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Effect of edible coatings on physiological and Functional parameters of guava fruits (*Psidium guajava* L.) cv. L-49

GK Choupdar, ML Meena, Rakesh Jangid, Ramdhan Choupdar and PK Bairwa

Abstract
The present investigation entitled Effect of edible coatings on physiological and Functional parameters of guava fruits (*Psidium guajava* L.) was conducted during the period of February –March, 2021 in the laboratory of Department of Horticulture, Baba Saheb Bhimrao Ambedkar University Lucknow. The experiment was laid out in Completely Randomized Design (CRD) with thirteen treatments *viz.*,T1-control, T2 - Sago starch- 10%, T3 - Sago starch- 15%, T4 - Aloe vera gel-5%, T5 - Aloe vera gel-10%, T6 - Cacl2- 1%, T7 - Cacl2- 2%, T8 - Sago-10% + Guava Leaf Extract - 0.05%, T9 - Sago-15%+ Guava Leaf Extract- 0.05%, T10 - Aloe vera- 5% + Guava Leaf Extract- 0.05%, T11 - Aloe vera 10% + Guava leaf Extract -0.05%, T12 - Cacl2- 1% + Guava Leaf Extract - 0.05% and T13 - Cacl2- 2% + Guava Leaf Extract - 0.05%. the application of Cacl2- 2% + Guava Leaf Extract - 0.05% recorded highest fruit Shelf life, and. total phenol content (%) while minimum Physiological loss in weight of guava cv. L-49.

Keywords: Physiological, guava fruits, Functional

Introduction
Guava (*Psidium guajava* L.) also known Apple of tropics is one of the most common and popular fruit grown in tropical and sub-tropical regions of India (Gaur *et al.* 2014) [10]. It belongs to the family Myrtaceae. It is classified under genus Psidium which as contains 150 species but only Psidium guajava is exploited commercially. It is believed to be originated in Tropical America and it was introduced in India by Portugese during 17thcentury (Chadha, 2001) [4]. This is highly popular crop among farmers owing to its wider adaptability, prolific bearing and high remunerative in nature (Das *et al.*, 1995) [7]. In North India, Uttar Pradesh may be considered as „Home of Guava" which stands first in production and area of guava. Besides, it is cultivated in Bihar, Maharashtra, Gujarat, Madhya Pradesh, Andhra Pradesh, Tamil Nadu, Rajasthan, Karnataka, West Bengal, Orissa, Kerala and Punjab. The total area under guava of the country is 0.26 million hectares with a production of 4.05 MT (Anonymous *et al.* 2019) [2].

Application of edible coatings is considered as alternative to chemical and other harmful methods. Edible coating can be used to protect perishable food products from deterioration by retarding dehydration, providing a selective barrier to moisture, oxygen, and carbon dioxide, suppressing respiration, improving textural quality, helping to retain volatile flavour compounds, and reducing microbial growth (Dhall *et al.*, 2013) [8]. Edible coatings are transparent films which are applied over the fruit surface and it act as barrier to humidity and oxygen, (Ruzaina *et al.*, 2012) [15]. Aloe vera gel is a polysaccharide type of edible coating, which can be easily dissolved in water. Aloe vera gel is transparent, odorless and has high absorption ability. The gel acts as a protective layer on the product and the underlying cells to be protected against mechanical damage and prevents water loss. The gel is completely safe and compatible with the environment, which can act as an alternative cover in various post-harvest fruit (Choi and Chung, 2003) [6]. Sago starch is commonly used as a functional ingredient in food industries such as a thickener, stabilizer, and gelling agent. To increase starch added value is to make modifications starch to obtain properties suitable for a particular application. Sago starch has great potential to be explored in the development of edible coatings because of the abundance of materials, easy to obtain, low price, edible, and easy to recycle (renewable) and its ease to be physically modified. In addition, the high amylose composition of sago starch that is 27% has potential as a strong film-forming material.

Sago coating reduce growth of microorganisms and coating provides semi permeable barrier against oxygen, carbon dioxide, moisture and volatiles. It is an ionic compound of chlorine and calcium. At room temperature, it is a crystalline solid white in colour. It is highly soluble in water and hence is hygroscopic in nature. It is odour less and has a very high enthalpy change of solution. This compound is widely used for dust control and de-icing.

Calcium chloride was discovered in the 15th century but received little attention or study until the latter part of the 18th century. All of the early work was done with laboratory prepared samples, since it was not produced on a commercial scale until after the ammonia-soda process for manufacture of soda ash was in operation. It was actually considered a waste product until its uses were discovered. Calcium chloride molecules feature two ionic bonds between the single calcium cation and the two chloride anions. The structure of calcium chloride molecules is illustrated blow. It can be noted that the calcium cation holds a charge of magnitude +2 and each chloride anion holds a charge of magnitude -1. The compound is, therefore, electrically neutral.

