Response of Post-Harvest Behavior of Pineapple (*Ananas comosus* var. Giant Kew) Fruits at Different Storage Conditions

Mira Dhakal[1*], Suprabha Pandey[1], Shandesh Bhattarai[2], Dipendra Ghimire[1] and Sujan Subedi[1]

[1]National Horticulture Research Center, NHRC, Khumaltar, Lalitpur, Nepal
[2]Nepal Academy of Science and Technology, Khumaltar, Lalitpur, Nepal

***CORRESPONDING AUTHOR:**

Mira Dhakal
Email: dhakalmira13@gmail.com

ISSN : 2382-5359(Online), 1994-1412(Print)

DOI:

https://doi.org/10.3126/njst.v21i2.62355

Date of Submission: 5/09/2022
Date of Acceptance: 22/03/2023

ABSTRACT

The present study was carried out to establish the synergistic effect of CoolBot storage and organic and chemical preservatives on pineapple fruit to lengthen the marketable shelf life. The research work was conducted during the period of 17th Mangsir to 28th, Poush 2077 at the laboratory of the National Horticulture Research Center, Khumaltar, Lalitpur. The pineapple fruits var. Giant Kew was set up in an experimental unit in a Completely Randomized Design (CRD) with eight treatments and replicated three times. The treatments were viz., T1= Dipped in 3 mM salicylic acid for 15 min. under CoolBot storage, T2= Dipped in 5 mM salicylic acid for 15 min. under CoolBot storage, T3= Coated with aloe Vera gel and T4=controlled treatment under CoolBot storage and T5= Dipped in 3 mM salicylic acid for 15 min. under ambient storage, T6= Dipped in 3 mM salicylic acid for 15 min. under ambient storage T7= Coated with aloe Vera gel under ambient storage and T8= Controlled treatment under ambient storage condition. Each replication of treatment comprises 8 fruits. Changes in Cumulative physiological weight loss % (Cum. PLW%), Vitamin C content (mg/100 gm), Outside and inside Firmness (N/F) of fruit, pH value of juice, and sensory evaluation were observed during the storage period at every 7 days of an interval. The samples at ambient storage conditions (20.5 °C and 61.6%) were removed on day 14, and samples at CoolBot storage (10-12 °C and 90-92%) were removed on 35 days of storage by observing the sensory evaluation. Thus the study concluded that the synergistic effect of aloe Vera gel coating and Cool Bot storage has been found effective in pineapple fruits to delay internal browning index and extend marketable shelf life from 14 days (ambient storage) to 35 days.

Keywords: Aloe Vera gel, CoolBot storage, Marketable Shelf Life, Salicylic acid, Sensory evaluation

1. INTRODUCTION

Pineapple is the third most important tropical fruit in the world after banana and citrus (Bartholomew *et al*. 2003). Pineapple, a non-climacteric fruit tends to be produced and utilized both for fresh consumption and processing. Pineapple (*Ananas comosus*) belongs to the Bromeliaceae family and is the most important commercial fruit crop in the world. The worldwide production of pineapple is 2.5 lakhs mt and the national is only 1500 mt per year (Gautam & Gautam 2017). The total area under cultivation is 1246 ha, whereas the productive area is 1102 ha with a production of 14,450 Mt/ha and productivity of 13.11 Mt/ha (MoALD 2020/2021).

The post-harvest loss of fruits varies from farmer field to consumer level is nearly 21% and sometimes it goes up to 40-50% (Kabir *et al*. 2010). Certainly, at ambient conditions, an enhanced biochemical transformation of starch made the fruit rich in sugar which consequently gets affected by microbial spoilage. Thus, pineapples have a short post-harvest shelf life at ambient temperature and deteriorate quickly (Lu *et al*. 2010). However, cold storage or refrigerated supply is effective at inhibiting the development of decay in pineapple fruit but symptoms of chilling injury especially internal browning are observed (Paull & Rohrbach 1985). The pineapple fruits can be stored at 7-10 ºC under cold storage for up to one month (Gautam & Gautam 2017). In previous research, Joshep *et al*. 2010, reported that fruits were harvested from a farmer's field and stored under different three conditions i.e. refrigeration, Ambient and intense sunlight up to 40 days and further noted that the fruits were stored under ambient and intense heat storage safe up to15th days of storage while at refrigerated condition up to 33rd days of storage.

The work aimed to study the effect of A. Vera was applied as an edible coating on the change in physiochemical parameters and shelf life in pineapple, related to fruit quality during ambient storage for a period of seven weeks.

