.2 or equal to 20%. The lower the preference distribution graph score indicates that acceptance of the sensory aspects is very difficult to accept. This graph is directly proportional to the graph preference plot.

Hazard Function

The hazard function graph is a graph that states the probability that the panelist can still recognize sensory changes when samples are consumed within the time limits tested after storage for some time. Sensory changes can occur in color, flavor, texture and taste.



Non vacuum (PE) **Vacuum (PEV)**

Fig. 3 Hazard function of brown rice Inpari 24 under non vacuum and vacuum packaging

The graph in Fig. 3 explained that the panelist probability still recognizes the monthly sensory changes in the Inpari 24. On the 2nd month of storage it has a high probability value. Both graphs are very different in the 2nd month. However, panelist probability value recognizes changes during the 3 months storage in both samples. PE samples have a high probability value compared to PEV samples at month 2. The PE sample has a probability value close to 1 or it can be said that almost all panelists can recognize sensory changes in the 2nd month. While the PEV sample has a probability value that is half the probability value of PE. PEV samples contained only half of the total panelists who can recognize sensory changes and the rest of the panelists cannot recognize sensory changes.

Moisture Content

In Table 1 it can be seen that there was a decrease of moisture content during 3 months. The analysis of variant of PE and PEV showed that moisture content for 3 months was not significantly different to sensory acceptance. The decreasing in moisture content during storage because of the fluctuations in storage room humidity (Tarigan and Kusbiantoro, 2011). Jumali et.al. (2011), moisture content of less than 14% to the end of its shelf life, is still relatively low and safe for storage. Although still considered safe in storage, the sensory may not be acceptable even if the water content tends to be safe. Indication of water content in this study does not reflect the quality of brown rice for consumption.

Table. 1 Moisture content in different packaging mode

Packaging	Month 1	Month 2	Month 3	*Anova*
Non vakum (PE)	12.48±0.04	12.46±0.05	12.39±0.08	0.44
Vakum (PEV)	12.63±0.02	12.62±0.00	12.6±0.00	0.258

Free Fatty Acid

Free fatty acids (FFA) are produced by hydrolysis and oxidation processes. This process will be accelerated by the presence of heat, water, acidity and enzymes. FFA can be regarded as a factor of damage to food products due to the oxidation or hydrolysis of food components (Zhout, 2003).

Table 2. Free fatty acid comparison

Pakaging	Month1	Month2	Month3	Anova
Non vakum (PE)	4.01±0.02[a]	6.15±0.26[b]	6.47±0.41[b]	0.006
Vakum (PEV)	4.52±0.14	5.89±1.24	6.28±1.25	0.33

FFA was increasing during 3 months of storage in PE and PEV, however only PE has increasing significantly ($p<0.05$). Zhout et al. (2003), FFA can be as a parameter of food deterioration and the presence of water and oxygen content increases brown rice damage during storage. Table 2 FFA results showed that PEV samples were similar however in PE samples were significant different ($p<0.05$).

The results of the FFA sample PE sample in the 1st month are significantly different from the 2nd and 3rd months.

Sensory Characteristics

Sensory characteristics in this study consisted of the color, aroma, taste and texture of the sample for 3 months of storage. 10 Panelist were asked their response on sensory attribute and Table 3 shows the panelist comment on the attributes.

Table 3. Panelist response on the attributes

Month	Type	Sensory Attributes	Panelist response
1	PE	Color	reddish
		Aroma	strong aroma
		Taste	tasteless
		Texture	fibrous
	PEV	Color	-
		Aroma	strong aroma
		Taste	tasteless
		Texture	Non-glutinous
2	PE	Color	-
		Aroma	sting
		Taste	savory
		Texture	dry
	PEV	Color	-
		Aroma	Strong aroma
		Taste	sweet
		Texture	Non-glutinous
3	PE	Color	-
		Aroma	Strong aroma
		Taste	Savory and sour
		Texture	-
	PEV	Color	-
		Aroma	Strong aroma
		Taste	tasteless
		Texture	dry

This sensory characteristic is based on a panelist agreement on four sensory attributes. In the color attribute, PE and PEV samples are equally likely to be favored and accepted by the panelists. This can happen because the panelists do not comment on the color attribute, which is considered a color is not a critical factor in this sensory test. In the aroma attribute, the scent of the PEV sample is preferred by the panelist compared to the PE sample.

