STANDARDIZATION OF ROSE APPLE *(Syzygium jambos)* SYRUP WITH DIFFERENT CONCENTRATIONS OF SUGAR

ABSTRACT

The experiment was conducted on "Standardization of rose apple *(Syzygium jambos)* syrup with different concentrations of sugar" during the period November 2021 to February 2022 at Post Harvest Technology Laboratory, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj (Uttar Pradesh). The experiment was planned in completely randomized block design, seven treatments with three replication. The observations were recorded on various characteristics like acidity, TSS, pH, ascorbic acid content and organoleptic qualities. The results obtained from the experiment shows that the treatment T_6 (rose apple juice + 55% sugar syrup) was found best in terms of the quality attribute as compared to other treatments. It shows the highest mean score in sensory evaluation like colour and appearance (8.85), taste (8.6), aroma (8.45), overall acceptability (8.7) and the chemical parameters like titratable acidity (0.458), T.S.S (64.66˚Brix), pH (4.427) and ascorbic acid (26.73%). Therefore on the basis of above findings it is concluded that the treatment T_6 (rose apple juice + 55% sugar syrup) is the most promising and best syrup in terms of their physico-chemical and organoleptic test of rose apple syrup.

Key words: Rose apple, syrup, sugar, citric acid, physico-chemical

INTRODUCTION

The rose apple (*Syzygium jambos)* is a blooming plant of myrtaceae family. The rose apple is native to East India and Malaya region and is widely cultivated throughout Southeast Asian countries and some parts of tropical for different purposes. It is grown for its sweet watery fruits and for its very beautiful foliage. The fruit can range in colour from white to greenish white to pale yellow. The edible fruit has a guava-like shape with four fleshy calyx lobes at the apex. The rose apple is more often used in jellies and jams or preserved combinations with other fruits of more pronounced flavour. They are delicious and highly refreshing beverages recommended for the manufacturing of like RTS drink, nectar, squash, crush, syrup and other value added products like jam, jelly, chutney, butter, sauce, etc. Value added products of rose apple can attract both national and international market because there is always a great demand from the consumers all over the world for the new food products which are nutritious, therapeutic, delicious, and attractive in colour and appearance. An infusion of the fruit act as a diuretic. According to Chattopadhayay and Ghosh (1992) rose apple is fair source of iron. It has many medicinal values. This fruit contains many minerals such as calcium, iron and magnesium. Fever is thought to be reduced by a sweetened floral mixture. Forty three volatile constituents were identified by Wong (1996) in rose apple. The vitamin C, phenolic content, flavonoids and numerous antioxidants are abundant in the pulp. It can help to increase immunity, control

diabetes, aid digestion, improve teeth and bone health, avoid muscle cramps, treat diarrhoea and constipation, and is also beneficial to pregnant women. This fruit is highly perishable in nature. To reduce the loss, the fruit is used to make juices, jams, pickles and wine. The juices are loved by everyone, irrespective of their age group. It can give you a nutritious and healthy life. The whole plant has a variety of medicinal values, ranging from dermatological, digestive, head and throat to endocrine remedies. In India, this fruit syrup is considered a tonic for the brain and liver because of its rich source of vitamin C, vitamin A, fibre, calcium and iron content.

Materials and Methods

The rose apple fruits (matured, fresh, ripen and free from insects and diseases), glass bottles, sugar and muslin cloth from the local market. Citric acid is used to avoid the crystallization of sugar syrup and it can also act as a preservative. The work was conducted in the Post harvest laboratory, Department of Horticulture, SHUATS, Prayagraj, during November 2021 – February 2022. The instruments viz. knife, trays, grinder, sieve, electronic balance, refractometer, digital pH meter etc. were used.

