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# Effect of *Aloe Vera* coating and storage temperature on quality of Burmese Grape (*Baccaurea sapida*) fruit during storage

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Burmese grape (*Baccaurea sapida*) is a fruit with thick dark green peel, inside opaque and grained white flesh. When eaten, the first feeling after the smooth crust is the sweet and sour juicy taste attracting many people. The ripen fruit become sweetened, soft, water-filled. It's well-known as folk medicine for different therapeutic purposes. However it is highly perishable under ambient storage condition due to its high moisture content. Numerous Burmese grape fruits decay in the farmland in harvesting season. It's urgent to have suitable strategy to extend its shelf life in sales. We attempted to demonstrate the effect of Aloe Vera coating and storage temperature on the physicochemical and sensory characteristics of Burmese grape (*Baccaurea sapida*). Our results showed that Burmese grape (*Baccaurea sapida*) fruit coated by 3.0% Aloe Vera and kept under temperature 15$^{o}$C had acceptable overall acceptance for 7 days of storage. Aloe Vera and temperature had significantly affected to physicochemical and sensory attributes of Burmese grape (*Baccaurea sapida*) fruit.

**Keywords: Burmese grape, aloe vera, coating, temperature, physicochemical, organoleptic**

## INTRODUCTION

Burmese grape *(Baccaurea sapida)* is an underexploited fruit with a mild acidic taste and mainly consumed as fresh fruit (Prahlad and Nilesh, 2013). The berry fruit is oval to round in shape and turns yellow or yellowish brown in ripen condition with edible aril portion covered by leathery rind (Minh et al., 2019). It could be considered as novel fruit due to high content of vitamins, phenols, flavonoids, and proanthocyanidins with potential health benefits (Hasan et al., 2009; Goyal et al., 2013). Aloe vera is well-known as its marvelous phytochemical attributes. This gel is tasteless, colorless and odorless (Jawadul et al., 2014).

Aloe vera coating is an effective post-harvest technology applied to preserve fruit quality (Tripathi et al., 2004). Aloe Vera gel creates biodegradable films serving antimicrobial mechanism (Misir et al., 2014). It forms a barrier to oxygen and moisture, retard oxidation and respiration, minimize weight loss and maturation. Aloe Vera edible coating was successfully implemented on various kinds of fruit such as cherry, peach, berry, plum, strawberry, grape, pomegranate, mango etc (Serrano et al., 2006; Guillén et al., 2013; Castillo et al., 2010; Del-Valle et al., 2005; Yaman and Bayoindirli et al., 2002; Tamiru, 2018). Not many literatures mentioned to the preservation of burmese grape. Therefore, we attempted to demonstrate the effect of Aloe vera coating and storage temperature on the physicochemical and organoleptic properties of burmese grape (*Baccaurea sapida*) during storage.

## MATERIALS AND METHODS

**Material**

Burmese grape (*Baccaurea sapida*) fruits were harvested at maturity stage in Hau Giang province, Vietnam. After collecting, they must be kept in dry place and quickly conveyed to laboratory for experiments. They were classified in uniform and subjected to edible coating and preservation. Other materials, standards and reagents such as Folin-Ciocalteu reagent, $Na_2CO_3$, gallic acid, $Al(NO_3)_3$, potassium acetate, DPPH, methanol, ethanol, acetate buffer, 2,4,6-tripyridyl-s-triazine, HCl , $FeCl_3.6H_2O$, 2, 6-dichlorophenol indophenol were analytical grade and purchased from Rainbow trading Co. Ltd.Lab utensils and equipments included weight balance, texture analyzer, spectrophotometer

**Researching method**

Fresh Aloe Vera leaf was cut transversely to extract out the hydroparenchyma. The hydroparenchyma was filtered properly to remove foreign matters. The consistent mucus obtained was the fresh Aloe Vera gel. The obtained matrix was subjected to heat at 65$^o$C for 30 minutes. Then the gel was cooled at ambient temperature before coating (Arghya Mani et al., 2018). Burmese grape fruits were coated by Aloe Vera gel in different ratio (1.5, 2.0, 2.5, 3.0, 3.5%). The treated samples were drained for 3 minutes and dried at ambient temperature for 15 minutes. The coated fruits were stored in different temperatures (25, 20, 15, 10, 5$^o$C) for 7 days. At the end of preservation period, they were sampled to estimate weight loss (%), firmness (N), ascorbic acid (mg/100g), total soluble solid ($^o$Brix), total phenolic (mg GAE/ 100g), flavonoid (mg QE/ 100g), sensory score

**Physicochemical, sensory and statistical analysis**

The difference between the initial and final weight of Burmese grape was calculated as weight loss (%). Firmness (N) was calculated by texture analyzer. Ascorbic acid (mg/100g) was determined by using titrimetric method with the titration of filtrate against 2, 6- dichlorophenol indophenol. Total soluble solid ($^o$Brix) was determined by hand-held refractometer. Total phenolic content (mg GAE/100g) was evaluated using Folin–Ciocalteu assay (Nizar et al., 2014). Total flavonoid content (mg QE/100g) was avaluated by the aluminium calorimetric method (Formagio et al., 2015).Sensory score was based on 9-point Hedonic scale. The experiments were run in triplicate with three different lots of samples. Statistical analysis was performed by the Statgraphics Centurion XVI.