The previous research study showed that Salicylic Acid delays the ripening process due to the reduction of ethylene production which prolongs the shelf life during storage and also plays a major role in maintaining firmness by delaying softening of fruits. On the other hand, organic i.e. Aloe Vera gel reduces respiration and ethylene production. It has also antifungal and antibacterial properties which provide a defensive barrier against microbial contamination of fruits and vegetables. The CoolBot storage technology is a cheaper alternative for-small scale farmer since operation costs are very low because it doesn't break up easily (Dubey 2013). CoolBot storage was found effective in lengthening shelf life as evidenced by significantly slower or delayed ripening-related changes including respiration rate, peel/flesh color, and firmness. The respiration rate of pineapple fruit in both storage conditions increased gradually as ripening progressed. The Respiration rate of fruits in the CoolBot room was lower and the respiratory peak was delayed by 22 days. Low temperatures slow down the rate of oxygen consumption and CO_2 evolution. In developing countries like Nepal, sophisticated storage technology is beyond the reach of smallholder farmers. There is a need to develop low-cost storage technologies that can be adapted by the majority of farmers. Therefore, it is of utmost importance to develop a technique for extending the shelf life of pineapple by reducing the post-harvest decay with an internal browning index and maintaining the physiochemical qualities of the pineapple fruit. In Nepal, no technology was developed to prolong the shelf life of pineapple so there is a greater need to cope with the post-harvest loss problem and it was aimed to determine the synergistic effects of Salicylic acid and aloe Vera gel with CoolBot storage on the postharvest quality of pineapple to delay internal browning index.

2. MATERIALS AND METHODS

Fruits of var. Giant Kew was harvested at the physiological maturity stage from the farmer's field of Karkare Chowk, Sindhuli. Fruits were subsequently transferred to NHRC Laboratory at next day after cooling and sorted based on size and the absence of physical injuries or infections. This experiment was conducted from 17th Mangsir 2077 to 28th Poush 2077. The experiment was conducted in CRD with three replications and eight post-harvest treatments were assigned to the pineapple fruits viz., T1= Dipped in 3 mM salicylic acid for 15 min. under CoolBot storage, T2= Dipped in 5 mM salicylic acid for 15 min.

under CoolBot storage, T3= Coated with aloe Vera gel and T4=controlled treatment under CoolBot storage and T5= Dipped in 3 mM salicylic acid for 15 min. at ambient storage, T6= Dipped in 3 mM salicylic acid for 15 min. under ambient storage T7= Coated with aloe Vera gel under ambient storage and T8= treatment condition under ambient condition. Each replication of treatment comprises 8 fruits. The average temperature and relative humidity during the entire research period in a normal room was 20.5 °C and 61.6% while under a CoolBot average temperature was 10-12 °C and relative humidity was 90-92%. Changes in cumulative physiological weight loss, Vitamin C, pH content, and fruit firmness were observed at every 7 days of intervals and other quality parameters like appearance, tartness, and sweetness, overall acceptability of pineapples were also scored at 35 days of storage to verify the quality during the storage period.

2.1 Measurement of pH of Pineapple Juice

The pH of the filtrate from the pulp sample was determined by using a glass membrane pH meter. After that, the glass membrane was washed in distilled water and placed membrane into the filtrate to measure the pH at room temperature with a Sartorius Professional meter PP-50 operation manual pH meter and stabilized reading was recorded.

2.2 Measurement of Vitamin C Content of Pineapple Juice

The ascorbic acid was measured by the volumetric method as per the reference from Sadasivsm and Manickam (1991). The following formula was used to calculate the ascorbic acid content.

Amount of ascorbic acid

$$\text{(mg/100 gm sample)} = \frac{0.5\ mg \times V2\ mL \times 12\ mL \times 100}{V1\ mL \times 5\ mL \times wt.\ of\ the\ sample}$$

A procedure used in the determination of Vitamin C:

Five mL of working standard was pipette out into 100 mL of the conical flask. Then 10 mL of 4% oxalic acid was added and titration was done against the dye. This consumed amount of dye (V1 mL) was the amount of V1 in the formula. The amount of dye consumed till the end point as represented by the appearance of pink coloration was equivalent to the amount of ascorbic acid.

Two mL of sample was extracted in 4% oxalic acid and 12 mL of known volume was made and centrifuged. Five mL of this supernatant were pipette out to which 10 mL of 4% oxalic acid was added and titration was done against the dye. This consumed amount of dye was the amount of V2 in the formula.

