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Application of Alginate Film for Soursop Fruit Preservation

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Abstract

Soursop is an abundant and nutritive fruit, and, currently, it has been considered a medicinal plant. It has a fragrant sweet-sour white pulp and many dark seeds. There is growing demand for soursop fruit, whose sensorial qualities allow its use for fresh consumption. We conducted one research to prolong the shelf-life of soursop fresh fruit by alginate film coating on its surface. Our results showed that alginate contributed significantly different effects to weight loss, firmness, color, chlorophyl, total acidity and vitamin C content. After 30 days of preservation at 1.5% alginate, weight loss was noticed at the lowest level 2.74% compared to samples treated with 1% and 2% alginate. Moreover at 1.5% alginate, the treated soursop had discoloration in minimum. Firmness of treated fruit remained 5.59 (kg/cm^2) after 30 days of preservation, better than samples treated at 1% and 2% alginate. Biochemical characteristics of 1.5% treated sample showed the highest content, notably with the total soluble matter (7.39%), total organic acidity (5.07%) and vitamin C (17.16mg%). This demonstration gave us a promising aspect to extend fresh soursop shelf-life.

Keywords: Soursop, preservation, alginate, coating, shelf life

INTRODUCTION

Like most tropical fruits, the soursop has a great potential for exportation and it is able to compete in the international market. It's popular fruit of tropical regions and prized for its very pleasant, sub-acid, aromatic, juicy flesh and distinctive flavor. When ripe, pulp is creamy, very sweet and pleasantly flavored. However, this fruit soften very rapidly during ripening and become difficult to consume fresh. It's commonly rejected at market because of external injury or uneven shape and size. Therefore, extension of its fruit shelf life is very urgent so that we can improve income for local people in rural area of Mekong delta, Vietnam. There were many studies mentioned to diversify its products into the value added one such as power (Janaina de Paula da Costa et al., 2014), juice (Emmanuel S. Abbo et al., 2006), nectar (M. Anaya-Esparza et al., 2017), yaourt (P.G. Imanthika Dias, M.C. Niroshan Jayasooriya, 2017), ice cream (Nabilah Ab Hamid, 2013), wine (Nguyen Phuoc Minh, 2015).

After harvesting, soursop fruit quickly degraded owing to respiration, ethylen production. Postharvest disorders of soursop fruit were succeptable to browning catalyzed by PPO affecting its sensory and nutritional qualities (Bora, Holschuh, and da Silva Vasconcelos (2004); fruit splitting, which occurs frequently, reduces marketable yield and quality and increases disease attack (George et al., 1987); chilling injury (Gutierrez, Sola, Pascual, Rodriguez-Garcia, & Vargas, 1992). There were many methods used to prolong its shelf life such as low temperature storage (Vishnu Prasanna et al., 2000), modified and controlled atmosphere (Asis et al., 2001; Maldonado et al., 2002), 1-methylcyclopropene (Benassi, Correa, Kluge, & Jacomino, 2003; Cristina L. Moreno-Hernández et al., 2014), waxing (Yonemoto et al., 2002), calcium treatment (Lima, 2000; Torres, Silva, Guaglianoni, & Neves, 2009), salicylic acid (Mo et al., 2008), packaging (Yamashita, Miglioranza, Miranda, & Souza, 2002).

In this our research, we focused on application of alginate film for waxing soursop fruit to extend fruit shelf life.

MATERIAL & METHOD

Material

We collected fresh soursop fruit in gardens of Mekong delta, Vietnam. Soursop fruit was collected while its peel in green smooth color. We used sharp knife to cut and collect soursop fruit so as to preventing damage. Soursop fruit was arranged individually one by one in basket before transporting to laboratory for experiment.

Research method

Research content

We examined different alginate concentration at 1%, 1.5%, 2% to verify physical (color, weight, firmness) and biochemical (total soluble dry matter, vitamin C, total organic acidity, chlorophyll) transformation of soursop fruit during preservation.

Research experiment

We randomly arranged samples in different formulas: AG1 (1% alginate), AG2 (1.5% alginate), AG3 (2% alginate). Time of treatment was 2 minutes and then naturally drying, holed PE packing. Samples were periodically tested 10 days/ time. Each formula had 3 bags, each bag contained 3 soursop fruits.

All samples were measured the physical criteria (physical (color, weight, firmness) and biochemical (total soluble dry matter, vitamin C, total organic acidity, chlorophyll).

Statistical analysis

Data were statistically summarized by Microsoft Excel and ANOVA.