**RESULTSAND DISCUSSION**

**Effect of Aloe vera coating on physicochemical and sensory characteristics of burmese grape during storage**

Aloe vera gel was demonstrated to be effective in minimizing fruit respiration as a barrier to moisture and oxygen, slowing dehydration (Ramirez et al., 2013). Aloe vera was proven to effectively improve the physicochemical, antioxidant capacity and stability of fruits like papaya, grape, zapote, cherry, apple, kiwi, strawberry, blueberry (Mendy et al., 2019; Martínez-Romero et al. 2006; Chauhan et al., 2011; Benítez et al., 2015; Vieira et al., 2016; Khaliq et al., 2019; Qamar et al., 2018). In our reseach, we examined different Aloe vera concentration (1.5, 2.0, 2.5, 3.0, 3.5%). Our results revealed that Burmese grape fruits should be coated by 3.0% Aloe Vera to achieve the best physicochemical and sensory characteristics (table 1). Positive effect in reduction of weight loss may be due to the hygroscopic characteristics of Aloe Vera gel composed of polysaccharide that permit the formation of moisture barrier between the Burmese grape and the external environment (Morillon et al., 2002; Ni et al., 2004). Aloe Vera coating has been proved to maintain the texture of fruit efficiently. This may be due to the effect of Aloe vera gel on the reduction of galactosidase, polygalacturonase, and pectinmethyl-esterase activities (Nunan et al., 1998). In another report, Aloe Vera gel (100%) has been used to store papaya fruit at ambient temperature. A gradual loss of weight during storage was observed (Brishti et al., 2013). Ascorbic acid content for coated orange by aloe Vera was found to be higher than that of uncoated one (Arowora et al., 2013). A similar finding was noted in Aloe gel coated nectarine (Ahmed et al., 2009). It was due to low oxygen permeability of coating which limited the deteriorative oxidation reaction of ascorbic acid content. Aloe vera gel with citric acid coating could extend the postharvest shelf life and maintaining quality of mango fruit for 29 days (Tamiru, 2018). Gaur gum blended with aloe Vera could retain post-harvest quality of ber for 15 days (Arghya Mani et al., 2018).

**Table 1; Effect of Aloe Vera coating on physicochemical and sensory characteristics of Burmese grape during 7 days of storage at ambient temperature**

| Aloe Vera concentration (%) | Control | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 |
|---|---|---|---|---|---|---|
| **Weight loss (%)** | 11.29 ±0.00$^{a}$ | 3.10 ±0.03$^{b}$ | 3.01 ±0.00$^{bc}$ | 2.83 ±0.01$^{c}$ | 2.67 ±0.02$^{cd}$ | 2.50 ±0.03$^{d}$ |
| **Firmness (N)** | 7.16 ±0.02$^{d}$ | 9.34 ±0.01$^{c}$ | 9.56 ±0.03$^{bc}$ | 9.85 ±0.00$^{b}$ | 9.97 ±0.01$^{ab}$ | 10.09 ±0.00$^{a}$ |
| **Total soluble solid (ºBrix)** | 16.31 ±0.03$^{d}$ | 19.12 ±0.00$^{c}$ | 19.43 ±0.01$^{bc}$ | 19.67 ±0.02$^{b}$ | 19.86 ±0.00$^{ab}$ | 19.97 ±0.01$^{a}$ |
| **Ascorbic acid (mg/100g)** | 36.75 ±0.01$^{d}$ | 40.58 ±0.03$^{c}$ | 40.87 ±0.02$^{bc}$ | 41.03 ±0.00$^{b}$ | 41.47 ±0.03$^{ab}$ | 41.86 ±0.02$^{a}$ |
| **Total phenolic (mg GAE/100g)** | 45.18 ±0.00$^{d}$ | 47.63 ±0.02$^{c}$ | 47.77 ±0.03$^{bc}$ | 47.98 ±0.01$^{b}$ | 48.11 ±0.02$^{ab}$ | 48.32 ±0.00$^{a}$ |
| **Flavonoid (mg QE/100g)** | 14.23 ±0.02$^{c}$ | 16.08 ±0.01$^{b}$ | 16.24 ±0.00$^{ab}$ | 16.38 ±0.03$^{ab}$ | 16.47 ±0.01$^{a}$ | 16.50 ±0.02$^{a}$ |
| **Sensory score** | 5.13 ±0.01$^{c}$ | 6.74 ±0.00$^{b}$ | 6.80 ±0.02$^{ab}$ | 6.87 ±0.03$^{a}$ | 6.90 ±0.00$^{a}$ | 6.91 ±0.01$^{a}$ |

Note: the values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant (α = 5%).