Note: 138.12 mg salicylic acid (SA) dissolved in 1 liter of water will give a 1 mM solution of SA.

2.3 Measurement of Fruit Firmness of Pineapple Fruit

Fruit Firmness (kg/f) of Pineapple fruit was determined (inside and outside) by measuring penetration force using an Instron universal testing machine. Fruits firmness of peeled tissue was measured with a penetrometer (FT 327, Made in Italy) fitted with a probe of 15 mM diameter.

2.4 Observation of Sensory Evaluation of Pineapple Fruit

Sensory Evaluation including Freshness, Tartness, and Overall acceptability of the pineapple fruit was measured using 1 to 5 hedonic scales. 1 for most freshness or good appearance,high acceptability, less tartness, and 5 for least freshness/appearance, low acceptability, more tartness from the consumers' point of view on the last marketable shelf life i.e. 35 days of storage under Cool Bot condition.

2.5 Evaluation of the Shelf Life of Pineapple Fruit

Shelf life is the period that started from harvesting and extends up to the start of the rotting of fruits (Mondal 2000). The shelf life of pineapple fruits as influenced by different post-harvest treatment and varieties were calculated by counting the days required to attain the last stage of ripening but the fruits remained still for optimum marketing and eating qualities.

2.6 Statistical Analysis

The data for the experiment was analyzed as a completely randomized design (CRD) with three replicates. An analysis of variance was used to analyze the difference between means and the LSD test was applied for mean separation at P 0.05. All analyzes were done through GenStatstatistical software (18.1).

3. RESULTS AND DISCUSSION

3.1 Cumulative Physiological Weight Loss Percentage at 14 Days of Storage in Two Different Conditions

The cumulative weight loss percentage was calculated at 14 days of storage . The cumulative PWL% was found highest (14.27%) in treated fruit dipped in 5 mM salicylic acid in ambient storage followed by fruit coated with aloe Vera gel in ambient storage (13.38 %) at 10 Days of storage. Similarly, cum. PWL% was found lowest (4.86%) in aloe vera gel-coated fruit in CoolBot storage followed by a controlled treatment in CoolBot storage (4.96%) at 14 DAS. (Fig. 1).

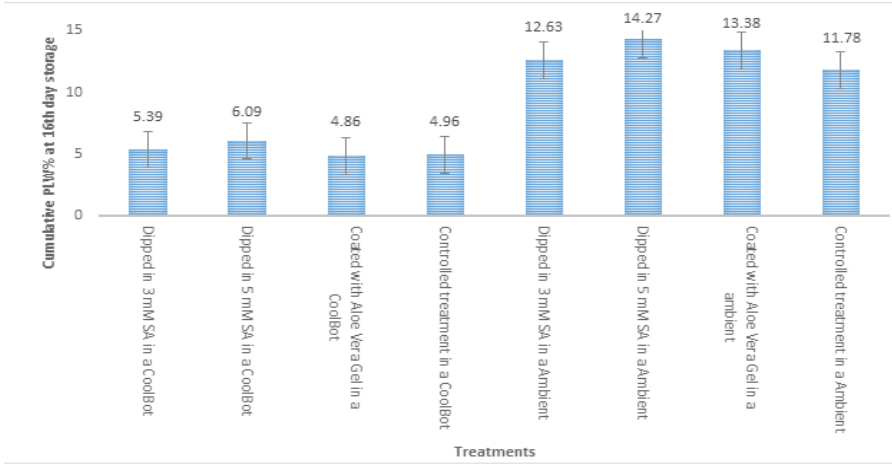

Fig. 1. Cumulative physiological weight loss percentage at 14 days storages of Pineapple with different treatments in two different conditions at NHRC, Khumaltar

3.2 Cumulative Physiological Weight Loss Percentage at 35 days of CoolBot Storage Condition

The cum. PWL% was found highest (17.91%) in fruts dipped in 5 mM salicylic acid at CoolBot storage followed by the fruits dipped in 3 mM salicylic acid (14.25%) at CoolBot storage. The cum. PWL% was found lowest (10.76%) in fruits coated with aloe Vera gel under CoolBot storage at 35 days of storage.

This finding coincides with the report of Bhusal (2002), Bastakoti, and Gautam (2007) in Mandarin fruit. They concluded that aloe Vera gel coated fruits act as a wax on a fruit that might have been an effective treatment to reduce weight loss by checking the stomata and lenticels of the cell wall of the fruits which reduces the rate of respiration and transpiration.