RESULT & DISCUSSION

Effect of alginate concentration in waxing to physical variation of soursop preservation

Effect of alginate concentration in waxing to the natural weight loss of the preserved soursop:

We examined different alginate concentration in waxing of soursop. The result of natural weight loss of the preserved soursop was follow:

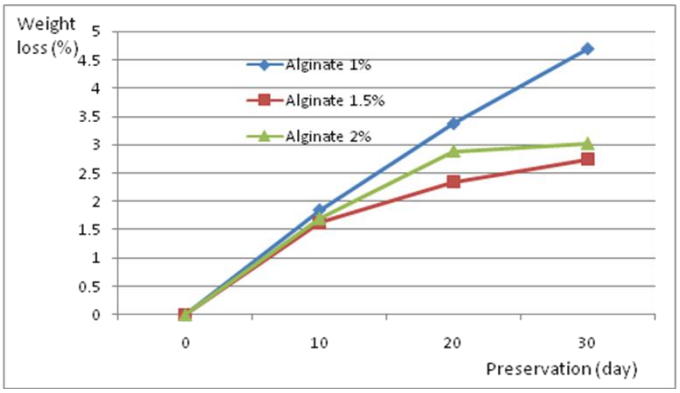

Figure 1: Weight loss of waxed soursop after preservation

We noticed that after 30 days of preservation, the treated sample with 1.5% alginate showed the minimum weight loss. So the waxing alginate film had positive effect to respiration and moisture evaporation

Effect of alginate concentration in waxing to the firmness of the preserved soursop

We examined different alginate concentration in waxing of soursop. The result of firmness of the preserved soursop was follow:

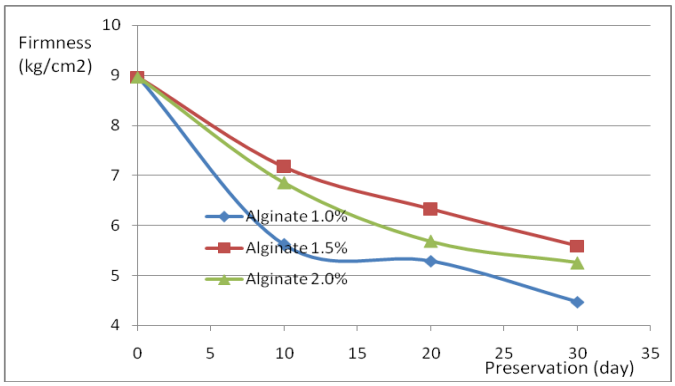

Figure 2: Firmness of waxed soursop after preservation

At beginning of preservation, soursop firmness was recorded at 8.96 (kg/cm^2). However, this indicator reduced to 4.47kg/cm^2 (AG1); 5.59kg/cm^2 (AG2) and 5.25 kg/cm^2 (AG3). This phenomenon could be expressed by respiration. During this period, protopectin was hydrolized by protopectinase and polygalacturonase, so soursop's firmness degraded dramatically. The treated soursop by 1.5% alginate showed the highest firmness. This result was paralel with weight loss experiment.

Effect of alginate concentration in waxing to the discoloration of the preserved soursop

We examined different alginate concentration in waxing of soursop. The result of soursop discoloration of the preserved soursop was elaborated by L-a-b indicator.

Discoloration regarding to L value :

L value ranged from 0 to 10 depicted the color intensity. The discoloration of preserved soursop by L value was illustrated below.

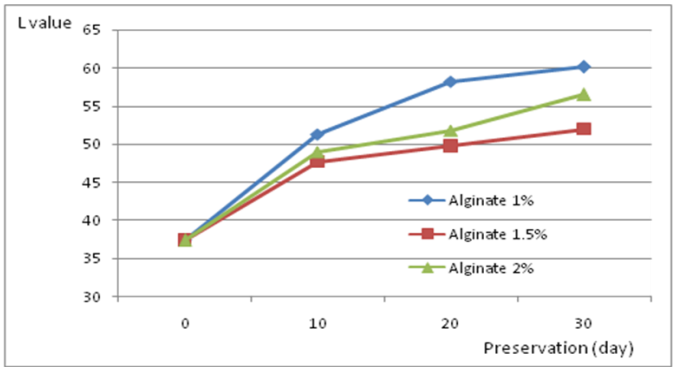

Figure 3: L value of waxed soursop after preservation

L value of soursop before preservation was 37.40. Howver this value increased to 55.88 (AG1), 49.77 (AG2) and 52.35 (AG3) after 30 days of preservation towards yellow color. In

respect of discoloration, AG2 (algiante 1.5%) gave us the minimum color change.

