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Investigation of Map for Durian Preservation

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Abstract

Durian (*Durio zibethinus Murr*) is a popular and expensive tropical fruit widely grown in Mekong delta, Vietnam. Durian fruit possesses high nutritional value and has rich bioactive properties. Generally, durian fruit pulp (flesh) is consumed directly. There are many ways to enhance its value. Application of MAP packaging was a case in point. We focused on investigation the effect of temperature and air composition to nutrition, sensory charactetistic and food safety of fresh durian fruit. Our results showed that temperature (5^{o}C) was positively affected to durian quality during preservation. Comparing to the preservation in normal temperature (28^{o}C), durian was only maintained in one week; the durian fruit quality could be extended to 10 days if it is preserved in 5^{o}C. When applying MAP packaging, durian fruit quality was maintained only 2 days at normal room temperature and 15 days at 5^{o}C. Air composition also actively affected to the fresh durian shelf life. MAP containing 3% O_2 and 5% CO_2 was believed the best option. At 5^{o}C, 3% O_2 and 5% CO_2 durian fruit shelf life could be prolonged 5 days higher compared to sample kept in normal packing and room temperature.

Keywords: Durian, MAP, shelf-life, temperature, air composition, preservation

INTRODUCTION

Durian is valuable tropical fruit in Southeat Asia. It has superlative flesh, which is highly nutritional. The importance of durian fruit as a nutraceutically valued source can be correlated to their composition and presence of bioactive antioxidant compounds s (Arancibia-Avila et al., 2008; Haruenkit et al., 2010). It's normally consumped as fresh fruit in local market. Variety of processed durian can be found as juice (Norjana, I. and Noor Aziah, A. A., 2011); powder (Chin et al., 2008); jam, candy, toffees, ice cream, durian wine, and milkshakes (Lim, 2012); natural bioactive compounds (Lee-Hoon Ho, Rajeev Bhat, 2015). During the durian season, there is excessive supply of the fruit which causes the price of durian drop to rather signifcantly.

Attempts therefore have been made to add value to the durian fruit. MAP is one of non-thermal processing technologies applied for tropical fruit preservation (Voon, Y.Y, 2006; Mohd. Adzahan, N. and Benchamaporn, P., 2017). In this our research, we focused on investigation of MAP packaging to improve durian shelf-life.

MATERIAL & METHOD

Material

Durian fruits (*Durio zibethinus Murr*) used in this study were obtained from a local market in Mekong delta, Vietnam. The collected semi-ripen durian fruit were gently transported to laboratory. PE tray and PVC film (20µm) were used for the research.

Research method

All durian fruitWe arranged 4 formulas, each formula having 35 trays, three replication, total trays for this research included 420. A1: Normal packing and preserving in room temperature (28^{o}C). A2: Normal packing and preserving at 5^{o}C. A3: Packing (3% O_2 and 5% CO_2) and preserving in room temperature (28^{o}C). A4: Packing (3% O_2 and 5% CO_2) and preserving at 5^{o}C.

Frequency of testing was depicted as follow: A1 and A3 (once per day); A2 and A4 (5 days per time). Each time of sampling used 9 trays: 3 trays for evaluation of respiration rate and biochemical parameter; 3 trays for sensory and 3 trays for microorganism. Three replication of each test was applicated. The fruits were dehusked (cut open the rind), by cutting along the suture on the back of the locules. Each PE tray contained 200 gram of durian pulp.

Statistical analysis

Data were statistically summarized by Microsoft Excel.

RESULT & DISCUSSION

The physical changes of durian pulp during preservation

Color :

From table 1, (L) color indicator was changed downward by preservation time. This change as a result of respiration, oxidation and evaporation leaded to darker color.