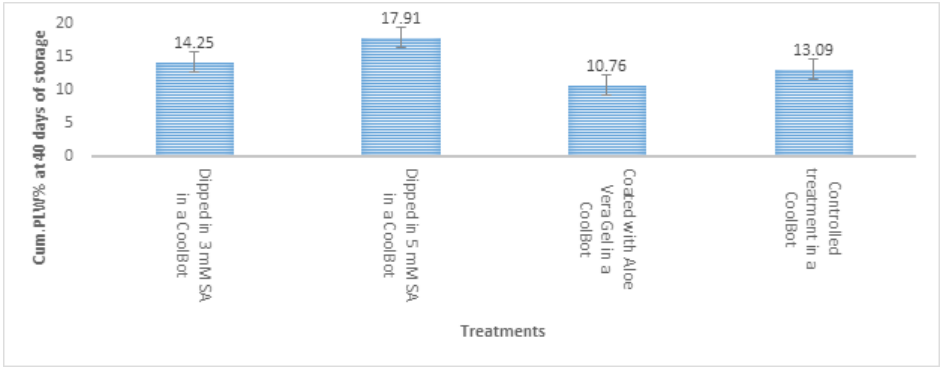

Figure 2 Cumulative physiological weight loss percentage at 35 days of storage of Pineapple with different treatments in CoolBot storage condition at NHRC, Khumaltar

3.3 pH Value of Pineapple Juice

The pH value of pineapple juice showed a highly significant effect among the treatments. In this experiment, the pH value of pineapple juice was increased up to 28 days of storage and then they gradually decreased or sometimes remain constant. The minimum pH value was retained by the aloe Vera coated fruits (3.60) which might be due to the slower process of respiration and utilization of organic acids present in pineapple fruits which were followed by treatment dipped in 3 mM SA (3.68) under CoolBot storage condition at 35 days of storage (Table 1). When the storage period was increased, the pH value of pineapple fruits also increased gradually. It might be due to the conversion and utilization of different acids in the respiration process (Rokaya 2017). Ali *et al*. (2015), reported that Pineapple fruit stands below 4.5 pH value was excellent storing qualities of fruits usually not spoiled by bacteria.

Table 1: Effect of Salicylic Acid (SA) and Aloe Vera gel on pH of Pineapple Fruit under CoolBot and ambient storage, 2077 at NHRC,Khumaltar

	pH Value					
Treatments	**Day 1**	**Day 7**	**Day 14**	**Day 21**	**Day 28**	**Day 35**
Dipped in 3 mM SA(CC)	3.5	3.60a	3.77d	3.76cd	3.88d	3.68c
Dipped in 5 mM SA (CC)	3.5	3.58a	4.11e	3.74bc	3.75bc	3.75d
Coated with Aloe Vera Gel(CC)	3.5	3.62a	3.70c	3.64b	3.72b	3.60b
Controlled Condition (CC)	3.5	3.51a	3.58ab	3.86d	3.77c	3.73d
Dipped in 3 mM SA(AmbC)	3.5	3.62a	3.59ab	Discard	Discard	Discard
Dipped in 5 mM SA (AmbC)	3.5	4.10c	4.00e	Discard	Discard	Discard
Coated with Aloe Vera Gel(AmbC)	3.5	3.62a	3.57a	Discard	Discard	Discard
Controlled Condition	3.5	3.83b	3.63b	Discard	Discard	Discard
Mean	3.5	3.68	3.74	1.87	1.89	1.84
F-value		<.001	<.001	<.001	<.001	<.001
LSD(0.05)		0.108	0.054	0.106	0.04	0.022
CV(%)		1.7	0.8	3.3	1.2	0.7

CC= CoolBot condition, Amb. = Ambient condition, CV= Coefficient of variation, LSD= least significant Difference, *= Significant at P≤0.05, **= Significant at P≤0.01, ***= Significant at P≤0.001 and NS= Non significant at 5% level of significance.

3.4 Vitamin C Content in a Pineapple Fruit

The vitamin C content in a pineapple fruit decreased with the advancement of the storage period up to 21 days of storage and further, they increased up to 28 days of storage and further they were again decreasing way. The maximum vitamin C content was found in a treatment dipped in 3 mM salicylic acid (38.1 mg/100 g) followed by a controlled treatment (36.4 mg/100 g) and the minimum was observed in a treatment dipped in 5 mM salicylic acid (32.6 mg/100 g) at 35 days of CoolBot storage and this experiment showed that vitamin C was decreased in all treatments (Table 2). The decrease in the ascorbic acid content of fruit juice with the advancement of the ripening stage of fruits and the storage period was due to the conversion of this acid to sugar with the activity of ascorbic acid dehydrogenase (Rahman *et al.* 1979).