Well, ripe, fresh, firm, healthy and disease-free rose apple fruits were washed thoroughly with running tap water and rinsed with distilled water. The pulp was extracted manually and juice has separated from it. The calculated amount of sugar syrup was made separately and added to rose apple juice according to different treatments viz. T_1 (rose apple juice + 30% sugar syrup), T_2 (rose apple juice + 35% sugar syrup), T_3 (rose apple juice + 40% sugar syrup), T_4 (rose apple juice + 45% sugar syrup), T_5 (rose apple juice +50% sugar syrup), T_6 (rose apple juice +55% sugar syrup), T_7 (rose apple juice + 60% sugar syrup) and heated it for just 5 minutes over a gas burner for proper dilution. The citric acid was added at 0.1% to avoid crystallization. The rose apple syrup was filled in cleaned, sterilized bottles and sealed with caps. The bottles were then labeled and stored in cold storage condition (10°C) for up to 90 days and physico-chemical parameters were analyzed. The rose apple syrup were analyzed for titratable acidity by titrate known volume of aliquot against 0.1 N NaOH and expressed as mg/100g and TSS (^{o}B) by using hand refractometer (Erma, japan). The pH was determined by using digital pH meter and and ascorbic acid was determined by 2, 6 - dichlorophenol indophenol titration method. Prepared rose apple syrup were evaluated for sensory attributed like colour and appearance, taste, aroma and overall acceptability using 9- point hedonic scale.

RESULTS AND DISCUSSION

The effect of sugar concentration in cold storage condition on the quality of rose apple syrup was determined by checking physico-chemical parameters viz. T.S.S., pH, titratable acidity, ascorbic acid content and organoleptic scores. The main objective of this experiment was to find out the suitable concentration of sugar syrup on rose apple syrup and the storage quality of rose apple syrup.

TOTAL SOLUBLE SOLIDS (T.S.S.) (^{o} Brix)

TSS of rose apple syrup was recorded with a hand refractometer (Srivasthava and Kumar 2000).

The TSS of rose apple syrup found to be increased with the increase in the proportion of sugar syrup and storage period (table.1). The results were 57.66, 64.66 and 67.00 for the treatments T_5 (rose apple juice + 50% sugar syrup), T_6 (rose apple juice + 55% sugar syrup) and T_7 (rose apple juice + 60% sugar syrup) at the day of preparation and it got increased as 59.66, 66.00 and 68.33 on the 90th day(graph 1). The TSS of rose apple syrup found to be increased during the storage period beacause of loss in moisture content. The highest mean value was observed in T_7 (67.66^{o} Brix) while minimum mean score recorded in T_1 (38.16^{o} Brix). Similar observations were recorded by Marimuthu M. and Thirumaran A. S. (2000) and in jamun syrup by (Kannan and Thirumaran, 2001).

ASCORBIC ACID

A significant decrease of ascorbic acid was observed from the data (table 1) during 90 days of storage period. The highest mean value was observed in the treatment T_1 (rose apple juice + 30% sugar syrup) (37.64) which was superior to all other treatments, followed by the treatment T_2 (rose apple juice + 35% sugar syrup) (35.1) while the minimum was recorded in the treatment T_7 (rose apple juice + 60% sugar syrup) (24.74) (graph 1). Ascorbic acid is very sensitive to light, heat and oxygen. Hence, it might be destroyed due to heat at the time of preparation and during the storage which might be due to the degradation into dehydro- ascorbic acid or presence of air in the head space. Similar results of ascorbic acid content were found in rose apple squash (Basavaraja, P.S, 2005) and Pattar *et al.*, (2013) .

pH

The pH shows a slight increase with the increase of the storage period (table 2). The highest mean value was observed in treatment T_7 (rose apple juice + 60% sugar syrup) (4.44) while the minimum value was observed in treatment T_1 (rose apple juice + 30% sugar syrup) (4.29). Initially, the results were 4.373, 4.403 and 4.42 for the treatment T_5 (rose apple juice + 50% sugar syrup), T_6 (rose apple juice + 55% sugar syrup) and T_7 (rose apple juice + 60% sugar syrup) which got increased during 90 days of storage period as 4.42, 4.46 and 4.48 (graph 2). The increase in pH values might be due to the decrease of titratable acidity and chemical reaction taking place during the storage period of 90 days . Similar results were obtained on aonla syrup by Reddy and chhikksubbanna, (2009) and Basavaraja P.S, (2005) in rose apple syrup.

TITRATABLE ACIDITY

Acids present in different quantities can give desirable taste to the syrup. The titratable acidity of rose apple syrup varied significantly with different treatments and the storage period (table 2). Initially, the results were 0.597, 0.533 and 0.426 for the treatments T_5 (rose apple juice + 50% sugar syrup), T_6 (rose apple juice + 55% sugar syrup), T_7 (rose apple juice + 60% sugar syrup)

and it got decreased according to the storage period of 90 days as 0.426, 0.341 and 0.298 (graph 2). The highest mean value was observed in T_1 (rose apple juice + 30% sugar syrup) (0.805) while the minimum was recorded in T_7 (0.399) The acidity decreased during the storage period of 90 days may be due to the increase in pH. Similar observations were found by Sravanthi *et al.*,(2014) studied on the custard apple squash and Nayak *et al.*, (2011) during the study of aonla syrup.