In the present era trend is changing and consumer are moving toward the eco -friendly approaches. Many techniques have been developed in order to extend the shelf life of fresh fruit and vegetable *viz.* low temperature and controlled atmospheric storage, use of chemicals, growth regulators and surface coatings (Kore *et al*., 2017) [11]. Edible coatings are non-chemical in nature which does not possess any harmful effect on human health. Edible coating is a comparatively newer technique of post-harvest treatment for increasing shelf-life of fruits & vegetables which has virtually replaced old commercial methods of post-harvest treatments of fruits and vegetables due to its obvious advantage. The use of edible coatings has been also employed in enhancing the shelf life of guava. As compared to non-treated guava, coated fruits exhibited lower weight loss during storage, which is associated with the increase in shelf life and, consequently, a decrease in postharvest losses (Ribeiro *et al.*, 2020) [14]. The shelf life of guava can be significantly enhanced by the application of surface coatings.

Materials and Methods

The present investigation entitled" "Effect of edible coatings on post-harvest quality and storage of guava fruits (*Psidium guajava* L.)", was conducted during the period of February – March, 2021 in the laboratory of Department of Horticulture, Baba Saheb Bhimrao Ambedkar university Lucknow.

Preparation of edible coating solution for dipping the fruits:

Aloe vera gel coating

Aloe vera gel for coating prepared according to Adetunji *et al*. 2012. Mature leaves of aloe vera plants were procured from the forestry nursery of college of horticulture and forestry Jhalawar. Leaves were thoroughly washed in tap water and tip portion were removed and matrix was separated from cortex region of leave. It was grounded, sieved and heated at 70 ° C for 45 15 min. After cooling 2.0 g / lit ascorbic acid and 4.0 g / lit citric acid were added to aloe vera gel to maintain the viscosity of aloe vera gel. Accordingly coating of Aloe vera gel was made in 1:3, 1:2 and 1:1 ratio with water.

$CaCl_2$ Coating

Guava fruits were dipped in 1.0 and 1.5% solutions as per the treatments for 1 min and were air dried at room temperature. Similarly, for CaCl2 treatments, ten and five grams of calcium chloride were dissolved separately in 1000ml of distilled water to obtain 1.0 and 0.5 per cent calcium chloride solution. Strawberry fruits were dipped either in 0.5 or 1.0 per cent solutions as per the treatments for 10 min and were air dried at room temperature. The edible coatings were compared against untreated control.

Guava leaf extract Coating

Mature green guava leaves were collected from a commercial guava farm around Khulna city, Bangladesh. The leaves were washed with distilled water to remove the impurities. Afterwards, 250 g guava leaves were transferred to 2000 ml water and boiled at 80 °C for 3 hours. Then, the temperature of the solution was maintained at 70°C to evaporate it until 0.5% concentration of extracted solution.

Sago Coating

Sago starch (Metroxylon sagu) was obtained from local market in Bogor, Indonesia. paration of Edible Film Sago starch as raw material of edible film was firstly dried until the water content of 13% then sieved until 80 mesh, packed in plastic bag and stored in refrigerator. Whenever it was used, starch was taken out and conditioned until the temperature was constant to process as material of edible film. Sago starch was mixed with distilled water with the ratio of 1: 10 (w/v) then stirred using mixer scale 1 for 10 minutes until homogenous, then filtered using screen cloth. Starch suspension then poured into beaker glass 1000 ml and heated on hot plate and stirred continously using mixer until temperature of about 65 ºC After reaching this temperature,

Treatments of fruit

Soon after preparation of coating solutions, were allowed to cool at room temperature followed by dipping of fruits in respective solutions for 5 min. Fruits were dried at room temperature and kept in perforated cartoon boxes to examine the physico chemical quality and storage life of guava fruit.

Details of experiment

The experiment comprised of 13 treatments consisting of post-harvest treatments of Sago starch, CaCl2, Aloe vera gel, Guava leaf extract. The details of treatments, treatment combinations and detail of experiment programme have been presented in table –1.

Results and Discussion

Physiological parameters

Physiological loss in weight (%)

The effect on physiological loss in weight influenced by different coating materials. There is significant difference among all treatments at 2nd, 4th, 6th, 8th and 10th days of storage. The physiological loss in weight of guava increased with the increase in storage period (Fig.1.). The rate of PLW was slowed down significantly under all treatments as compared to control. Among all the treatments T_{13} (Cacl2-2% + Guava Leaf Extract - 0.05%) was most effective treatment and it was recorded significantly minimum Physiological loss in weight (6.80%) which is statistically at par with remaining all treatments except T1 (Control).

