PHYSICO-CHEMICAL STUDIES DURING THE RIPENING OF THE FRUIT OF *LYCOPERSICON ESCULENTUM* MILL VAR. NAVEEN

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ABSTRACT

A correlative study on physico-chemical changes during fruit ripening in *Lycopersicon esculentum* has been carried out. The tomato fruit was collected at its four successive stages viz. 1. Mature green, 2. Half ripened, 3. 3/4th - ripened and 4. Fully ripened for its physico-chemical analysis. The obtained result showed that with advancement of fruit maturation the amount of pigments (total carotenoids, lycopene), total sugars, reducing sugars increase significantly. While that of physio chemical studies of weight of fruit, pulp, peel and volume of fruit decrease gradually. However TSS, titrable acidity, PH, ascorbic acid, tannins as moisture of tomato fruits could be considered as maturity indices to judge the ripening stages of tomato fruits for various value added products preparation.

1. INTRODUCTION

Lycopersicon esculentum Mill var. *Naveen* is one of the most important and widely cultivated vegetables in India and according to (FAD, 2001) the annual production of tomato in India was 4,500 MT, there is increasing evidence that diet can play an important role in human health by providing important substances that increase the body defence system against several diseases. Tomato is a major contribution of carotenoids (especially lycopene), phenolics, vitamin C, and small amount of vitamin E in daily diet (Khachik *et al.*, 2002). Ripening stage of fruit affects physico-chemical parameters of fruit which ultimately affects the quality of processed product prepared from them. Hence, an experiment was undertaken to study the effect of different stages of ripening on physico-chemical parameters of tomato fruits.

2. MARERIALS AND METHODS

The present investigation was conducted at the Department of Botany, Annamalai University, Annamalainagar, India during the year 2013. Well matured fruits of uniform medium size of cv. *Naveen* were collected, washed with tap water and kept in the laboratory at an ambient temperature for ripening. *Lycopersicon esculentum* fruits of different stages of ripening viz. 1. Mature green, 2. Half ripened, 3. 3/4th - ripened and 4. Fully ripened were selected and used for physico-chemical analyses. The experiment was conducted by the following complete randomized design with 4 levels of ripening stage with 5 replications. To study the physico-chemical characteristic, 10 tomato fruits from each ripening stage were randomly selected and examined individually for various physical parameters. The average of 10 fruits has been reported for each physical parameter. For chemical analysis of tomato fruit from different ripening stages was taken for estimating various chemical parameters. Moisture and TSS were estimated by the method described by (Anon, 1975). However, reducing sugar, total sugar, titratable acidity, ascorbic acid and tannin content were estimated by the methods described by (Ranganna, 1977). The PH was measured by using standard solutions of PH 4.0 and 7.0 as reference to calibrate.

3. RESULTS AND DISCUSSION

Weight of fruit and peel, weight of pulp, volume of fruit, length and diameter and colour of fruit from mature green stage to fully ripened stage of tomato fruit. The fruit weight ratio showed decreasing trend from mature green stage to fully ripened stage. This decreasing trend obtained during ripening of tomato fruit may be attributed to loss of moisture due to respiration and transpiration during ripening process. The present study of decreasing trends in weight, volume, length and diameter of fruit are supported by (Pawar, 1988) karonda fruit. Minimum weight of peel observed at fully ripened stage (4.25 g) was the impact loss of maximum moisture from skin. However, increase in gravity of fruits from 1.02 (Mature green stage) to 1.05 (3/4th – ripened stage) during ripening indicated that, the decrease in weight of fruit was lesser than the corresponding decreasing in its volume. Similar observations have been reported by (Joshi *et al.*, 1986) for karonda fruits. The colour of the tomato fruit changed from green (Mature green stage) to red (Fully ripened stage) during ripening (Table – I).