SENSORY EVALUATION

In terms of colour and appearance, The treatment T_6 (rose apple juice + 55% sugar syrup) recorded the highest score (8.85) mean value, which was significantly superior to all treatments, followed by the treatment T_5 (rose apple juice + 50% sugar syrup) (8.2) and treatment T_7 (rose apple juice + 60% sugar syrup) (7.65). The lowest (7.0) mean value for colour and appearance was observed in treatment T_1 (rose apple juice + 30% sugar syrup) followed by treatment T_2 (rose apple juice + 35% sugar syrup). And it is also observed from the data (table.3) that the pleasant colour of syrup increases as the proportion of the sugar increase (illustrated in graph. 3). The decreasing trend in the organoleptic score of colour and appearance was noticed irrespective of the different recipes and the storage period as it shows a dark and cloudy appearance during the storage period from 0^{th} day to 90^{th} day. This might be due to oxidation of phenols.

In terms of taste of the syrup varies significantly during the storage irrespective of the treatments. The highest mean score (8.6) was observed in treatment T_6 (rose apple juice + 55% sugar syrup) which was significantly superior to all the other treatments and followed by T_7 (rose apple juice + 60% sugar syrup) (8.15) and treatment T_5 (rose apple juice + 50% sugar syrup) (7.95). The lowest mean score of 6.2 was observed in treatment T_1 (rose apple juice+ 30% sugar syrup) and followed by treatment T_2 (rose apple juice+ 35% sugar syrup) as 6.9 because of its strong acidic taste. This may be happens because of the highest mean titratable acidity which was shown by T_1 (0.805), T_2 (0.753) (table 2) and less T.S.S also shown by T_1 (38.16) and T_2 (41.08) (table 1). It is also observed from the data that the taste of the syrup got decreased during the storage from the 0^{th} day to 90 days (table.3).

Terms of the aroma of the rose apple syrup revealed that the value for aroma is influenced significantly due to recipe treatments as well as the storage period (table.4). The aroma of the syrup varies significantly during the storage irrespective of the treatments. The highest mean score (8.2) was observed in treatment T_6 (rose apple juice + 55% sugar syrup) which was significantly superior to all the other treatments and followed by treatment T_5 (7.40) (rose apple juice + 50% sugar syrup) and T_7 (7.4) (rose apple juice + 60% sugar syrup) (graph 4). The lowest mean score of 6.05 was observed in treatment T_1 (rose apple juice + 30% sugar syrup) and followed by treatment T_2 (6.35) (rose apple juice + 35% sugar syrup) because of strong and unpleasant smell . It is also observed that the taste of the syrup got decreased during the storage of 90 days.

The organoleptic score for the overall acceptability of the syrup, prepared by seven different treatments was statistically significant (table 4). The treatment T_6 (rose apple juice + 55% sugar syrup**)** recorded the highest mean (8.7) score for overall acceptability which was significantly

superior to all the other treatments followed by T_5 (rose apple juice+ 50% sugar syrup) with 7.85 and T_7 (rose apple juice+ 60% sugar syrup) while the lowest score was achieved by treatment T_1 (rose apple juice + 30% sugar syrup) 5.6 and T_2 (rose apple juice + 35% sugar syrup) with the score 6.45 (graph 4). The organoleptic score for the overall acceptability of rose apple syrup was reduced during the storage periods which might be due to oxidation, storage time or packaging material. Similar results were found by (Kannan *et al.,* (2004)) and Roy and Singh (1979) in bael beverages.