Table 1: Color change of durian fruit at room temperature preservation

Criteria	Preservation (day)	A1	A3
L	0	75.6 ± 1.1	75.6 ± 1.1
	1	71.3 ± 1,3	73.2 ± 1.5
	2	65.0 ± 1,0	67.8 ± 1,1
	3	63.4 ± 0.5	66.2 ± 0.8
a	0	4.4 ± 0.4	4.4 ± 0.4
	1	5.9 ± 0.4	5.8 ± 0.5
	2	6.8 ± 0.5	6.6 ± 0.5
	3	7.7 ± 0.4	7.2 ± 0.5
b	0	35.2 ± 0.5	35.2 ± 0.5
	1	34.1 ± 0.5	34.8 ± 0.6
	2	33.4 ± 1.3	34.3 ± 0.5
	3	30.4 ± 1.0	33.9 ± 1.2
ΔE	0	0.0	0.0
	1	4.6	3.0
	2	11.5	8.4
	3	13.4	10.3

MAP (3% O_2 and 5% CO_2) showed the L value higher than MAP (without modified atmosphere). So the air composition actively affected to bright color of durian. From table 2, we noticed the color change of durian preserved at 5°C. The L value of A2 and A4 decreased by preservation time.

Table 2: Color change of durian fruit at 5°C preservation

Criteria	Preservation (day)	A2	A4
L	0	75.6 ± 1.1	**75.6 ± 1.1**
	5	73.3 ± 1.2	**73.9 ± 0.4**
	10	71.4 ±1.1	**72.3 ± 0.9**
	15	70.0 ±1.0	**71.3 ± 0.5**
a	0	4.4 ± 0.4	**4.4 ± 0.4**
	5	5.8 ± 0.2	**5.8 ± 0.1**
	10	6.9 ± 0.3	**6.5 ± 0.2**
	15	7.4 ± 0.4	**7.3 ± 0.1**
b	0	35.2 ± 0.5	**35.2 ± 0.5**
	5	34.7 ± 0.5	**34.9± 0.3**
	10	33.4 ± 0.6	**33.6 ± 0.4**
	15	32.2 ± 0.5	**33.4 ± 0.6**
ΔE	0	0.0	**0.0**
	5	2.7	**2.2**
	10	5.6	**4.2**
	15	**7.5**	**5.4**

Keeping durian at chilling temperature (5°C) or in the modified atmosphere (3% O_2 and 5% CO_2) hindered the respiration and biochemical metabolism so we got the better color for the preserved durian.

Firmness :

Firmness was an important indication to evaluate the ripen mature and product quality. By keeping durian in modified atmosphere ((3% O_2 and 5% CO_2) together with chilling temperature (5°C), product quality was prefered.

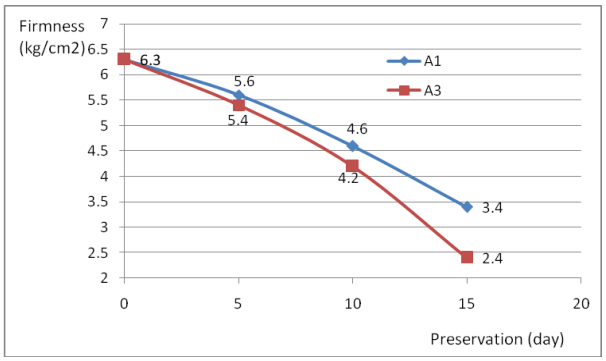

Figure 1: Firmness of preserved durian (28°C)

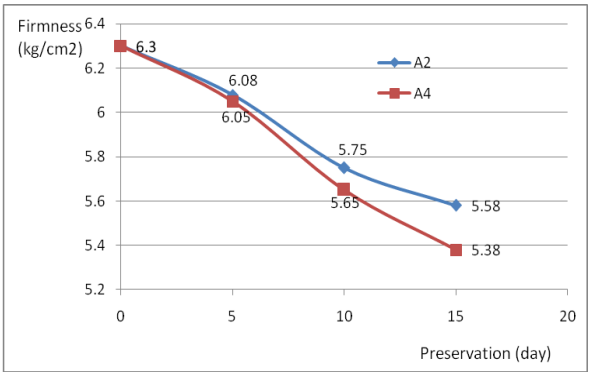

Figure 2: Firmness of preserved durian (5°C)

Effect of air composition to durian quality during preservation :

Respiration operated during preservation. It used O_2 and produced CO_2. This moved to the reduction of reserved soluble matter, sensory characteristic and shelf-life.