Table 2: Effect of Salicylic Acid (SA) and Aloe Vera gel on vitamin C content of Pineapple Fruit under CoolBot and ambient storage, 2077 at NHRC, Khumaltar

	Vitamin C content (mg/100 g fruit)					
Treatments	**Day 1**	**Day 7**	**Day 14**	**Day 21**	**Day 28**	**Day 35**
Dipped in 3 mM SA(CC)	40.5	40.6a	32.9a	34.0b	35.98b	38.1b
Dipped in 5 mM SA (CC)	40.5	36.3a	30.9a	34.0b	43.56b	32.6b
Coated with Aloe Vera Gel (CC)	40.5	40.6a	32.9a	35.7b	37.88b	34.5b
Controlled Condition (CC)	40.5	38.5a	36.2a	32.3b	37.87b	36.4b
Dipped in 3 mM SA(AmbC)	40.5	51.3a	48.9a	Discard	Discard	Discard
Dipped in 5 mM SA (AmbC)	40.5	38.5a	35.2a	Discard	Discard	Discard
Coated with Aloe Vera Gel (AmbC)	40.5	47.0a	43.6a	Discard	Discard	Discard
Controlled Condition	40.5	38.5a	37.6a	Discard	Discard	Discard
Mean	40.5	41.4	37.3	17	19.41	17.7
F-value		0.342	0.489	<.001	<.001	<.001
LSD(0.05)		13.77	15.54	12.49	8.03	9.28
CV(%)		19.2	24.1	42.4	23.9	30.3

CC= CoolBot condition, Amb. = Ambient condition, CV= Coefficient of variation, LSD= least significant Difference, *= Significant at P≤0.05, **= Significant at P≤0.01, ***= Significant at P≤0.001 and NS= Non significant at 5% level of significance.

3.5 Outer Firmness of a Pineapple Fruit

The outer firmness of the fruit was recorded 7.53 kg/f at day 1 before the treatments. At day 7 the outer firmness was increased in all treatments except in aloe vera-treated fruits and after then the value decreased with the advancement of the storage period in all the treatments except the fruits dipped in 3 mM SA under CoolBot storage. The firmness of pineapple was decreased from 10.35 kg/f to 6.13 kg/f at controlled treatment under CoolBot storage followed by treated with dipping in 5 mM salicylic acid 10.21 kg/f to 7.61 kg/f from 7th days of storage to 35th days of storage under CoolBot condition whereas, Aloe Vera coated pineapple showed gradually decreased in firmness from 6.76 kg/f at 7 days of storage to 6.75 kg/f at 35 days of storage under CoolBot condition (Table 3).

Table 3: Effect of Salicylic Acid (SA) and Aloe Vera gel on Outer firmness of Pineapple Fruit under CoolBot and ambient storage, 2077 at NHRC, Khumaltar

	Outer firmness (kg/f)					
Treatments	**Day 1**	**Day 7**	**Day 14**	**Day 21**	**Day 28**	**Day 35**
Dipped in 3 mM SA(CC)	7.53	7.96ab	8.99e	5.7a	6.84ab	6.18a
Dipped in 5 mM SA (CC)	7.53	10.21c	5.52b	5.6a	6.56ab	7.61a
Coated with Aloe Vera Gel(CC)	7.53	6.76a	5.41b	6.9b	6.97b	6.75a
Controlled Condition (CC)	7.53	10.35c	6.36c	7.0b	5.46a	6.13a
Dipped in 3 mM SA(AmbC)	7.53	9.12bc	4.70a	Discard	Discard	Discard
Dipped in 5 mM SA (AmbC)	7.53	9.40bc	8.17d	Discard	Discard	Discard
Coated with Aloe Vera Gel (AmbC)	7.53	6.29a	5.57b	Discard	Discard	Discard
Controlled Condition	7.53	7.38ab	5.95bc	Discard	Discard	Discard
Mean	7.53	8.43	6.33	3.15	3.22	3.34
F-value		0.002	<.001	0.018	0.117	0.167
LSD (0.05)		1.97	0.68	0.96	1.36	1.58
CV%		13.5	6.3	8	11.2	12.1

CC= CoolBot condition, Amb. = Ambient condition,CV= Coefficient of variation, LSD= least significant Difference, *= Significant at P≤0.05, **= Significant at P≤0.01, ***= Significant at P≤0.001 and NS= Non significant at 5% level of significance.

