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Evaluation of pectin based edible coating impregnated with mango leaf extract to reduce the post-harvest losses of tomato

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ABSTRACT

Edible coating is any type of material used for enrobing, coating or wrapping various food to extend the shelf life of the products and also to protect the fruits from microbial contamination. Tomato (Lycopersicon esculentum) is a highly perishable produce and it gets spoiled quickly due to various post harvest conditions, so considering these facts our research work was conducted to evaluate the efficacy of pectin based edible coating impregnated with Mango leaf extract on the Physicochemical parameters of the produce. The present work was carried out by preparing an edible coating solution which consists of pectin (5%), glycerol (1%), Mango leaf extract (2%) and the fresh Tomato were immersed into the edible coating solution and stored under room temperature. The fruit sample was then divided into two slots T1(uncoated samples) and T2(coated samples).Both coated and uncoated tomato samples were stored under ambient temperature(30℃). The effect of pectin based edible coating impregnated with Mango leaf extract on physicochemical properties of the tomatoes were studied and recorded. Comparison was made on the physico-chemical properties of both uncoated and coated sample and results were tabulated. With the obtained results it was concluded that the prepared edible coating solution protected the sample from deterioration when compared with the uncoated samples and the shelf life of coated sample was extended to 15 days under ambient temperature.

Keywords: *Edible coating, Enrobing, Wrapping, Pectin, Deterioration.*

1. INTRODUCTION

Fruits and vegetables during storage undergo many physiological changes such as Tissue softening, increase in sugar level, and decrease in organic acids level, degradation of chlorophyll accompanied by the synthesis of anthocyanins or carotenoids upon maturation, production and losses of volatile compounds, decrease in phenolic and amino acids contents and breakdown of cell materials due to respiration. Due to their physiological changes during storage fruits spoil quickly. Preserving fruits and vegetables during their Post harvest storage is a very big challenge to the world. Edible coating is an emerging technology developed to protect the fruits from their Post harvest losses. The best part of the edible coating is that these are edible, healthy and biodegradable in nature, unlike other chemical post harvest treatments which have a residue (Kumar R and Kapur S et al.,2016) Tomato (*Lycopersicon esculentum)* is one of the most important vegetable in the world vegetable economy as they are loaded with more nutrients and Health benefits. They are a major source of Antioxidants, Carotenoids, Vitamins and Tocopherols. The major carotenoids present in tomatoes are Lycopene and these Lycopene possess the greatest antioxidant activity. The fresh tomato consists of 90% of Water which makes tomato highly perishable. Tomato fruits are still alive and respire and its quality changes continuously after harvesting. During this period tomato fruits ripen. Although ripening makes fruit edible it also initiates the gradual deterioration of fruit quality. They may become overripe quickly depending upon their temperature and storage conditions.This results in loss of quality and restricted shelf life. In order to overcome these problems, we have developed a pectin based edible coating solution impregnated with Mango leaf extract to protect the fruit from microbial contamination and also to extend the shelf life of the produce. In food applications, edible coating is applied to foods by several methods such as dipping, spraying, fluidized bed coating, electro stating coating followed by drying. Edible coating materials which are used in food processing fields are classified into three types: hydrocolloids (proteins and polysaccharides), lipids (fatty acids and glycerol) and composites. In our work we have used polysaccharide based edible coating material called Pectin. The hydrophilic polysaccharides components are found to have good mechanical properties. Among polysaccharides, chitosan derivatives, cellulose, alginate, pectin, seaweed extract and starch are most commonly used in the preparation of edible films and coatings (Bourtom,2008).These films and coatings are also used as the carrier of many additives such as Antimicrobial, Anti softening, Antioxidant and Nutraceuticals (Rosa and Jonathan,2012)

Pectin belongs to the class of complex water-soluble polysaccharide used to form coatings. It is a purified carbohydrate product obtained by aqueous extraction of some edible plant material usually citrus fruits or apples. Pectin coatings have been also studied for their ability to retard lipid migration, moisture loss and to improve appearance and handling of foods (Moalemiyan Mitra et al., 2012).In our work we have used pectin obtained from guava. Guava (*Psidium guajava* L.) fruit not only consists of Exotic flavor but also is a rich source of low Methoxylated pectin (50%) amounting to more than 10% of dry weight. Pectin not only used as functional ingredient in food but also as a wide application in the pharmaceutical industries. Pectin has been shown to reduce cholesterol levels and it also decrease cancer tumor formation (Liu Y et al.,2006).The new emerging technique in edible coating technology is impregnating Herbal leaf extracts into the edible coating solution. The herbal extracts contains antimicrobial, antioxidant and therapeutic properties and also it acts as a Nutraceutical. Mango (*Mangifera indica L.)* Leaves are a rich source of phenolic compounds with strong antioxidant power, particularly Mangiferin a special Xanthone commonly called as "Super-antioxidant" because of their potent antioxidant capacity. Due to its antioxidant properties mango leaves extract can also be used as natural preservative in food applications (Morsi et al., 2010).