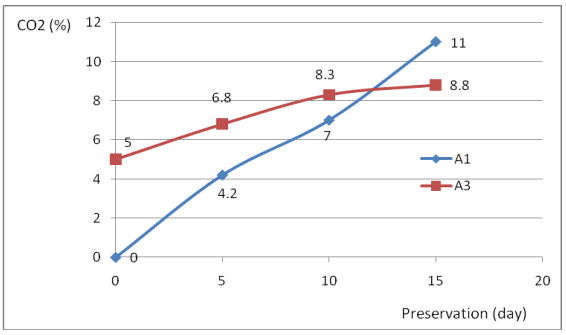

Figure 3: CO_2 of preserved durian (28ºC)

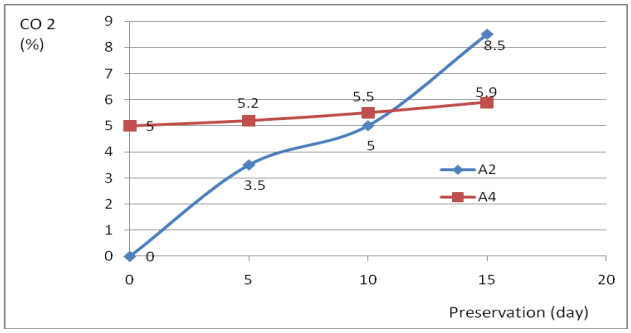

Figure 4: CO_2 of preserved durian (5ºC)

From figure 3 & 4, we realized CO2 increased by preservation time. By applying modified atmosphere (3% O_2 and 5% CO_2), the respiration rate was limited. This formula was superior to the normal atmosphere (21% O_2 and 0% CO_2). So we could conclude the chilling and MAP method actively controlled the respiration in significance.

Effect of MAP to nutrional component of durian during preservation

Total soluble substance (TSS) of durian :

From figure 5, we noticed the increasing of TSS after one day and decreasing afterwards. This could be explained by the biotransformation of starch into sugar; utilization of soluble substance for the respiration, activation of microorganism.

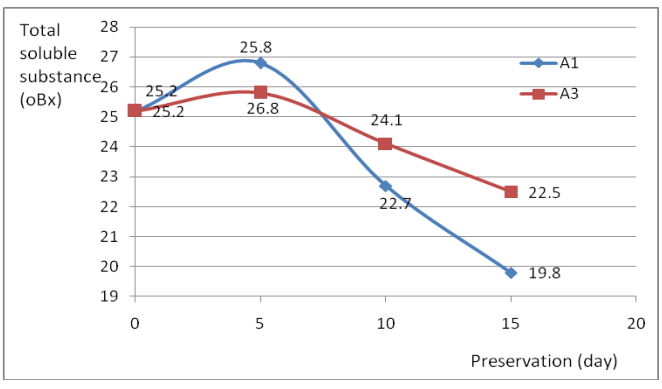

Figure 5: TSS of preserved durian (28ºC)

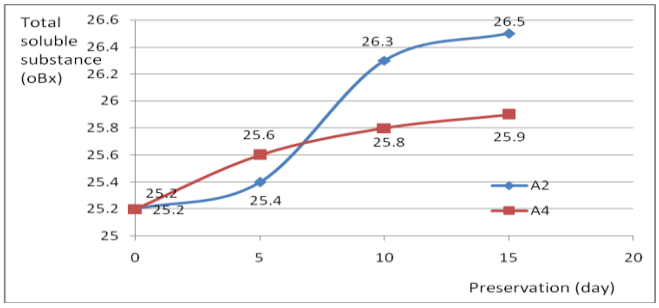

Figure 6: TSS of preserved durian (5ºC)

From figure 6, when preserving at 5ºC the TSS value increased in the first 15 days.

Total organic acidity (TOA) of durian :

From figure 7 and 8, the total organic acidity decreased by the preservation time. This was the result of respiration.

