

ROLE OF ALOE VERA GEL COATINGS IN PROLONGING SHELF LIFE OF BANANA

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Abstract: The present study was carried out to evaluate the ability of *Aloe vera* gel based herbal coatings to reduce the loss of post harvest fruit quality in banana. Unripe green banana fruits were coated with different formulations of Aloevera gel. The coated and uncoated fruits were stored at 25°C in polypackaging and in open as well for 12 days. Visual, Firmness and sensory characteristics and marketability were analysed at regular intervals during the storage period. The coated fruits survived the storage period for 12 days in polybags and 10 days in open condition whereas all the uncoated controls decayed within 4-5 days in open and polybags respectively. The coatings controlled the PLW, ripening process and decay to a great extent and there by extended the shelf life and quality of the fruits. The effectiveness of AG coating was found to improve on incorporation of citric acid. This is probably the first study on utilizing an herbal alternative to extend the shelf life of banana.

Keywords: *Aloe vera*, Banana, Coating, Shelf life, Polypackaging

INTRODUCTION

Banana (*Musa* sp.) is a large perennial herb with leaf sheaths that form trunk like pseudostem. Banana has its origin in tropical region of south east Asia. Banana is a nutritious gold mine. They are high Vitamin B6 which helps to fight infections and is essential for this synthesis of heme the iron containing of hemoglobin; they are also rich in potassium and great source of fiber. Bananas are the fifth largest agricultural commodity in the world trade after cereals, sugar, coffee and cocoa. India, Ecuador, Brazil and China alone produce half of total banana of the world. The availability of this fruit is its availability round the year. FAO estimates that the present status of India is the largest producer of Bananas in the World with annual production of 29.7 million tonnes, which is the 23% of World's over all banana production. The major Banana producing states of India are Tamilnadu, Maharashtra, Karnataka, Gujarat, Andhra Pradesh, Assam, Madhya Pradesh. India has the potentials to emerge as a major exporter of banana by minimizing the post harvest losses which is nearly up to 30-40 % .This high loss is due to lack of packaging, storage facilities and poor means of transportation (Workneh *et al.*, 2010). For the fresh Bananas to reach the consumer in the right condition, it must be marketed properly, bearing in mind the application of most suitable temperature and humidity as well as appropriate packaging and handling method. Good handling during harvesting can minimize mechanical damage and reduce subsequent wastage due to microbial attack (Wills *et al.*, 1998). Recently, the use of *Aloe vera* (*Aloe barbadensis*) gel as an edible coating has been reported to prolong the shelf life and delay senescence in sweet cherry and table

grapes (Martinez Romero *et al.*, 2006; Serrano *et al.*, 2006). *Aloe vera* gel based edible coatings have been shown to prevent moisture loss and softening decrease, control respiration and senescence rate, delay oxidative browning and reduce microorganism proliferation in fruits such as sweet cherries, table grapes, nectarines and papaya (Ahmad *et al.*, 2009; Valverde *et al.*, 2005; Martinez- Romero *et al.*, 2006; Marpudi *et al.*, 2011).

The traditional packaging method for banana is nested packaging in which dried banana leaf are used but the effectiveness of these packaging materials even has not yet been well investigated. Plastic films have been found to increase the shelf life of banana fruit but so far very little work has been done on post harvest management of banana. Use of edible coatings over fruits is used to improve their quality and shelf life. These can be also safely eaten as part of the product and do not add unfavorable properties to the food stuff. Recently, there has been increased interest in using *Aloe Vera* gel as an edible coating material for fruits and vegetables driven by its antimicrobial activity. *Aloe Vera* gel based edible coating have been shown to prevent loss of moisture and firmness, control respiratory rate and maturation development, delay oxidative browning and reduce microorganism proliferation in fruits such as Oranges, Grapes, sweet cherries and Papaya.

There are no reports presently on the post harvest application of *Aloe Vera* coating with polypackaging in minimizing the post harvest losses and enhancement of shelf life and quality of banana fruits. Therefore, this study was conducted with the objective of evaluating the effects of different formulation of *Aloe Vera* gel on post harvest life of banana fruits.

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MATERIAL AND METHOD

Freshly harvested banana (variety Robusta) fruits were procured from the local market of Noida. They were selected on the basis of absence of injuries and colour, fresh leaves of aloe vera were obtained from the Noida International University, Greater Noida, U.P.