Discoloration regarding to a value :

The a value expressed discoloration from green to red. Monitoring the a value change, we noted as follow:

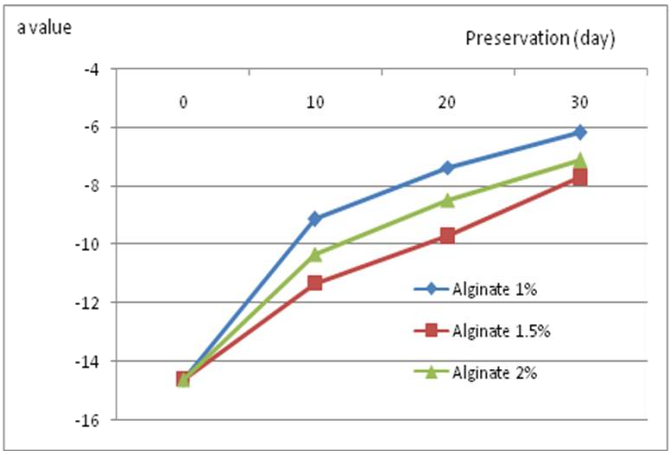

Figure 4: A value of waxed soursop after preservation

At begining of preservation, a value of waxed soursop was -14.62. However, this result increased to -6.18 (AG1); -7.44 (AG2) and -7.14 (AG3). This phenomenon was very important during preservation. Samples treated with 1.5% alginate showed the lowest a value compared to other two formulas.

Discoloration regarding to b value:

The a value expressed discoloration from blue to yellow. Monitoring the b value change, we noted as follow:

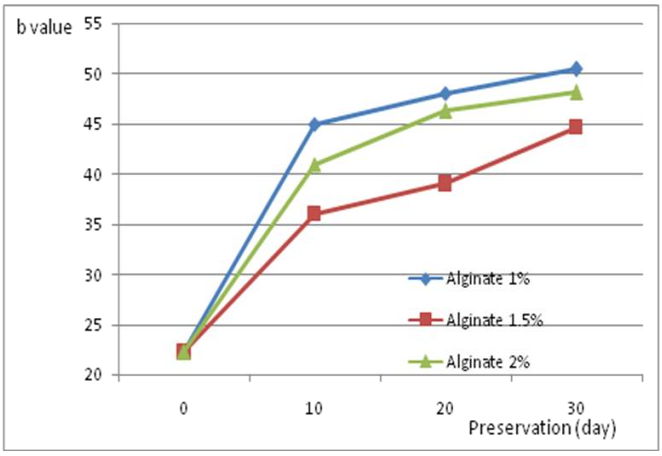

Figure 5: b Value of waxed soursop after preservation

At begining of preservation, b value of waxed soursop was 22.26. However, this result increased to 50.42 (AG1); 44.64 (AG2) and 48.13 (AG3). Samples treated with 1.5% alginate showed the lowest b value compared to other two formulas.

Effect of alginate concentration in waxing to biochemical variation of soursop preservation

Effect of alginate concentration in waxing to chlorophyll content during soursop preservation

Chlorophyll was a natural pigment constructed to soursop quality. Apart from measuring color, we also examined chlorophyl content during soursop preservation.

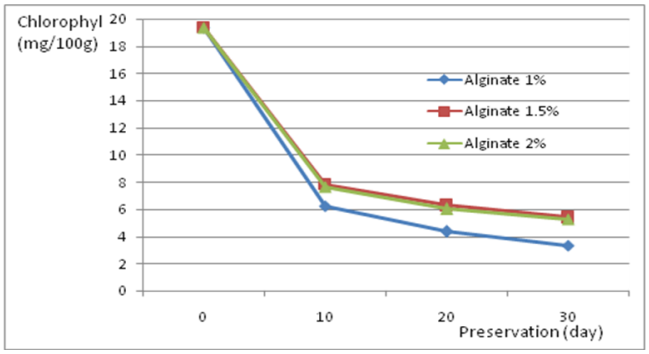

Figure 6: Chlorophyll content of waxed soursop after preservation

From figure 6, chlorophyl decreased day by day. In the first 20 days, we didn't see clearly this difference. However until 30 days, this degradation was notably recorded. Among three formulas, the samples treated by 1.5% alginate showed the highest chlorophyl content.

Effect of alginate concentration in waxing to the toltal soluble dry matter content during soursop preservation

Total soluble dry matter was an important indicator to estimate the soursop quality. So we monitored the total soluble dry matter in waxed soursop fruit by different treatments.