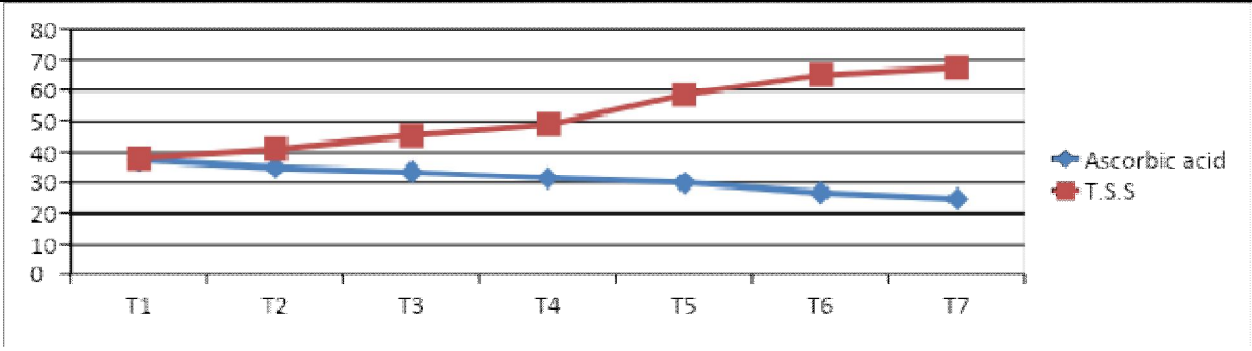
Fig. 1 : Rose apple syrup during storage (immediately after preparation)

Fig. 2 : Rose apple syrup after 90 days of storage in refrigerator

Table 1 : Effects of sugar level in cold storage condition on the ascorbic acid content and total soluble solids of rose apple syrup.

TREATMENT	TOTAL SOLUBLE SOLIDS					ASCORBIC ACID				
	0 days	30 days	60 days	90 days	Mean	0 days	30 days	60 days	90 days	Mean

T_1(Rose apple juice +30%sugar syrup)	37.66	38.00	38.00	39.00	38.16	41.68	38.19	36.62	34.10	37.64
T_2(Rose apple juice +35%sugar syrup)	40.33	40.66	41.33	42.00	41.08	39.48	35.29	33.67	31.96	35.1
T_3(Rose apple juice +40%sugar syrup)	45.00	45.33	45.66	46.00	45.49	37.27	33.62	32.28	31.06	33.55
T_4(Rose apple juice +45%sugar syrup)	47.00	47.33	50.66	51.00	48.99	35.68	31.96	30.21	28.67	31.63
T_5(Rose apple juice +50%sugar syrup)	57..66	58.00	59.33	59.66	58.99	33.62	30.06	28.96	27.78	30.10
T_6(Rose apple juice +55%sugar syrup)	64.66	65.00	65.33	66.00	65.24	30.58	27.88	25.28	23.21	26.73
T_7(Rose apple juice +60%sugar syrup)	67.00	67.33	68.00	68.33	67.66	27.62	25.28	23.78	22.29	24.74
Mean	51.33	51.85	51.37	51.85	52.3	34.99	31.89	30.11	28.43	31.3
F ratio	**S**	**S**	**S**	**S**		**S**	**S**	**S**	**S**	
S.E.M	0.25	0.25	0.30	0.21		0.003	0.002	0.002	0.003	
CD 5%	0.76	0.76	0.93	0.66		0.011	0.008	0.007	0.009	

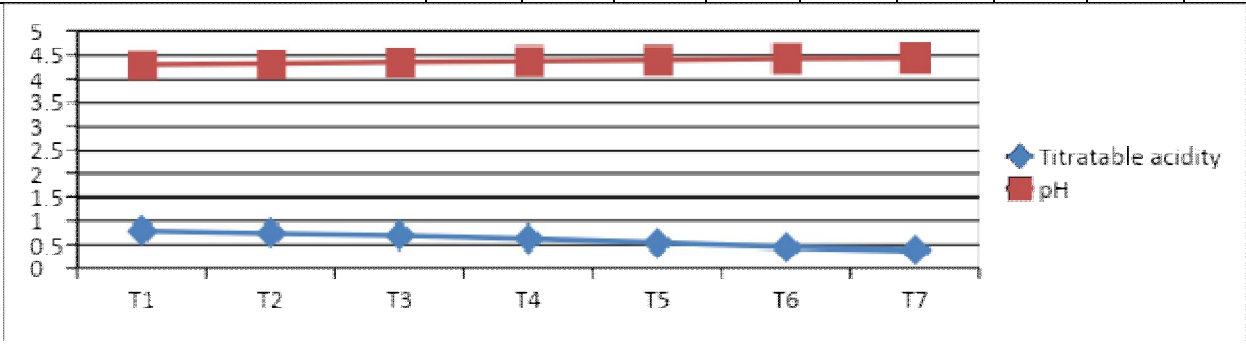


Graph 1 : Graphical representation of ascorbic acid content and total soluble solids of rose apple syrup in cold storage condition

Table 2 : Effects of sugar level in cold storage condition on the pH and titratable acidity of rose apple syrup.