Preparation of coating solution

Aloe Vera gel matrix was separated from the outer cortex of leaves and this colourless hydroparenchyma was ground in a blender. The resulting mixture was filtered to remove the fibers. The liquid obtained constituted fresh Aloe vera gel. The gel matrix was pasteurized at 70°C for 45 minutes. Four different formulations of pure Aloe vera gel were made i.e. 20%, 40%, 60% and 80%. Among them 40% pure Aloe vera gel at pH4 is giving efficient result. 40% Pure Aloe Vera gel is divided into four formulations

1-40% pure *Aloe vera* Gel (Pure AG)

2-40% Aloe Gel with citric acid (4.5-4.6g/L-1)(AG+CA)

3-40% Aloe Gel with Ascorbic acid (1.9-2g/L-1) plus citric acid (4.5-4.6g/L-1)(AG+AS+CA)

4-40% Aloe Gel with Ascorbic acid (2g/L⁻¹) only.(AG+AS)

Application of Herbal Coating

Before Coating, banana fruits were washed thoroughly and dried. The coating solution used for banana fruits were 40% Aloe vera gel, AloeGel+ Citric acid, AloeGel plus Ascorbic acid, Aloe vera Gel plus citric acid plus ascorbic acid. The fresh fruits were dipped in coating solution with gelling agent to increase the efficiency of coating at room temperature for 15 min. They were allowed to drain and then dried at room temperature to allow a thin film layer to be formed on the fruits. A bunch of six fruits were used for each coating solution. Fruits were then weighed and stored at 25°C. Fruit without coating were stored under same conditions as those for coated fruits. Various parameters were analysed at fixed intervals. The parameters analysed included physiological loss in fresh weight, Change in peel colour, Appearance of sugar spot, Texture analysis and sensory analysis of fruit quality.

Visual Analysis

Visual Analysis of the fruit was done for the change in fruit weight and peel color rating.

Peel color rating is done on the basis of 7 point score scale.

1=All Green, 2=Light Green 3=50% Green, 50% yellow, 4=More Yellow than green, 5=Yellow with green tips, 6=Full Yellow, 7=Yellow flecked with Brown)

Sugar Spot Rating

Differently Aloe vera coated fruits were visually observed for sugar spot Rating

Sugar spot rating is done on the basis of 0 to 3 score scale.

[0=no spots, 1=1-20 spots per hand, 2=21 to 50 spots per hand, 3=more than 50 spots per hand]

Texture Analysis: For texture analysis penetrometer of 5/16" (8mm) tip was used after peeling the fruit.

Sensory Analysis: Sensory Analysis was carried out by 6 selected panelists. The fruits were randomly selected from each batch was evaluated visually in terms of peel color, texture, Flavor, Marketability. They rated each of the variant on the basis of 9-point Hedonic Score Scale.

(1=Dislike extremely, 2=Dislike very much, 3=Dislike moderately, 4=Dislike slightly, 5=neither like nor dislike, 6=like slightly, 7=like moderately, 8=like very much, 9=like extremely.)

RESULT

Pure Aloe vera gel and aloe vera gel with citric acid coated banana in polybags maintained at pH-4, kept at 25°C showed delayed ripening, less sugar spot, fresh extended the shelf life upto 10-12 days whereas control got deteriorated within 4-5 days.

Visual Characteristics

The effect of different formulations of Aloe Vera coating in PLW was observed in table 1 and the shelf life is showed in fig.1. Physiological loss in weight during storage was found to be significantly different among the banana fruits treated with the different coatings and from control at the end of 10-12 days storage.

Table 1. Change in Fresh Weight of poly packed banana stored at 25°C

Days	Control	G+CA	AG+CA+AS	AG+AS	Pure AG
0	327.15	373.18	369.58	385.50	310.58
4	308.14	368.50	358.55	371.65	306.74
8	-	356.65	-	-	295.55
12	-	340.95	-	-	280.05

Change in peel color rating is observed (Table 2) in banana during 12 days storage. Pure AG and AG+CA coated banana showed approximately similar result till 10 days storage in open condition.

AG+CA+AS and AG+AS coated bananas showed 6 (full yellow) and 7 (yellow flecked with brown) respectively stages of peel color rating scale during 10 days storage in open.

Sugar Spot Rating is also observed (Table2) in banana during 12 days of storage. On 10th day of storage AG+CA and Pure AG coated banana showed stage 3 (> 50 spots per hand), AG+CA+AS and

AG+AS stage 3 (more than 50 spots per hand) on 6th day, during 10th day of storage. Control got deteriorated within 4th day of storage.

Table 2. Peel Color(PC) & Sugar Spot(SS) Rating of Polypacked banana stored at 25⁰C

Days	Control		AG+CA		AG+CA+AS		AG+AS		Pure AG	
	PC	SS	PC	SS	PC	SS	PC	SS	PC	SS
0	2	0	2	0	2	0	2	0	2	0
4	7	3	4	1	5	2	5	2	4	1
8	-	-	5	2	-	-	-	-	6	2
12	-	-	6	2	-	-	-	-	7	3

Firmness Characteristics

During 12 day storage of banana in open and in polypackaging as well, on the 10th day there is approximately similarity between the texture of AG+CA coated and pure AG Coated i.e. 1.2 and 1.5

kg/cm². On the other hand banana showed improved texture comparative to control in polypackaging in terms of extended shelf life i.e. 12th day AG+CA and Pure AG coated banana showed 0.7 and 0.6 kg/cm² firmness (Table3).