3.6 Inner Firmness of a Pineapple Fruit

The inner firmness of the fruit also showed highly significant among the treatments along the storage period. The firmness slowly decreased in treatment dipped in 3 mM Salicylic acid under CoolBot storage, from 2.57 kg/f to 1.58 kg/f followed by coated with aloe Vera gel from 2.57 kg/f to 1.63 kg/f under CoolBot storage from 7 days of storage to 35 days of storage (Table 4).The slow decline of firmness in aloe Vera coated fruits might be due to aloe Vera acting as a wax and reducing moisture loss from the fruit surface that reduces the respiration and transpiration of the fruits. Further two scientists Sidhu *et al*. 2006 and Yadav *et al*. 2010 also reported that firmness decreased with the increase in storage period. Thus, in our research, inner firmness was slowly decreased in an aloe vera-coated pineapple and simultaneously in other treated fruits.

The result was coinciding with Mahajan *et al*. 2004, Sindhu *et al*. 2006 and Yadav *et al*. 2010 who explained from their research results that the wax-coated fruits reduced moisture loss or reduced slowly from the skin surface and maintain cell wall integrity and tissue turgidity and ultimately maintain the firmness of fruits.

The Firmness of tissue makes sure the quality of fruits at storage conditions. The fruits lost their firmness with an increase in the storage period. From the table, it was shown that the outer and inner firmness of pineapple was slightly changed because when their moisture percentage decreased during storage and then remained unchanged their inside and outside firmness. As ripening progressed, peel and flesh firmness decreased in all the fruits irrespective of storage conditions. The decrease has been attributed to enzymes that degrade the cell wall and the insoluble protopectin to more simple soluble pectin (Hoffman *et al*. 2001).

Table 4: Effect of Salicylic Acid (SA) and Aloe vera gel on Inner firmness of Pineapple Fruit under CoolBot and ambient storage, 2077 at NHRC, Khumaltar.

	Inner firmness (kg/f)					
Treatments	**Day 1**	**Day 7**	**Day 14**	**Day 21**	**Day 28**	**Day 35**
Dipped in 3 mM SA(CC)	2.57	3.23a	1.69a	1.81b	2.03c	1.58b
Dipped in 5 mM SA (CC)	2.57	3.02a	1.97bc	1.60b	1.28b	1.75bc
Coated with Aloe Vera Gel(CC)	2.57	2.19a	1.70a	1.79b	2.09c	1.63bc
Controlled Condition (CC)	2.57	2.76a	1.84ab	1.70b	1.30b	1.82c
Dipped in 3 mM SA(AmbC)	2.57	1.66ab	2.20c	Discard	Discard	Discard
Dipped in 5 mM SA (AmbC)	2.57	4.53ab	3.85d	Discard	Discard	Discard
Coated with Aloe Vera Gel(AmbC)	2.57	3.55ab	1.80ab	Discard	Discard	Discard
Controlled Condition	2.57	2.33b	1.86ab	Discard	Discard	Discard
Mean	2.57	2.78	2.11	0.86	0.83	0.84
F-value		0.053	<.001	<.001	<.001	<.001
LSD(0.05)		1.69	0.24	0.21	0.31	0.19
CV%		35.1	6.7	14.5	21.6	13

CC= CoolBot condition, Amb. = Ambient condition,CV= Coefficient of variation, LSD= least significant Difference, *= Significant at P≤0.05, **= Significant at P≤0.01, ***= Significant at P≤0.001 and NS= Non significant at 5% level of significance.

3.7 Sensory Evaluation of Pineapple Fruit

3.7.1 Fruit Freshness, Tartness, and Overall acceptability (1-5 Scale)

Different quality parameters were scored on the last marketable shelf life i.e. 35 days of storage under CoolBot conditions to verify the quality of the fresh produce. The Sweetness, Tartness, and Overall acceptability of the fruit were measured using 1 to 5 hedonic scales, 1 for optimum sweetness, tartness, and overall acceptability, and 5 for least sweetness, tartness, and overall acceptability. The panelist of 10 scientists and a technical officer of the National Horticulture Research Center (NHRC) was involved in scoring the fruit under CoolBot storage. Shelf life is a period that started from harvesting and extends up to the start of the rotting of fruits (Mondal 2000). The shelf life of pineapple fruits as influenced by different post-har-

vest treatment and varieties were calculated by counting the days required to attain the last stage of ripening but the fruits remain still for optimum marketing and eating qualities.