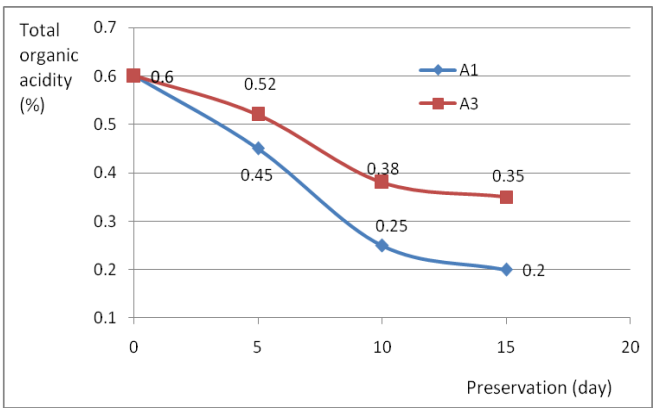

Figure 7: TOA of preserved durian (28ºC)

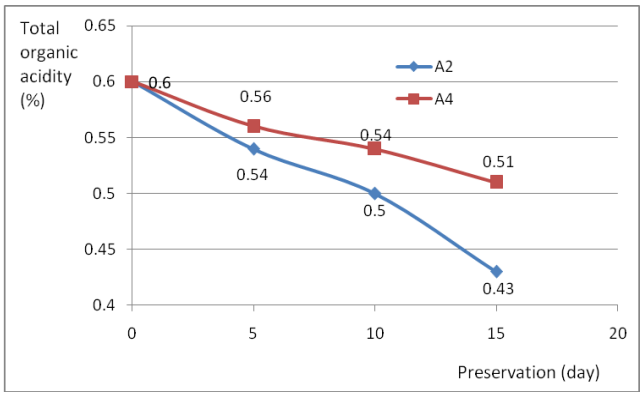

Figure 8: TOA of preserved durian (5ºC)

Keeping durian in MAP gave significant difference of TOA compared to the sample kept at normal room temperature. Air composition affected to the respiration. The TOA nearly remained as begining if MAP combined with chilling (5ºC).

Vitamin C (mg%) of durian :

Vitamin C was easily damaged by the oxidation. From figure 9 & 10, the vitamin C content decreased by the preservation time. MAP combined with chilling (5ºC) maintained the vitamin C in the first 15 days of preservation.

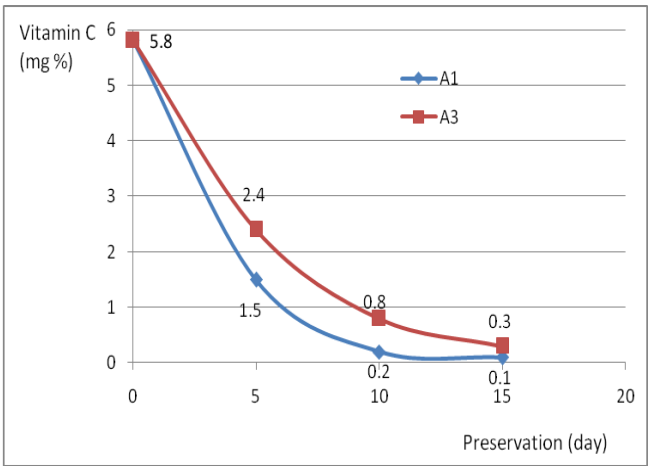

Figure 9: Vitamin C of preserved durian (28ºC)

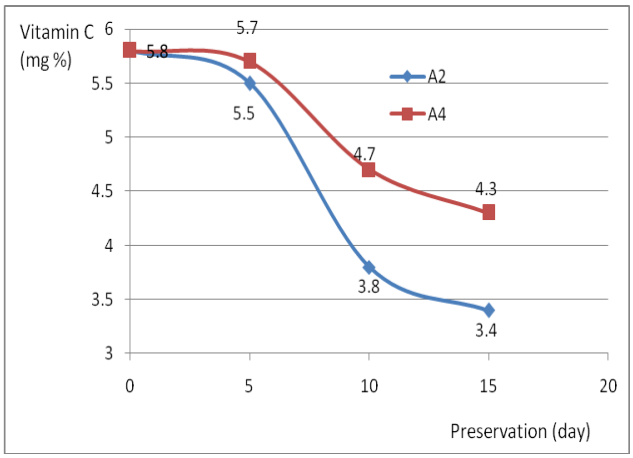

Figure10: Vitamin C of preserved durian (5ºC)

Sensory characteristics of the preserved durian

From table 3 &4, we could see the possitive effect of MAP in maintaining product quality. Temperature played an important role in keeping durian sensory appearance.