2. MATERIALS AND METHODS

2.1 Collection of Material

Fresh Tomatoes were purchased from the local market of Coimbatore, Tamilnadu. Tomatoes with physical damage were discarded. The tomatoes were washed with chlorine water to remove the impurities and surface microorganisms. The fruits were then randomly separated into two slots (T1) and (T2). One slot of fruits will be dipped in prepared edible coating solution and the other slot will be the uncoated sample.

2.2. Method of Extraction

2.2.1 Extraction of Pectin from Guava fruit peel: Guava Fruit was obtained from the local market of Coimbatore, Tamilnadu. The fruit was washed with distilled water to remove the impurities and then peeled. Peels were then cut into small pieces for efficient drying .The peels were then dried in an hot air oven drier at 65°C for 6hours .The Dried peels were then grinded to prepare fine powder.20g of guava peel powder was added in 250ml distilled water. The mixture was then boiled with 0.01N HCl at a temperature of 70℃ for 2 hours. The extract obtained was then filtered through muslin cloth. The Filtrate obtained was cooled to 4℃. The filtrate was then precipitated with 96% Ethanol. The pectin was then filtered from the precipitate through muslin cloth. The pectin was then put in tray drier at 70℃ for 2 hours. The pectin obtained is then grinded to fine powder.

2.2.2 Preparation of Mango leaf Extract: Fresh mango leaves were collected and the leaves were washed thoroughly in order to remove any impurities. After washing the leaves were shadow dried for 4 days and the dried leaves were grinded into fine powder using a electric blender and the powdered material is boiled in water for about 20minutes. Then it is filtered using muslin cloth. The filtrate obtained was concentrated and the concentrate was transferred to hot air oven and it was dried at 77℃ for about 3 hours and the dried material is finely grinded to obtained the dried mango leaf extract powder.

2.2.3 Preparation of Edible coating solution: The pectin (5%), glycerol (1%), mango leaf extract (2%) was dispersed in 100ml distilled water and the solution was mixed for 10mins.After mixing, the solution is cooled to room temperature and the fresh Tomato fruits were dipped into the Edible coating solution and it is air dried for 2 hours and it is stored in room temperature.

2.3 Physico-chemical analysis

Before Analyzing the Physicochemical parameters of the Tomatoes.The Tomato samples were divided into two slots. The first slot consists of Uncoated sample (T1) and the second slot consists of pectin coated Tomato sample(T2).The physico-Chemical parameters were calculated for both coated and Uncoated Tomato sample.

2.3.1Weight loss: For calculating the weight loss, Samples from both coated and uncoated treatments were selected and were weighed using an Electric Weighing Balance. The weight loss in both coated and uncoated samples is measured using the following formula (Mir, Muhammad et al., 2014).

$$Weight\ loss\ \% = \frac{Initial\ weight - Final\ weight}{Initial\ weight} \times 100$$

2.3.2Total soluble solids: The TSS content of the fruit was determined by using a Refractometer. Refractometer measure the refractive index of the solution by using the phenomenon of light refraction or total internal reflection of light. The TSS of the fruit was determined by placing a few drops of juice on the prism of Refractometer and direct reading was taken from the scale in meter according to AOAC (1994).

2.3.3Titratable acidity: The Titratable acidity was determined according to the method of Mazumdar and Majumder(2003) by titration of 5ml of sample with 0.1N Sodium hydroxide using phenolphthalein as an indicator and the results were expressed as the percent of citric acid.

2.3.4 Reducing sugars: 5 grams of sample is placed in test tube and same amount of Benedict's reagent is added. The test tube is placed in hot water bath at 100℃ for 5 minutes. The color changes indicate the amount of reducing sugar present in the sample.

2.3.5 Sensory evaluation: Sensory evaluation of Pectin coated tomato was conducted using a 9 point hedonic scale to check its acceptability level. The scale includes 9 points from dislike extremely to like extremely for four parameters which includes Texture, Colour, Flavour and Overall acceptability.