In taste attribute, the assessment of the taste is not constant. The brown rice taste assessment tends to be favored and sometimes less favorable. In the 3rd month the assessment of taste attributes tends to increase from previous months.

In texture attributes, the assessment tends to increase and decrease by the panelists. In the 3rd month the texture decreased compared to the previous month. Duration of storage and temperature greatly affect texture after cooked rice (Zhout et al., 2003). The texture of the rice is strongly influenced by the amylose content. The cooked rice with low amylose content has a soft and sticky rice texture. While cooked rice with high amylose content has a fluffy texture.

CONCLUSIONS

Inpari 24 brown rice have decreased sensory attribute for 3 months of storage. Storage of brown rice with vacuum packaging (PEV) for 3 months is still acceptable by its sensory attribute. However, in non-vacuum packaging (PE), the possibility can only be stored for less than 3 months because the sensory aspect is no longer acceptable to consumers. FFA content of non-vacuum packaging increased over three months of storage. The moisture content of Inpari 24 CPC decreased for three months of storage.

REFERENCES

Badan Standardisasi Nasional. ISO 16779. 2015. Sensory Analysis –Methodology – Triangle test. Badan Standar Nasional Indonesia. Jakarta : Dewan Standarisasi Indonesia.

Bergonio, K.B., Lucatin, L.G.G., Corpuz, G.A., Ramos, N.C., dan Duldulao, J.B.A. 2016. Improved Shelf Life of Brown Rice by Heat and Microwave Treatment. Published by Faculty of Biotechnology and Food Science.

Chrastil, J. 1990. Protein-Starch Interaction in Rice Grains. Influence of Storage on Oryzenin and Starch. Journal of Agricultural and Food Chemistry.

Cuyno, R. 2003. The Campaign to Combat Hidden Hunger through Brown Rice. Consultative Meeting on Nutritional Aspect of Brown Rice, at Food & Nutrition Research Institute, Manila Philippines..

Garcia, R. 2013. Shelf-life Extension of Brown Rice. PCIEERD Technology Promotion Activity. im

Imsanguan, P., Roaysubtawee, A., Borirak, R., Pongamphai, S., Douglas, S., dan Douglas, P.L. 2008. Extraction of Alpha Tocopeherol and Gamma Oryzanol from Rice Bran. Journal of Food Science and Technology 41, 1417-1424.

Marimuthu, K., Magesh, P., George, J. S., Dhanalakshmi, R., Ponraj, K., Lavanya, K., & Kalimuthu, R. 2014. Antioxidant Potential of Brown Rice, 28(25), 134–137.

Ory, R.L., DeLucca, A.J., St. Angelo, A.J. and Dupuy, H.P. 1980. Storage Quality of Brown Rice as Affected by Packaging With and Without Carbon Dioxide. J. Food Protection, 43(12):929-32.

Piggott, J.R., Morrison, W.R., dan Clyne, J. Changes in Lipids and in Sensory Attributes on Storage of Rice Milled to Different Degrees. International Journal of Food Science and Technology, 26, 615-628.

Sinija, V.R., Sulochana, S., dan Shwetha. 2017. Engineering Propertied of Brown Rice from Selected India Varieties. Dalam buku Brown Rice chapter 3.

Tarigan, E. B., dan Kusbiantoro, B. 2008. Pengaruh Derajat Sosoh dan Pengemas terhadap Mutu Beras Aromatik selama Penyimpanan.

Varshini, V., Sudharam, A., dan Praven, V. 2013. Brown Rice - Hidden Nutrients, 4(1), 503–507.

Wahid, S., Rosniyana, Hashifah dan Norin, S. 2003. Packaging Technique to Prolog The Shelf Life of Brown Rice and Partially Milled Rice at Ambient Storage. J. Trop. Agric. And FD. 31(2)(2003): 225-233.

Zhimin X., Na H, and Samuel GJ. 2001. Antioxidant Activity of Tocopherols, Tocotrienols and Gamma Oryzanol Component from rice bran againt cholesterol oxidation eccelarated by 2,2 –Azobus Dihydrocholride. Journal agriculture chemistry, 49, 2077-2081.

Zhout, Z., Robards, K., Helliwelt, S., dan Blanchard, C. 2001. Ageing of Storage Rice: Changes in Chemical and Physical Attributes. Journal of Cereal Science 33.

Zhout, Z., Blanchard, C., Helliwell, S., dan Robards, K. 2003. Fatty Acid Composition of Three Rice Varieties Following Storage. Journal of Cereal Science 37, 327-335.