TREATMENT	pH					TITRATABLE ACIDITY				
	0 days	**30 days**	**60 days**	**90 days**	**Mean**	**0 days**	**30 days**	**60 days**	**90 days**	**Mean**

T_1(Rose apple juice +30%sugar syrup)	4.28	4.286	4.29	4.32	4.294	0.874	0.832	0.768	0.746	0.805
T_2(Rose apple juice +35%sugar syrup)	4.30	4.311	4.32	4.34	4.317	0.832	0.789	0.731	0.661	0.753
T_3(Rose apple juice +40%sugar syrup)	4.316	4.336	4.34	4.36	4.332	0.810	0.746	0.661	0.618	0.708
T_4(Rose apple juice +45%sugar syrup)	4.35	4.366	4.38	4.40	4.374	0.746	0.682	0.597	0.533	0.639
T_5(Rose apple juice +50%sugar syrup)	4.373	4.39	4.40	4.42	4.395	0.682	0.597	0.505	0.426	0.552
T_6(Rose apple juice +55%sugar syrup)	4.403	4.416	4.43	4.46	4.427	0.597	0.533	0.362	0.341	0.458
T_7(Rose apple juice +60%sugar syrup)	4.42	4.44	4.45	4.48	4.44	0.533	0.426	0.341	0.298	0.399
Mean	4.348	4.363	4.375	4.397	4.36	0.724	0.657	0.552	0.517	0.61
F ratio	**S**	**S**	**S**	**S**		**S**	**S**	**S**	**S**	
S.E.M	0.002	0.002	0.002	0.002		0.02	0.03	0.019	0.021	
CD 5%	0.008	0.008	0.006	0.006		0.07	0.091	0.059	0.064	

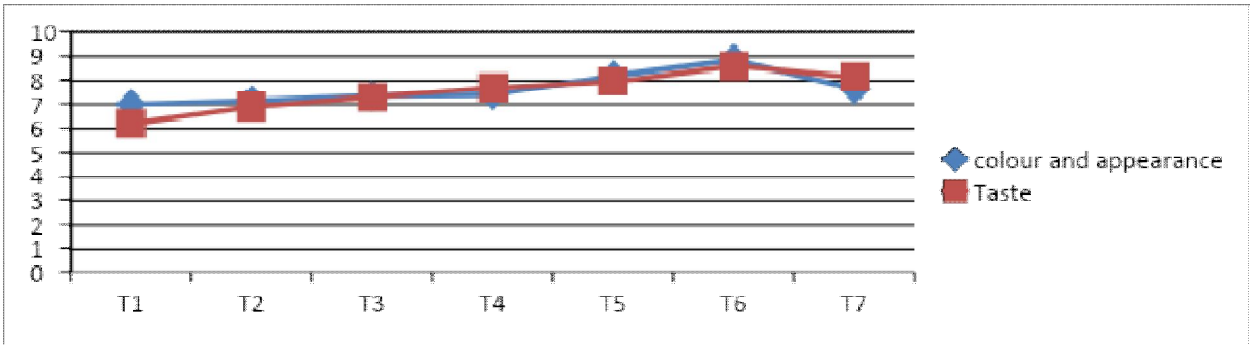


Graph 2 : Graphical representation of pH and titratable acidity of rose apple syrup in cold storage condition

Table 3 : Effects of sugar level in cold storage condition on the colour and appearance, taste, aroma of rose apple syrup.

TREATMENTS	COLOUR AND APPEARENCE					TASTE				
	0 days	30 days	60 days	90 days	Mean	0 days	30 days	60 days	90 days	Mean