It is observed from (Table – II) that, all the chemical parameters studied showed significant difference with respect to ripening stage of fruit, except moisture content of fruit. Total soluble solids total and reducing sugar content of tomato fruit at different stages of ripening increased significantly from Mature green stage (18.0 °Brix, 14.40 % and 8.75%) to 3/4th – ripened stage (23.56 °Brix, 17.12% and 11.08%) with slight decline at Fully ripened stage (22.60 °Brix, 18.20% and 10.11%). An increase in TSS and sugars during ripening process in tomato fruit may probably be due to accumulation of more sugars in the fruit due to hydrolysis of starch and slight decline at fully ripened stage was due to utilization of sugars during respiration process. The results of this investigation are in agreement with the results obtained by (Raut, 1999) in sapota fruit. Decrease in acidity from mature green stage (10.20%) to fully ripened stage (0.9%) observed during ripening may be attributed to the oxidation of organic acids (Hulme, 1970). The increase in PH from 4.20 to 5.30 during ripening of tomato fruit may be attributed to the decrease in acidity during ripening. Results of the present study are supported by (Paralkar, 1985) in sapota and (Pawar, 1988) in karonda fruit.

An increase in ascorbic acid content in fruit though to be indication that the fruit still in the ripening stage, while a decrease indicates a senescent fruit (Esteves *et al.*, 1984). The presence of phenolics in the fruit cells may help to maintain the ascorbic acid content. Ascorbic acid content of tomato fruit decline throughout the ripening process from 12.60mg/100g (Fully ripened stage) due to oxidative destruction during ripening (Hulme, 1970). Identical observation during ripening were also reported by (Suryanarayana and Goud., 1984) in sapota fruit. Sharp decrease in tannins was observed during ripening of tomato fruit. This may due to the fact that tannins are hydrolysed into components like sugars, acids and other compounds during ripening and also due to its oxidation by polyphenol oxidase to form colour pigment. Similar results were reported by (Swant, 1989). The moisture content of tomato fruit decreased continuously from Mature green stage (60.80%) to Fully ripened stage (52.80%). However, the results were non significant. Decline in moisture of tomato fruit during ripening could be attributed to the loss of moisture through respiration and transpiration. Similar findings were also reported by (Raut, 1999) in sapota fruits.

Table – I Physical parameters of *Lycopersicon esculentum* during ripening

Ripening Stages	Weight of fruit (g)	Weight of peel (g)	Weight of pulp (g)	Volume of fruit (ml)	Specific gravity	Length of fruit	Diameter of fruit	Fruit colour
Mature green	95.23	7.26	84.41	92.51	1.02	5.54	5.53	Green
Half- ripened	92.87	8.43	81.84	88.54	1.05	5.59	5.39	Greenish yellow
3/4th – ripened	85.62	8.74	73.34	78.09	1.05	5.43	5.32	Yellowish red
Fully ripened	60.66	4.25	54.28	59.32	1.02	4.85	4.78	Completely red
S.Em ±	1.65	0.39	2.18	1.41	0.01	0.25	0.19	-
C.D at 1%	6.78	1.57	8.73	5.78	0.03	1.07	NS	-

Table – II Chemical composition of *Lycopersicon esculentum* during ripening

Ripening Stages	T.S.S (°Brix)	Total sugars (%)	Reducing sugars (%)	Titrateable Acidity (%)	pH	Ascorbic acid (mg/100g)	Tannins (%)	Moisture
Mature green	18.00	15.40	8.75	0.20	4.02	12.60	0.45	60.80
Half- ripened	22.50	16.75	9.90	0.21	5.60	15.23	0.29	74.10
3/4 th – ripened	23.65	17.12	11.07	0.13	6.20	11.96	0.18	72.55
Fully ripened	23.60	18.21	10.12	0.09	6.30	7.98	0.15	52.75
S.Em±	0.42	0.23	0.07	0.01	0.07	0.18	0.02	2.21
C.D at 1%	1.67	0.94	0.26	0.05	0.30	0.67	0.08	NS

4. CONCLUSION

From the present study, it is concluded that, physical parameters viz. weight of fruit, peel and pulp, volume of fruit, specific gravity, length and diameter of fruit, fruit colour and chemical parameters viz. TSS. Total and reducing sugars, titrateable acidity, PH, ascorbic acid, tannins and moisture of fruits could be considered as maturity indices the potential to extend the shelf of tomato while retaining its nutritional quality.

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