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Effect of calcium pectate on the physiochemical changes during the ripening of bitter gourd fruit (*Momordica charantia* L Var-Co-1)

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ABSTRACT

The present investigation was aimed to study the effect of calcium pectate on the ripening of momordica charantia l. var -co-1 fruits. The fruits were treated with different micro molar concentration of (50, 70 and 100 µm) calcium pectate. All the studies were carried out using the fruit pericarp tissue individually both in the treated and control fruits and the following results were obtained during the ripening process. The fruit firmness and titratable acidity decreased while the total soluble solid and ph increased during ripening. Among the different concentration of calcium pectate (50, 70 and 100 µm). The 70 µm concentration treated fruits alone had more delaying effect then that of other treatment during the ripening process.

Keywords: calcium pectate, fruit firmness, titratable acidity, *momordica charantia*, Total soluble solid and pH.

INTRODUCTION

The calcium ion is known to be involved in many fundamental physiological plant processes involving cell walls, membranes, chromosomes, and enzyme activation. In post-harvest physiology, disorders such as bitter pit in apples have been directly linked to low Ca content of the fruits. It has been suggested that such disorders result from increased respiration rate following membrane permeability changes. Higher Ca levels are seen in the fresh depressed preclimacteric, climacteric, and post climacteric respiration of apples. The same inhibitory effect was observed on respiration of apple Mitochondria [1]. Physio-chemical characteristic features such as fruit firmness, total soluble solid, titratable acidity and pH changes during fruit ripening were studied by several workers in detail [2-11].Firmness is one of the major quality indicators of fruit and has been used a useful guide for producers, quality inspectors and consumers. Firmness is used especially as an indication of the handling characteristics of many fruit, and picking and grading of fruit may be based on firmness measurements. Traditional destructive methods such as penetrometers or compression tests have been used to estimate the firmness of fruit [12]. In banana, changes in mechanical properties of pulp and peel during ripening decreasing fruit firmness was associated with fruit softening [5]. The effect of various concentrations of ethanol or acetaldehyde vapour on banana during ripening showed that the weight loss, fruit firmness and titratable acidity decreased and TSS gradually increased [13].[6] studied the changes in the physico-chemical and bio-chemical compositions of custard apple (*Annona squamosa* L.) fruits during growth, development and ripening. In cherimoya fruits during ripening, considerable loss in firmness was recorded and the soluble solid increased progressively from 13.3 to 18.7 Brix and pH of juice decreased strongly. On the other hand, titratable acidity increased from 0.06 to 0.36 g of citric acid equivalent in 100g fresh weight [3]. In apple a cultivars of gala, golden delicious and fuji during ripening the TSS and fruit firmness were determined by [7]. Fruit firmness and grape berry maturation and development of different rheological parameters during ripening were studied [14]. [8] Observed the physic-chemical changes such as fruit firmness, titratable acidity and pH during

the storage and ripening of papaya fruit. Though no change was observed in titratable acidity the pH was slightly increased. The objectives of this study were to find out the efficacy of different concentration calcium pectate on the physiochemical changes during ripening of bitter gourd fruit.

MATERIALS AND METHODS

The detached fruit of *Momordica charantia* L. Var-Co-1 has been selected for the present ripening study. *Momordica charantia* L. Var-Co-1 seeds were obtained from Tamil Nadu Agricultural University, Coimbatore. *Momordica charantia* was grown in the green house of the Botany Department of Annamalai University. The mature green fruits were harvested whenever required for the experimental study. The unripe mature green fruits were stored in the laboratory of Botany Department at room temperature of 28 ± 2°C with a humidity of 85 per cent. The mature green fruits took about five days for their complete ripening. The fruits were treated with Calcium pectate of different micromolar concentration (50, 70, and 100 µM). All the experiments were conducted daily with seven replicates. The pericarp of the fruit was used to study the ripening process.

PHYSIO-CHEMICAL STUDIES

Fruit firmness

Fruit firmness was determined by using screw gauge, by hand force.

Total soluble solid

Total soluble solids in the fruits were determined by using a refractometer P_{20} model RL2 and their concentration was designated in Brix degree at 33°C.

Total titratable acidity

The fruit juice was obtained from 100 g of the fruit. The total titratable acidity was determined by diluting the juice with 25 ml of deionized water, and titrating to pH 8.1 with 0.1 M sodium hydroxide. Results were expressed in citric acid equivalent in 100 g of fresh weight.

pH

The range of pH was determined by the pH meter. 100 g of pericarp tissue was ground with mortar and pestle. Fruit juice was diluted with 25 ml of deionized water and the pH was estimated.

RESULTS

In the present investigation the mature detached fruit of *Momordica charantia* L. Var-Co-1 was used to study the ripening process and the fruits were treated with different micro molar concentration of (50, 70 and 100 µM) calcium pectate. The colour changes from green to yellow with in the 4 day the 5^{th} day the fruit got split into several valves with over ripening.

Changes in the physio-chemical characters

Fruit firmness and total soluble solid

The results on the fruit firmness and the total soluble solid changes are presented in Table - 1. The fruit firmness gradually decreased while the total soluble solids increased during ripening both in the control and treated fruits. The level of increase/decrease in the content was slow in 70 µM treated fruits.