All the produce stored at ambient conditions was discarded as the consumers' acceptability was not found. The maximum overall acceptability of the fruit was found in pineapple treated with aloe vera gel stored at cool bot storage. The treated fruits had more freshness and glossy appearance with good flavor because aloe Vera gel acts as a barrier to moisture loss and rapid respiration and transpiration loss.

More freshness of pineapple fruit was obtained in fruits coated with aloe Vera gel (1.6) followed by those Dipped in 3 mM Salicylic acid (2.5) while the least freshness and shriveling of Pineapple skin was observed in 5 mM salicylic acid (4.4) treated fruits which were at par with controlled treatment (4.4) under CoolBot storage condition (Fig:3).The maximum tartness was found in fruits dipped in 5 mM Salicylic acid (2.8) under CoolBot storage followed by the fruits at a controlled condition (2.6) and minimum tartness was found in fruits coated with aloe vera gel under CoolBot storage condition (1.7). Similarly, The overall acceptability was found maximum in aloe vera gel-coated fruits (3.0) followed by the fruits dipped in 3 mM Salicylic acid (3.50). Thus from the data, we concluded that aloe vera gel-coated fruits showed better performance in terms of freshness, tartness, and overall acceptability.

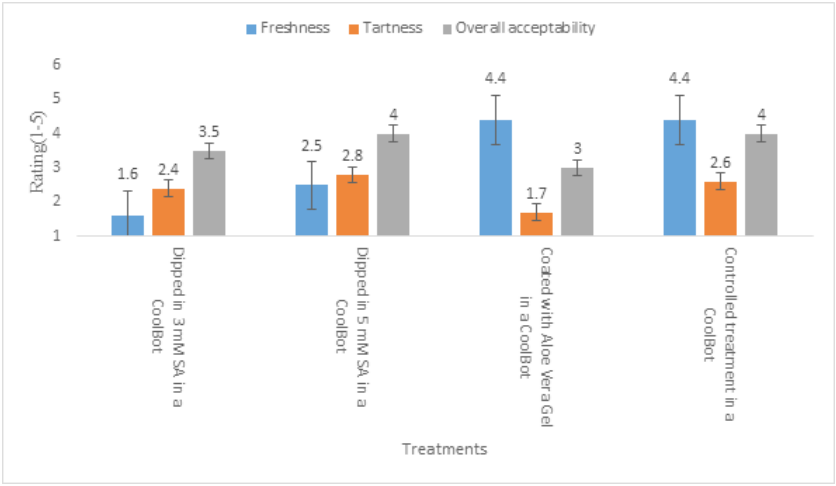

Fig. 3: Sensory evaluation of pineapple fruit at 35 days of storage under CoolBot storage condition at NHRC, Khumaltar

4. CONCLUSION

The above experiment concluded that aloe Vera coated fruits of pineapple acts as an edible coating and has a beneficial effect in retarding the ripening process and have less Cumulative Physiological Weight Loss with good keeping quality followed by SA- treated fruits with 3 mM under CoolBot conditions. The synergistic effect of CoolBot storage technology and aloe vera gel coated on pineapple fruits is effective in extending shelf life and preserving quality. It extends the marketable shelf life of pineapple fruit from 14 days to 35 days. It is recommended for adoption by smallholder and their response to CoolBot storage is documented for wider use of the technology. Other technologies (such as aloe vera coating) used to extend the shelf life of perishable commodities should be tested in combination with CoolBot storage to evaluate their synergistic effect in extending shelf life and quality preservation.

ACKNOWLEDGEMENT

The authors would like to acknowledge the Value Chain Development of fruits and vegetable Project in Nepal (VCDP) for providing financial support to carry out the study. All the supporting staff of the National Horticulture Research Center (NHRC) is thankfully appreciated for timely providing necessary facilities, logistic support, and physical assistance for the accomplishment of this experiment.

REFERENCES

Ali, S.M.Y., M. Ahiduzzaman, M.M. Hossain, M.A Ali, M.A.M, Biswas, M.H. Rahman, and J.C. Oink, 2015a. Physical and Chemical Characteristics of Pineapples Grown in Bangladesh. Int. J. Bus. Soc. Sci. Res.