Table 3. Texture Analysis (Kg/cm²) of polypacked banana stored at 25⁰C

Days	Control	AG+CA	AG+CA+AS	AG+AS	Pure AG
0	2.5	2.6	2.4	2.9	2.6
4	0.5	2.0	1.3	0.9	2.0
8	-	1.4	-	-	1.6
12	-	0.7	-	-	0.3

Sensory Characteristics

Colour, firmness, taste and marketability the major sensory attributes were scored by selected panel members. During 4th day, over all liking score 8.0,6.8,8.4,8.8,6.2 for Control AG+CA, AG+CA+AS, AG+AS, Pure AG respectively. Control showed complete ripening yellow in colour, sweeter in taste with adequate sugar spot, AG+CA coated showed towards ripening, 50% yellow, 50% green stage with less sugar spot, AG+CA+AS showed full yellow peel colour with

adequate sugar spot AG+AS yellow flecked with brown with adequate sugar spot, Pure AG coated showed more yellow than green peel colour.

On 12th day of storage AG+CA showed full yellow peel colour, less sugar spot and better in taste comparative to pure AG coated banana showed yellow flecked with brown peel colour with more sugar spot. Polypacked bananas showed improved quality and shelf life compared to different formulations of Aloe Vera coated bananas in open. (Table4).

Table 4. Sensory Evaluation of polypacked banana stored at 25⁰C

Days	*Control	*AG+CA	*AG+CA+AS	*AG+AS	*Pure AG
0	2	3.2	3.8	2.3	2.1
4	8	6.8	8.4	8.8	6.2
8	-	8.4	-	-	8.8
12	-	8.8	-	-	7.8

*Mean of Color, texture, Flavour & overall acceptability for each treatments.

DISCUSSION

Postharvest losses of fruits are a serious problem because of rapid deterioration during handling, transport and storage. Use of edible coatings over fruits is used to improve their quality and self life. These can be also safely eaten as part of the product and do not add unfavourable properties to the foodstuff. Recently there has been increased interest in using Aloe Vera gel as an edible coating material for fruits and vegetables driven by its antifungal activity. Edible coatings provide a barrier against

external elements and therefore increase shelf life (Guilbert et al., 1996) by reducing gas exchange, loss of water, flavors and aroma and solute migration towards the cuticle (Saltveit, 2001 and Marpudi et al. 2012). Aloe Vera gel based edible coating have been shown to prevent loss of moisture and firmness, control respiratory rate and maturation development, delay oxidative browning and reduce microorganism proliferation in fruits such as Oranges, grapes, sweet cherries and Papaya. In case of Papaya, the Aloe Vera coated fruits survived the storage period of 15 days at low temperature whereas all the uncoated

controls decayed within 10 days. (Marpudi *et al*; 2011) Marketability was also found to be better for coated fruits. When studies were done of Grapes, it was found that the storability could be extended up to 35 days at 1 °C. (Asghari *et al.*, 2013). Oranges have also been used for study and it was found that Aloe Vera coating in oranges resulted in decrease in

weight loss, increase in titrability of acids and higher TSS. (Arowara *et al*;2013). Thus, Aloe Vera gel is being increasingly studied as edible coating in fruits, which would be an innovative and interesting means for commercial application and an alternative to the use of postharvest chemical treatments leading to the enhancement of shelf life of fruits.