**Table 2: Stability of Burmese grape coated by 3.0% Aloe vera by different storage temperature (ºC) in 7 days of preservation**

| Storage temperature (ºC) | 25 | 20 | 15 | 10 | 5 |
|---|---|---|---|---|---|
| Weight loss (%) | 2.67 ±0.02$^{a}$ | 2.43 ±0.03$^{b}$ | 2.16 ±0.02$^{c}$ | 2.30 ±0.01$^{bc}$ | 2.53 ±0.02$^{ab}$ |
| Firmness (N) | 9.97 ±0.01$^{c}$ | 10.36 ±0.00$^{b}$ | 10.74 ±0.01$^{a}$ | 10.53 ±0.03$^{ab}$ | 10.11 ±0.01$^{bc}$ |
| Total soluble solid (ºBrix) | 19.86 ±0.00$^{c}$ | 20.25 ±0.01$^{b}$ | 20.58 ±0.00$^{a}$ | 20.31 ±0.00$^{ab}$ | 20.07 ±0.02$^{bc}$ |
| Ascorbic acid (mg/100g) | 41.47 ±0.03$^{c}$ | 41.98 ±0.02$^{b}$ | 42.75 ±0.00$^{a}$ | 42.30 ±0.02$^{ab}$ | 41.72 ±0.00$^{bc}$ |
| Total phenolic (mg GAE/100g) | 48.11 ±0.02$^{c}$ | 49.76 ±0.00$^{b}$ | 50.69 ±0.03$^{a}$ | 50.04 ±0.03$^{ab}$ | 49.50 ±0.01$^{bc}$ |
| Flavonoid (mg QE/100g) | 16.47 ±0.01$^{c}$ | 16.82 ±0.01$^{b}$ | 17.13 ±0.02$^{a}$ | 17.01 ±0.01$^{ab}$ | 16.61 ±0.03$^{bc}$ |
| Sensory score | 6.90 ±0.00$^{c}$ | 7.85 ±0.03$^{b}$ | 8.16 ±0.01$^{a}$ | 8.02 ±0.02$^{ab}$ | 7.34 ±0.00$^{bc}$ |

Note: the values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant (α = 5%).

### 3.2 Stability of burmese grape coated by Aloe vera under storage temperature

Texture firmness of fruit is a major determinant for customer preference (Alica Bobková et al., 2016). Fruit softening is due to deterioration in the cell structure, the cell wall composition and the intracellular materials (Lazan and Ali, 1993). It's mainly due to synergistic action of hydrolytic enzymes such as polygalacturonase, pectinase, β-Galactosidase, pectate lyase and cellulase. Retention of firmness can be explained by retarded degradation of components responsible for the structural rigidity of the fruit, primarily the insoluble pectin and proto-pectin. During fruit ripening, depolymerization or shortening of pectin and other pectic substances occurs with an increase in pectinesterase and poly-galacutronase activities. Fruit weight loss is strongly correlated to respiration and moisture evaporation (Atress et al., 2010). It is mostly depended on the water pressure gradient between the fruit tissue and the surrounding atmosphere, and the storage temperature (Rayees et al., 2013). Dehydration will speed up tissue damage. Physical degradation like texture firmness and weight losses led to further chemical

damages like total solid, ascorbic acid, total phenolic, flavonoid as well as declined overall acceptance. Appropriate temperature could delay produce deterioration, depress physiological activity of tissues and activity of spoilage microorganisms (Nunes et al. 2009). In this experiment, we demonstrated to store burmese grape in different temperature (25, 20, 15, 10, 5$^{o}$C) for 7 days. Our result showed that 15$^{o}$C was suitable to extend the physicochemical and sensory characteristics of burmese grape fruits for 7 days without any chilling injury (table 2). Our results were similar to one report. Burmese grape is a non-climacteric fruit. The best storage temperature was 15°C with 21 days of storage life. At this temperature, the fruit had little weight loss but the peel turned brown, the fruit rotten, and there was high level of fruit drop (Narachai et al., 2016).

## CONCLUSION

Burmese grape (*Baccaurea sapida*) is a favorable fruit with unique texture and aroma as well as nutritional constituents, biologically active elements like polyphenols, flavonoids, vitamins, minerals with numberous therapeutic benefits. It is highly decomposed due to high moisture content. Aloe vera coating has been demonstrated as one of the optimal edible and versartile preservative method due to its film-forming ability, antimicrobial mechanism, biodegradability and biochemical capability. Our findings demonstrated that Aloe vera coating 3.0% under temperature 15$^{o}$C could maintain the physicochemical and overall acceptance for 7 days. It's very important to improve the shelf-life of burmese grape fruit during commercial distribution.

## CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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## AUTHOR CONTRIBUTIONS

Minh Phuoc Nguyen arranged the experiments and also wrote the manuscript.



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