Bartholomew, D.P., R.E. Paul, and K.G. Rorbach, 2003. The pineapple 'Botany, Production and Uses', University of Hawaii Manoa Honolulu, USA. [Available: http://bookshop.cabi.org/Uploads/Books/PDF/978085995038/]

Bastakoti, P., and D.M., Gautam, 2007. Effect of Maturity Stages and Postharvest Stages on Shelf Life and Quality of Mandarin Orange in Modified Cellar Store. Journal of Institute of Agriculture and Animal Science, 28, 65-74.

Bhusal, Y., 2002. Improvement of Postharvest Shelf Life of Mandarin Orange (Citrus reticulate Blanco), M.Sc. Thesis, Institute of Agriculture and Animal Science (IAAS), Rampur, Chitwan, Nepal.

Dubey, N., and M.N. Raman, 2013. Effect of Coolbot on shelf-life of Cabbage and Cauliflower. American International Journal of Research in Formal, Applied and Natural Sciences 13 (1):66-69.

Gautam, D.M., and G.P. Burlakoti, 2017. Fruits, plantation crops, and post-harvest Technology. Heritage publishers and Distributors, Bhotahiti, Kathmandu.

Hoffman, P.J., M.J. Decor, G.F. Meiburg, A.J. Macnish, and D.C. Joyce, 2001. Ripeningand quality responses of avocado, custard apple, mango, and papaya fruit to 1-methylcyclopropene. Australian Journal of Experimental Agriculture, 41: 567-572.

Joseph-Adekunle, T., M.A. Okelona, and I.A. Adekaya, 2010. Storage of pineapple fruits under different conditions: implication on shelf life. Nigerian Journal of Horticultural Science, 14(1), 62161.https://doi.org/10.4314/njhs.V14i1.62161.

Kabir, H., J, Howlader, T.K. Ghosh, C. Goswami, and M.A. Haque, 2010. Effect of different maturity phases and post-harvest treatments on the shelf life of pineapple. International Journal of Bio Research 2, 11-16.

Lu XH Sun, YMW DQXi, and G.M Sun, 2010. Effect of post-harvest salicylic acid treatment on fruit quality and anti-oxidant metabolism in pineapple during cold storage. The Journal of Horticultural Science and Biotechnology 85, 454-458.

Mahajan, B.V.C., A.S. Datta, and W.S. Dhillon, 2004. Effect of Pre-Storage Treatments on the Quality and Storage Life of Asian Pear. Indian Journal of Horticulture, 61, 342-344.

MoALD. 2020/21 Statistical information of Nepalese Agriculture (2019/20).Agri-Business Promotion and Statistical Division, Ministry of Agriculture and Cooperatives, His Majesty's Government of Nepal.

Paull, R.E., K.G. Rohrbach, 1985. Symptom development of chilling injury in pineapple fruit. Journal of the American Society for Horticultural Science 110, 100-105.

Rokaya, P.R., 2017. Effect of altitude and various post-harvest factors on quality and shelf life of mandarin (Citrus reticulate, Blanco) (Ph.D. thesis). Agriculture and Forestry University,Rampur,Chitwan,Nepal.

Mahajan, B.V.C., A.S. Datta, and W.S. Dhillon, 2004. Effect of Pre-Storage Treatments on the Quality and Storage Life of Asian Pear. Indian Journal of Horticulture, 61, 342-344.

Mondal, M.F., 2000. Production and storage of fruits (in Bangla). Published by Mrs. Afia Mondal. BAU Campus, Mymensingh-2202. pp-312.

Rahman, M.A., M. Shahidullah, and M.S. Haque, 1979. Studies on pineapple: Part III-The effects of different concentrations of alpha naphthalene acetic acid on the quality characteristics of mature ripe pineapples. Bangladesh J. Sci. Ind. Res., 14 (1-2): 126- 130.

Sadasivam, S., and A. Manickam, 1991. Biochemical methods for agricultural sciences- Carbohydrates. Coimbatore: Newage International Publisher.

Sidhu, G.S., W.S. Dhillon, and B.V.C. Mahajan, 2006. Effect of Waxing and Packaging on Storage and Shelf Life of Pear cv. Punjab Beauty. Haryana Journal of Horticulture Science, 35, 51-56.

Yadav, M., N. Kumar, D.B. Singh, and G.K. Singh, 2010. Effect of Postharvest Treatments on Shelf Life and Quality of Kinnow Mandarin. Indian Journal of Horticulture, 67, 243-248.