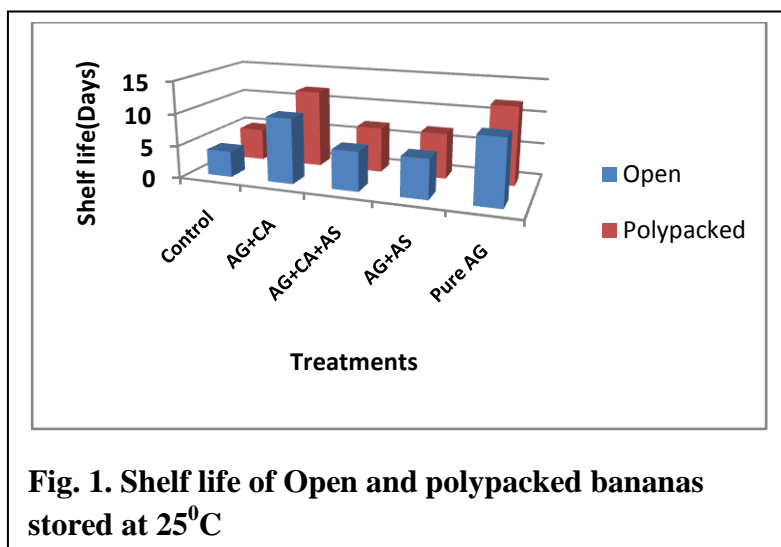


Fig. 1. Shelf life of Open and polypacked bananas stored at 25°C

The results have proved the ability of different formulations of Aloe Vera in extending the shelf life of banana. Different formulations of *Aloe vera* has been tried on banana. Banana in polybags showed better shelf life comparative to open at 25°C. Pure Aloe vera gel has extended the shelf life up to 10-12 days without and with bagging in terms of quality also. Different concentrations of pure Aloe vera has shown appreciating results. 40% Aloe Vera gel with citric acid giving efficient results in comparison to 20%, 40%, 60%, 80% Aloe Vera gel coated banana. 40% Aloe Vera gel with citric acid coated banana in poly bags maintaining pH-4 keeping at temperature 25°C showed encouraging results. 60% and 80% pure aloe vera gel coated banana showed not much effective results as they got deteriorated within 7 days. 20% Aloe vera gel maintaining pH-5,7 showed less sugar spot but there is no proper ripening as banana showed shrinkage. 40% Aloe Vera gel maintaining pH-5,7 showed fast ripening, more sugar spot, shelf life is not much extended in comparison to control.

Aloe Vera with citric acid played significant role in extension of shelf life of banana as there is less microbial infection is observed comparative to other formulation of Aloe vera. Aloe Vera with citric acid improved the quality, firmness, less sugar spot & sensory characteristics of banana.

CONCLUSION

On the basis of finding, it can be concluded that the shelf life of banana enhanced with Aloe Vera gel

based coating and its effectiveness can be increased with polypackaging. 40% Aloe Vera gel with citric acid maintaining pH-4 keeping at temperature 25°C showed significant role in retarding microbial infection. Polybags showed effective results as they have enhanced the shelf life upto 12 days.

REFERENCES

- Abirami, L.S.S.** (2009). Efficacy of chitosan and natural plant extracts on the growth of selected fungal pathogens and control of anthracnose disease of papaya. *M.Sc thesis, Sri Sathya Sai University, Prashanthi Nilayam.*
- Arowara, K.A., Williams, J.O., Adetunji, C.O., Fawole, O.B., Afolayan, S.S., Olaleye, O.O., Adetunji, J.B. and Ogundele, B.A.** (2013). Effects of Aloe vera coatings on quality characteristics of Oranges stored under cold storage. *Greener Journal of Agricultural Sciences*; **Vol. 3 (1)**, pp. 39-47
- Asghari, M., Ahadi, L. and Riaie, S.** (2013). Effect of salicylic acid and edible coating based Aloe vera gel treatment on storage life and postharvest quality of grape (*Vitisvinifera* L. cv. GiselUzum). *Intl. J. Agri. Crop Sci.* **Vol. 5 (23)**, 2890- 2898.
- Asghari, M., Yusof, H., Rasmi and Mohammadzadeh, A.** (2013). Influence of postharvest nitric oxide and Aloe vera gel application on Sweet Cheery quality indices and storage life. *International Journal of Agronomy and Plant Production.* **Vol., 4 (9)**, pp. 2393-2398,

- Athmaselvi, K., A., Sumitha, P. and B. Revathy** (2013). Development of Aloe vera based edible coating for tomato. *Int. Agrophys*, pp 369-375
- Devlieghere, F., Vermeullen, A. and Debevere J.C.** (2004). Antimicrobial activity, interactions with food components and applicability as a coating on fruits and vegetables, *Food Microbiol*, pp 703-714.
- Habeeb, F., Shakir, E., Bradbury, F. and Cameron, P.** (2007). Screening methods used to determine the antimicrobial properties of Aloe vera inner gel. *Methods*, 42 pp. 315-320.
- Marpudi, S. L., Abirami, L. S. S., Pushkala, R. and Srividya, N.** (2011). Enhancement of storage life and quality maintenance of papaya fruits using Aloe vera based antimicrobial coating. *Indian Journal of Biotechnology*, Vol. (10) pp. 83-89.
- Martinez-Romero, D. L., Alburquerque, N., Valverde, J., M., Guillen, F. and Castillo, S.** (2006). Post harvest cherry quality and safety maintenance by Aloe vera treatment: A new edible coating. *Post Harvest Biol Technol.*, pp. 93-100.
- Vargas, M., Pastov, C., Chirau, A., Clements, M. C., Julian, D and Gunzalez, M.C.** (2008). Recent advances in edible coatings for fresh and minimally processed fruits. *Crit Rev Food Sci Nutr.* pp 496-511.