Table 3: Sensory characteristics of durian preserved by the normal temperature

Durian	Parameter	Score
Raw durian pulp	Color	**4.7**
	Flavor	**4.7**
	Firmness	**4.8**
	Taste	**4.7**
Total		**18.9**
A1 (one day)	Color	**4.3**
	Flavor	**3.7**
	Firmness	**3.7**
	Taste	**3.8**
Total		**15.5**
A1 (two days)	Color	**3.5**
	Flavor	**3.1**
	Firmness	**3.3**
	Taste	**3.3**
Total		**13.2**
A1 (three days)	Color	**2.9**
	Flavor	**2.5**
	Firmness	**2.3**
	Taste	**2.3**
Total		**10.0**
A3 (one day)	Color	**4.3**
	Flavor	**3.7**
	Firmness	**3.9**
	Taste	**4.1**
Total		**16.0**
A3 (two days)	Color	**3.7**
	Flavor	**3.3**
	Firmness	**3.5**
	Taste	**3.9**
Total		**14.4**
A3 (three days)	Color	**3.3**
	Flavor	**2.7**
	Firmness	**3.2**
	Taste	**2.9**
Total		**12.1**

Table 4: Sensory characteristics of durian preserved by 5°C

Durian	Parameter	Score
A2 (5 days)	Color	**4.3**
	Flavor	**4.1**
	Firmness	**4.1**
	Taste	**4.3**
Total		**16.8**
A2 (10 days)	Color	**4.2**
	Flavor	**3.4**
	Firmness	**4.2**
	Taste	**4.1**
Total		**15.9**
A2 (15 days)	Color	**3.7**
	Flavor	**3.7**
	Firmness	**3.7**
	Taste	**3.9**
Total		**15.0**
A4 (5 days)	Color	**4.2**
	Flavor	**4.3**
	Firmness	**4.6**
	Taste	**4.7**
Total		**17.8**
A4 (10 days)	Color	**4.3**
	Flavor	**3.7**
	Firmness	**4.3**
	Taste	**4.7**
Total		**17.0**
A4(15 days)	Color	**4.1**
	Flavor	**3.8**
	Firmness	**4.1**
	Taste	**4.3**
Total		**16.3**

Microorganism in the preserved durian

Durian pulp was highly sensitive to microorganism. Monitoring the microbial load on durian preserved in normal room temperature and chilling combined with MAP, we clearly noticed the difference.

Table 5: TPC, yeast, mold (cfu/g) on the preserved durian pulp at room temperature

Parameter	Preservation (day)	A1	A3
TPC (cfu/g)	0	2.4×10^2	2.4×10^2
	1	3.5×10^4	1.3×10^3
	2	4.9×10^6	1.4×10^5
Yeast, mold (cfu/g)	0	<10	<10
	1	1.6×10^2	0.7×10^2
	2	3.3×10^4	1.1×10^4

Table 6: TPC, yeast, mold (cfu/g) on the preserved durian pulp at 5°C temperature

Parameter	Preservation (day)	A2	A4
TPC (cfu/g)	0	2.4×10^2	2.4×10^2
	5	3.8×10^2	3.3×10^2
	10	3.6×10^3	1.6×10^3
	15	1.4×10^4	3.8×10^3
Yeast, mold (cfu/g)	0	<10	<10
	5	2.3×10^2	5.1×10
	10	1.2×10^3	2.2×10^2
	15	3.3×10^3	1.9×10^3

From table 5 & 6, we noticed the chilling temperature combined with MAP had positive effect on prevention of microbial proliferation. Durian pulp could be preserved by MAP at 5°C in 15 days.

CONCLUSION

Durian is rich in carbohydrate, protein, fat, phosphorus, iron and vitamin A. Durian is usually used for fresh consumption. As durian fruit supply is highly restricted in the market owing to its low shelf life, the fruit needs to be consumed or processed within a limited time frame. MAP combined with chilling could be considered as a new approach for enhancing durian added value.

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