However, the maximum Physiological loss in weight (11.43%) was recorded with control at 2nd, 4th, 6th, 8th and 10th days of storage. This might be due to chitosan coating forms thin semi-transparent to smooth layer on the pericarp surface (Dong *et al.*, 2004) [9] and can be used as a protective barrier to reduce respiration and transpiration rates through fruit surfaces. Similar result found on coating treatment of $Cacl_2$ by Ali *et al.*, (2011) in papaya, Mandal *et al.*, (2021) [13] in guava, Deb & Gautam (2018) in sapota. In 24 control condition physiological loss in weight was high, because of higher rate of transpiration, respiration and evaporation.

Table 1: Effect of edible coatings on Physiological loss in weight (%) of guava fruits

Treatments	Physiological loss in weight (%)					
	0 day	2nd Day	4th Day	6th Day	8th Day	10th Day
T1: Control	0.0	3.13	6.78	8.79	11.31	11.43
T2: Sago starch- 10%	0.0	2.79	6.11	6.17	8.09	8.43
T3: Sago starch- 15%	0.0	2.39	6.56	7.99	8.37	8.62
T4: Aloe vera gel-5%	0.0	2.27	4.86	7.69	7.55	8.07
T5: Aloe vera gel-10%	0.0	2.43	5.29	7.21	7.49	8.03
T6:Cacl2- 1%	0.0	2.05	4.85	7.10	7.43	7.99
T7:Cacl2- 2%	0.0	1.46	4.49	7.08	7.41	7.98
T8: Sago-10% + Guava Leaf Extract - 0.05%	0.0	2.22	4.65	7.07	7.30	7.90
T9: Sago-15%+ Guava Leaf Extract- 0.05%	0.0	2.22	4.57	7.04	7.28	7.89
T10: Aloe vera- 5% + Guava Leaf Extract- 0.05%	0.0	2.24	4.30	7.01	7.06	7.73
T11: Aloe vera 10% + Guava leaf Extract - 0.05%	0.0	1.78	4.03	6.57	6.49	7.36
T12:Cacl2- 1% + Guava Leaf Extract - 0.05%	0.0	1.56	5.43	5.90	6.64	7.52
T13:Cacl2- 2% + Guava Leaf Extract - 0.05%	0.0	1.51	3.64	4.50	5.50	6.80
S.Em±	0.0	0.23	0.22	0.13	0.12	0.64
C.D. at 5%	0.0	0.66	0.65	0.37	0.33	1.86
C.V.%	0.0	22.81	18.95	15.02	17.83	13.42