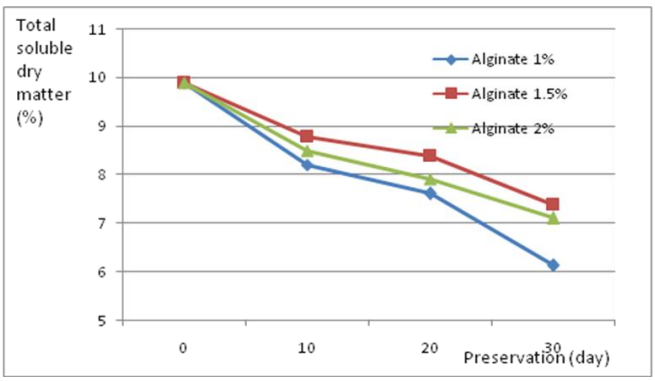

Figure 7: Total soluble dry matter of waxed soursop after preservation

Before preservation, the total sluble dry matter in waxed soursop noted at 9.90%. After 30 days of preservation, this content reduced to 6.13 (AG1), 7.39 (AG2) and 7.11 (AG3). The respiration process utilized soluble dry matter for the metabolism. The highest total soluble dry matter was marked at samples treated by 1.5% alginate.

Effect of alginate concentration in waxing to the total organic acidity during soursop preservation

Acidity significantly contributed to shelf-life of fruit. We examined the total organic acidity of waxed soursop by three treatments.

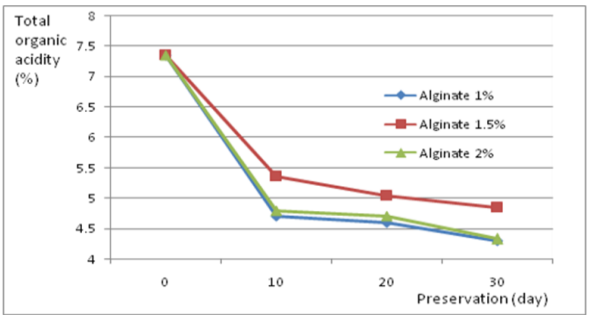

Figure 8: Total organic acidity of waxed soursop after preservati**on**

In the first 10 days, the total organic acidity decreased dramtically, but slowly from 20 to 30 days. At the begining, the total oragnic acidity in raw waxed soursop was 7.35%. After 30 days, its content deducted to 4.71% (AG1); 5.36% (AG2); 4.79% (AG3). This reduction was owing to respiration. Organic acidity was mobilzed for the decabolylation. The highest organic acidity was realized by the sample treated by 1.5% alginate.

Effect of alginate concentration in waxing to vitamin C during soursop preservation

Vitamin C was considered as an important indicator of fruit quality so we monitored vitamin C content in the waxed soursop during preservation.

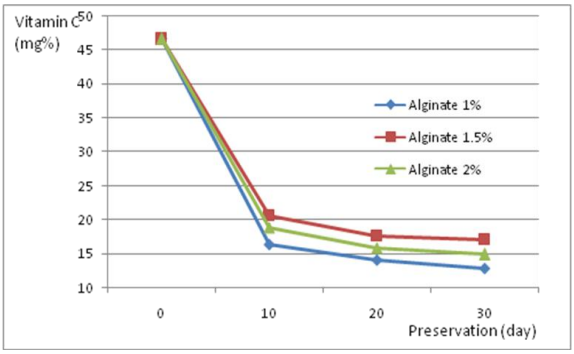

Figure 9: Vitamin C of waxed soursop after preservation

As long as of preservation, vitamin C degraded day by day. Its content in raw material was analyzed at 46.39 mg%. However after 30 days of preservation, this content reduced to 12.86 mg% (AG1); 17.16 mg% (AG2) and 14.90 mg% (AG3). Vitamin C was sentively degradable by oxidation with the presence of ascorbinase. So waxing had a great contribution to vitamin C defense.

CONCLUSION

We successfully studied several factors affecting to soursop shelf life by waxing with alginate. This substance proved effectiveness in its preservation. By applying 1.5% alginate, we could see soursop quality in acceptable remains. This application gave us a significant approach to increase fresh soursop shelf-life. From this research, we improved fresh soursop quality during transporation to consumer. A great contribution to increase agricultural income for horticulturers in rural area of Mekong delta, Vietnam would be highly appreciated.

REFERENCE

[1] Asis, J. S., Maldonado, R., Muñoz, T., Escribano, M. I., & Merodio, C., Effect of high carbon dioxide concentration on PAL activity and phenolic contents in ripening cherimoya fruit. *Postharvest Biology and Technology 23*: 33-39 (2001).

[2] Benassi, G., Correa, G. A. S. F., Kluge, R. A., & Jacomino, A. P., Shelf life of custard apple treated with 1-methylcyclopropene — An antagonist to the ethylene action. *Brazilian Archives of Biology and Technology* 46: 115-119 (2003).