3. RESULTS AND DISCUSSION

3.1 Weight Loss

Weight loss is the most important factor which is calculated to determine the quality of the Produce during their Post harvest storage. Both coated and uncoated Tomato sample showed significant weight loss throughout their storage period. But the uncoated sample showed more weight loss when compared to the coated sample. From the result it is evident that Pectin along with impregnated mango leaf extract coating has shown a better effect on reducing the weight loss of Tomato which resulted in extended shelf life of the produce.

Table 1: Weight loss (%) values of coated and uncoated tomatoes

S no.	Sample	Storage period Days					
		0	3	5	7	13	15
1.	T1(Uncoated)	2.32	9.45	18.67	28.67	35.65	44.56
2.	T2(Coated)	2.45	2.67	8.45	10.57	15.67	18.57

3.2 Total soluble solids

According to the obtained results the TSS of the both coated and uncoated samples were measured to be 21 degree brix at the first day of storage and as the storage time prolonged the TSS increased in both coated and uncoated samples. In case of uncoated samples the TSS increased to 48 degree brix at the 15th day of storage due to the excess ethylene production. But in case of coated samples the TSS increased from 21to 32 during the end of 15th day. But the increase rate was slow in coated sample when compared to the uncoated samples. This is due to the pectin coating which modifies the internal gas atmosphere which resulted in decreased ethylene production so the TSS value begin to increase in slower rate in coated sample

Table 2: TSS (Brix) values of coated and uncoated tomatoes

S no.	Sample	Storage period Days					
		0	3	5	7	13	15
1.	T1(Uncoated)	21	25	35	39	42	48
2.	T2(Coated)	21	24	27	28	30	32

3.3 Titratable Acidity

The results of the current study prove that there is a significant decrease in titratable acidity both in coated and uncoated samples. The Titratable acidity of the both coated and uncoated samples were 1.56 during the first day of storage and the Titratable acidity of the uncoated sample reached 0.10 at the 15th day of storage and the Titratable acidity of the coated sample reached 0.32 at the 15th day of storage. But the decrease rate was slow in coated sample when compared with the uncoated sample.

Table 3: Titratable acidity (%) values of coated and uncoated tomatoes

S no.	Sample	Storage period Days					
		0	3	5	7	13	15
1.	T1(Uncoated)	1.56	0.42	0.40	0.35	0.23	0.10
2.	T2(Coated)	1.56	0.95	0.65	0.56	0.45	0.32

3.4 Reducing sugars

The Reducing sugar was found to decrease in the uncoated sample when compared to that of the coated sample. Edible coating reduces the respiration rate and reduces the losses in reducing sugar. The change in reducing sugar content during ripening of the coated tomato is less.

Table 4: Reducing sugars (%) values of coated and uncoated tomatoes

S no.	Sample	Storage period Days					
		0	3	5	7	13	15
1.	T1(Uncoated)	3.7	3.2	2.4	2.35	2.2	2.0
2.	T2(Coated)	3.7	3.6	3.54	3.45	3.38	3.32

3.5 Sensory Evaluation

The above table indicates the score of parameters on an average scale of 10.The colour of the sample was given a score of 8 and for texture, flavour and overall acceptability 9 was found to be an average score. This indicates that the pectin coated tomato sample has good acceptability and the reviews obtained while evaluation was good.

Table 5: Sensory Evaluation of Pectin Coated Tomato Sample

Parameters	1	2	3	4	5	6	7	8	9
Color	8	7	6	7	8	8	9	7	8
Texture	9	8	8	9	9	8	9	9	8
Flavor	9	8	8	9	9	8	9	8	9
Overall Acceptability	9	9	8	8	9	9	8	8	9

4. CONCLUSION

The coating of tomatoes by dipping them in Pectin based coating solution impregnated with Mango leaf extract was found to increase the storage attributes and hence has the potential to increase the shelf life of Tomatoes. The shelf life of the pectin based edible coated tomatoes were 15 days under ambient temperature while the uncoated tomato sample had a shelf life of about 5 days under ambient temperature. The addition of mango leaf extract to pectin based edible coating was found to increase the storage attributes acting as anti-microbial and anti-oxidant properties. Other Physicochemical parameters such as weight loss, Total soluble solids, Titratable acidity, reducing sugars were analyzed for both coated and uncoated samples. The results proves that that pectin coated fruit samples showed superior results than uncoated sample in most quality attributes.

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