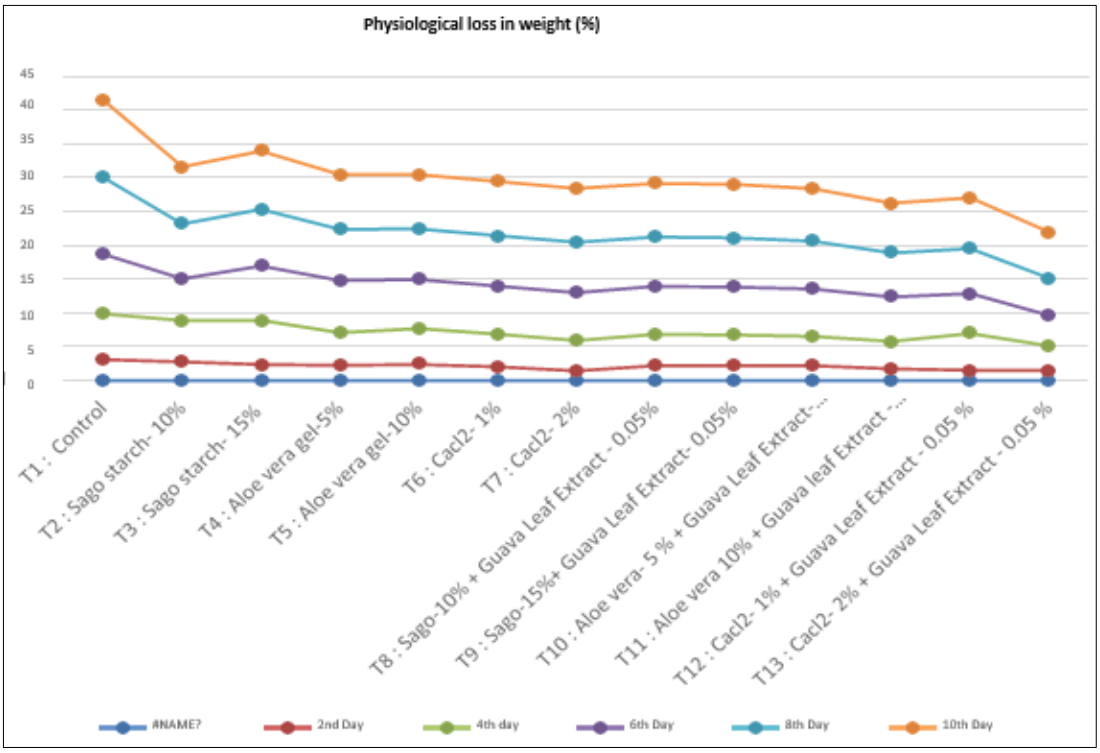

Fig 1: Effect of edible coatings on Physiological loss in weight (%) of guava fruits

Shelf life (Days)

The shelf life was affected significantly by post-harvest treatments in guava. The shelf life of guava was significantly increase under all treatments as compared to control. Among all the treatments T13 (Cacl2- 2% + Guava Leaf Extract - 0.05%) was most effective treatment and it was recorded significantly maximum shelf life (16.33 days). However, the lowest shelf life (9.35 days) was recorded with control. Cacl2 coated fruits had higher shelf life it might be due to Cacl2 had better fruit quality with minimum spoilage per cent and reduces shrinkage of fruits by reducing loss of moisture and degradative metabolism in terms of catalase and PME activities are helpful in retains freshness of fruits and extending shelf-life of the fruits. Similar result found in coating treatment of Cacl2 by Deb & Gautam (2018) in sapota and Bhavna *et al.*, (2018) [3] in ber.

Table 2: Effect of edible coatings on Shelf life (Days) of guava fruits

Treatments	Shelf life (Days)
T_1: Control	9.35
T_2: Sago starch- 10%	10.20
T_3: Sago starch- 15%	11.00
T_4: Aloe vera gel-5%	11.80
T_5: Aloe vera gel-10%	11.95
T_6: $Cacl_2$- 1%	12.45
T_7: $Cacl_2$- 2%	13.45
T_8: Sago-10% + Guava Leaf Extract - 0.05%	14.00
T_9: Sago-15%+ Guava Leaf Extract- 0.05%	12.40
T_{10}: Aloe vera- 5% + Guava Leaf Extract- 0.05%	13.25
T_{11}: Aloe vera 10% + Guava leaf Extract -0.05%	14.78
T_{12}: $Cacl_2$- 1% + Guava Leaf Extract - 0.05%	15.66
T_{13}: $Cacl_2$- 2% + Guava Leaf Extract - 0.05%	16.33
S.Em±	0.11
C.D. at 5%	0.33
C.V.%	16.01