Titratable acidity and pH

The results in the titratable acidity and pH changes are presented in the Table - 2. The titratable acidity gradually increased on the other hand the pH gradually decreased both in the control and treated fruits during the ripening. The level of the increase/decrease in the content was slow in 70 µM treated fruits.

Table - 1. Effect of calcium pectate on the changes in the fruit firmness and total soluble solids during the ripening of fruit of bitter gourd (*Momordica charantia* Linn.)

(Values are mean ± SE of seven samples expressed in Kg cm^2 and Brix %)

Days	Fruit firmness				Total soluble solids			
	Control	50 µM Calcium pectate	70 µM Calcium pectate	100 µM Calcium pectate	Control	50 µM Calcium pectate	70 µM Calcium pectate	100 µM Calcium pectate
	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE
1	2.86 ± 0.228	4.89 ± 0.342	4.67 ± 0.373	4.92 ± 0.393	0.00 ± 0.00	0.01 ± 0.008	0.02 ± 0.014	0.01 ± 0.008
2	2.45 ±0.171	4.33 ± 0.259	4.10 ± 0.287	4.15 ± 0.290	0.00 ± 0.00	0.01 ± 0.007	0.02 ± 0.016	0.02 ± 0.014
3	2.12 ± 0.127	5.58 ± 0.246	3.27 ± 0.196	3.87 ± 0.232	0.01 ± 0.005	0.01 ± 0.006	0.03 ± 0.015	0.03 ± 0.015
4	2.07 ± 0.124	3.00 ± 0.150	3.10 ± 0.155	3.10 ± 0.186	0.02 ± 0.012	0.02 ± 0.001	0.03± 0.018	0.03 ± 0.018
5	2.00 ± 0.100	2.80 ± 0.168	3.00 ± 0.24	2.70 ± 0.185	0.05 ± 0.003	0.03 ± 0.024	0.03 ± 0.024	0.04 ± 0.024

Table - 2. Effect of calcium pectate on the changes in the titratable acidity and pH during the ripening of fruit of bitter gourd (*Momordica charantia* Linn.)

(Values are mean ± SE of seven samples expressed in % bases citric acid equivalent)

Days	Titratable acidity				pH			
	Control	50 µM Calcium pectate	70 µM Calcium pectate	100 µM Calcium pectate	Control	50 µM Calcium pectate	70 µM Calcium pectate	100 µM Calcium pectate
	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE
1	4.5 ± 0.36	4.3 ± 0.344	5.2 ± 0.416	4.9 ± 0.392	5.98 ± 0.478	6.38 ± 0.510	6.06 ± 0.484	5.76 ± 0.460
2	4.0 ±0.28	3.9 ± 0.273	5.0 ± 0.350	4.2 ± 0.294	5.70 ± 0.456	6.07 ± 0.485	6.10 ± 0.427	5.85 ± 0.409
3	3.0 ± 0.24	3.7 ± 0.222	4.8 ± 0.288	3.2 ± 0.192	5.80 ± 0.406	6.10 ± 0.427	6.13± 0.367	6.06 ± 0.363
4	3.5 ± 0.21	2.9 ± 0.174	4.0 ± 0.240	3.7 ± 0.185	5.87 ± 0.352	6.19 ± 0.371	6.29 ± 0.377	6.24 ± 0.499
5	3.4 ± 0.17	3.3 ± 0.165	3.5 ± 0.225	3.0 ± 0.24	5.90 ± 0.295	6.46 ± 0.313	6.31 ± 0.310	6.79 ± 0.309

DISCUSSION

Calcium is an element that differs from others by being imported into fleshy fruit only in small amounts, much less than into leaves. Although Ca is sufficiently available in the soil of most orchards, localized Ca deficiency may become a problem in several fruit and vegetable crops, with the risk of large economic losses. The fruit firmness gradually decreased while the total soluble solids increased during ripening both in the control and treated fruits. The level of increase/decrease in the content was low in 70 µM treated fruits (Table-1). The titratable acidity gradually increased on the other hand and pH gradually decreased both in the control and treated fruits during the ripening the level of the increase/ decrease in the content was slow in 70 µM treated fruits (Table-2).The effect of various concentration of ethanol vapour on banana ripening showed that titratable acidity decreased and total soluble solid gradually increased [13] The results on titratable acidity and total soluble solid during ripening of the fruit of *Momordica charantia* coincide with the finding of [13]. Similar results were obtained by [7] In apple cultivars of gala, golden delicious and Fuji during ripening, the studies on [3] and [15] Showed that in the fruit firmness while the total soluble solid increased on the other hand, the pH was decreased in *Momordica charantia* the titratable acidity decreased during fruit ripening. Fruit flesh firmness of the two tomato cultivars showed a progressive decline during ripening. Most of this decline occurred between the light-pink and canning-ripe stages. A similar drop in flesh firmness was reported in guava [16], banana [17] and mango [18]. In general, the level of organic acid declined during frit ripening probably due to their utilization in the respiratory metabolism [2].

CONCLUSION

In these studies among the different concentration of calcium pectate treatment, 70**µ**M alone had more delaying effect than that of other concentration and control.

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