[3] Bora, P. S., Holschuh, H. J., & da Silva Vasconcelos, M. A., Characterization of polyphenol oxidase of soursop (*Annona muricata* L.) fruit and a comparative study of its inhibition in enzyme extract and in pulp. *Ciencia Tecnology Alimenterius 4*: 267-273 (2004).

[4] Cristina L. Moreno-Hernández, Sonia G. Sáyago-Ayerdi, Hugo S. García-Galindo, Miguel Mata-Montes De Oca, and Efigenia Montalvo-González. *Hindawi Publishing Corporation The Scientific World Journal* 1(1): 1-7 (2014).

[5] Emmanuel S. Abbo, Taiwo O. Olurin and Grace Odeyemi, Studies on the storage stability of soursop (Annona muricata L.) juice. *African Journal of Biotechnology* 5(19): 1808-1812 (2006)

[6] George, A. P., Nissen, R. J., & Brown, B. I., The custard apple. *Queensland Agricultural Journal 113*: 287-297 (1987).

[7] Janaina de Paula da Costa, Érica Milô de Freitas Felipe Rocha, José Maria Correia da Costa, Study of the

physicochemical characteristics of soursop powder obtained by spray-drying. *Food Sci. Technol, Campinas* 34(4): 663-666 (2014).

[8] Lima, C. L. C., *Uso de ceras e do calico, associados ou nao, na conservacao poscolheita de frutos da pinheira (Annona squamosa L.) armazenados ao ambiente ou sob refrigeracao. Tese. (Duotorado em Energia na agricultura)* (pp. 119). Botucatu: Faculdade de Ciencias Agronomicas, Universidade Estadual Paulista (2000).

[9] Luis M. Anaya-Esparza, Rita M. Velazquez-Estrada, Sonia G. Sayago-Ayerdi, Jorge A. Sanchez-Burgos, Marco Vinicio Ramírez-Mares, María de Lourdes García-Magana, Efigenia Montalvo-Gonzalez, Effect of thermosonication on polyphenol oxidase inactivation and quality parameters of soursop nectar. *Food Science and Technology* 75 (1): 545-551 (2017).

[10] Maldonado, R., Molina-Garcia, A. D., Sanchez-Ballesta, M. T., Escribano, M. I., & Merodio, C., High CO2 atmosphere modulating the phenolic response associated with cell adhesion and hardening of *Annona cherimola* fruit stored at chilling temperature. *Journal of Agricultural and Food Chemistry 50*: 7564-7569 (2002).

[11] Mo, Y., Gong, D., Liang, G., Han, R., Xie, J., & Li, W., Enhanced preservation effects of sugar apple fruits by salicylic acid treatment during postharvest storage. *Journal of the Science of Food and Agriculture* 88(15): 2693-2699 (2008).

[12] Nguyen Phuoc Minh, Production of fermented beverage from soursop fruit. *Bulletin of Environment, Pharmacology and Life Sciences* 4(7): 95-100 (2015).

[13] Nabilah Ab Hamid, *Product development of soursop (Annona muricata L.) ice cream mixed with soymilk.* Universiti Malaysia Sabah 2013.

[14] P.G. Imanthika Dias, M.C. Niroshan Jayasooriya, Enhancing the Physiochemical and Antioxidant Properties of Stirred Yoghurt by Incorporating Soursop (*Annona Muricata*). *International Journal of Life Sciences Research* 5(1): 69-77 (2017).

[15] Torres, L. M. A. R., Silva, M. A., Guaglianoni, D. G., & Neves, V. A., Effects of heat treatment and calcium on postharvest storage of atemoya fruits. *Alimentos e Nutrição, Araraquara 20*(3): 359-367 (2009).

[16] Vishnu Prasanna, K. N., Sudhakar Rao, D. V., & Krishnamurthy, S., Effect of storage temperature on ripening and quality of custard apple (Annona squamosa L.) fruits. *Journal of Horticultural Science and Biotechnology 75*: 546-550 (2000).

[17] Yamashita, F., Miglioranza, L. H. D. S., Miranda, L. D. A., & Souza, C. M. D. A. E., Effects of packaging and temperature on postharvest of atemoya. *Revista Brasileira*
Fruticultura 24: 658-660 (2002).

[18] Yonemoto, Y., Higuchi, H., & Kitano, Y., Effects of storage temperature and wax coating on ethylene production, respiration and shelf life in cherimoya fruit. *Journal of Japanese Society of Horticultural Science 71*: 643-650 (2002).