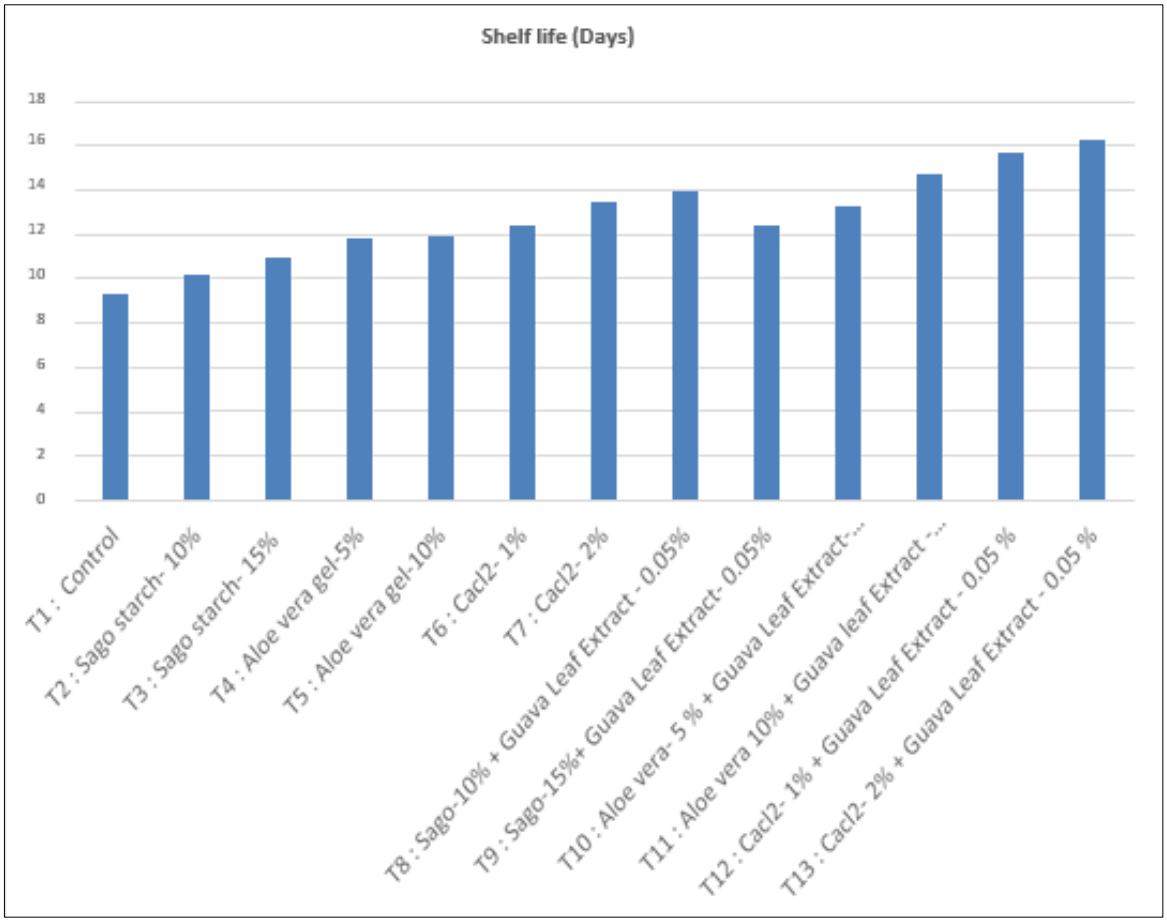

Fig 2: Effect of edible coatings on Shelf life (Days) of guava fruits

Functional Parameter

Total phenol content (%)

The result indicated significant effect of edible coatings on total phenol content (%) of guava fruits. There is significant difference among all treatments at 2nd, 4th, 6th, 8th and 10th days of storage. Among all the treatments, T13 (Cacl2- 2% + Guava Leaf Extract - 0.05%) was found significantly maximum total phenol content (155.73%) which is statistically at par with remaining all treatments except control. However, minimum total phenol content (155.29%) was observed with control. Cacl2 coated fruits contain high phenol, it might be due the compound acting as elicitors produced in host cells and reduction of ripening rate and respiration, which lead to maintained phenol during storage period. Similar result found on coating treatment by Chauhan *et al.*, (2014) [5] in mango and Krishna & Rao (2017) [12] in guava.

Table 3: Effect of edible coatings on Total phenol content (%) of guava fruits

Treatments	Total phenol content (%)					
	0 day	2nd day	4th Day	6th Day	8th Day	10th Day
T_1: Control	182.0	181.22	179.22	171.15	168.21	155.29
T_2: Sago starch- 10%	182.0	181.23	179.24	172.27	168.29	155.43
T_3: Sago starch- 15%	182.0	181.24	179.25	172.26	168.26	155.48
T_4: Aloe vera gel-5%	182.0	181.26	179.26	172.27	168.27	155.52
T_5: Aloe vera gel-10%	182.0	181.30	179.31	172.32	168.33	155.55
T_6: $Cacl_2$- 1%	182.0	181.32	179.33	172.34	168.35	155.57
T_7: $Cacl_2$- 2%	182.0	181.32	179.35	172.36	168.36	155.58
T_8: Sago-10% + Guava Leaf Extract - 0.05%	182.0	181.33	179.35	172.36	168.36	155.59
T_9: Sago-15%+ Guava Leaf Extract- 0.05%	182.0	181.33	179.35	172.36	168.38	155.67
T_{10}: Aloe vera- 5% + Guava Leaf Extract- 0.05%	182.0	181.34	179.35	172.36	168.36	155.64
T_{11}: Aloe vera 10% + Guava leaf Extract -0.05%	182.0	181.33	179.37	172.38	168.38	155.68
T_{12}: $Cacl_2$- 1% + Guava Leaf Extract - 0.05%	182.0	181.33	183.38	174.27	159.75	155.70
T_{13}: $Cacl_2$- 2% + Guava Leaf Extract - 0.05%	182.0	181.29	179.64	173.06	167.61	155.73
S.Em±	-	0.01	0.01	0.18	0.01	0.08
C.D. at 5%	-	0.02	0.04	0.52	0.02	0.24
C.V.%	-	0.02	0.63	0.39	1.41	0.08

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