T_1 (Rose apple juice +30%sugar syrup)	7.4	7.2	7.0	6.4	7.0	6.6	6.4	6.0	5.8	6.2
T_2 (Rose apple juice +35%sugar syrup)	7.6	7.4	7.0	6.8	7.2	7.4	7.2	6.8	6.2	6.9
T_3 (Rose apple juice +40%sugar syrup)	7.8	7.6	7.2	6.8	7.35	7.8	7.6	7.2	6.6	7.3
T_4 (Rose apple juice +45%sugar syrup)	8.0	7.6	7.2	7.0	7.45	8.0	7.8	7.6	7.4	7.7
T_5 (Rose apple juice +50%sugar syrup)	8.8	8.8	7.8	7.4	8.2	8.2	8.2	7.8	7.6	7.95
T_6 (Rose apple juice +55%sugar syrup)	9.0	9.0	8.8	8.6	8.85	9.0	9.0	8.4	8.0	8.6
T_7 (Rose apple juice +60%sugar syrup)	7.8	7.8	7.6	7.4	7.65	8.4	8.4	8.0	7.8	8.15
Mean	8.00	7.9	7.5	7.2	7.6	7.91	7.82	7.35	6.95	7.5
F ratio	**S**	**S**	**S**	**S**		**S**	**S**	**S**	**S**	
S.E.M	0.03	0.20	0.17	0.20		0.18	0.20	0.18	0.20	
CD 5%	0.11	0.59	0.50	0.60		0.53	0.59	0.53	0.59	

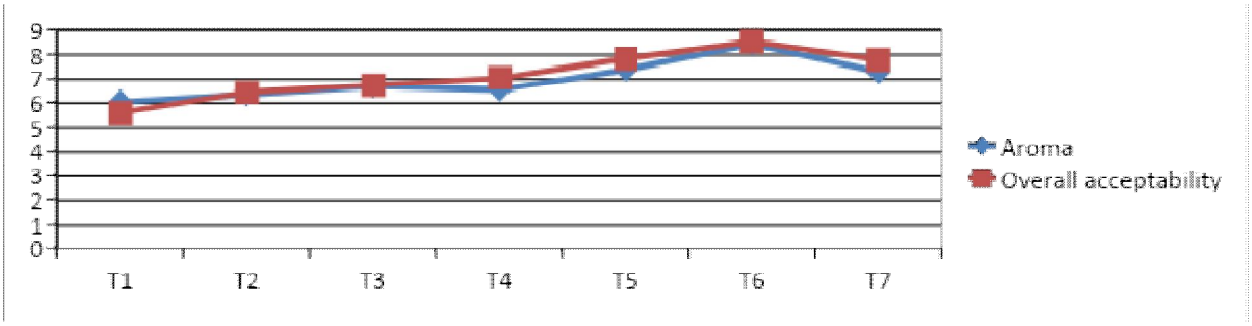


Graph 3: Graphical representation of colour and appearance , taste of rose apple syrup in cold storage condition

Table 4: Effects of sugar level in cold storage condition on the aroma and overall acceptability of rose apple syrup.

TREATMENTS	**AROMA**					**OVERALL ACCEPTABILITY**				
	0 days	**30 days**	**60 days**	**90 days**	**Mean**	**0 days**	**30 days**	**60 days**	**90 days**	**Mean**

T_1(Rose apple juice + 30%sugar syrup)	6.4	6.2	6.0	5.6	6.05	6.0	5.8	5.4	5.2	5.6
T_2(Rose apple juice + 35%sugar syrup)	6.8	6.4	6.2	6.0	6.35	6.8	6.6	6.4	6.0	6.45
T_3(Rose apple juice + 40%sugar syrup)	7.2	7.0	6.4	6.2	6.7	7.2	7.0	6.6	6.2	6.75
T_4(Rose apple juice + 45%sugar syrup)	6.8	6.6	6.4	6.4	6.55	7.6	7.4	6.8	6.4	7.05
T_5(Rose apple juice + 50%sugar syrup)	7.4	7.6	7.4	7.2	7.4	8.2	8.2	7.8	7.2	7.85
T_6(Rose apple juice + 55%sugar syrup)	8.6	8.6	8.4	8.2	8.45	9.0	8.8	8.6	8.4	8.7
T_7(Rose apple juice + 60%sugar syrup)	7.6	7.4	7.2	7.0	7.3	8.2	8.0	7.6	7.4	7.8
Mean	7.25	7.1	6.8	6.6	6.9	7.48	7.4	7.02	6.6	7.1
F ratio	**S**	**S**	**S**	**S**		**S**	**S**	**S**	**S**	
S.E.M	0.17	0.22	0.21	0.18		0.17	0.18	0.23	0.20	
CD 5%	0.69	0.63	0.61	0.53		0.51	0.53	0.67	0.59	



Graph 4 : Graphical representation of aroma and overall acceptability of rose apple syrup in cold storage condition

CONCLUSION

From the present investigation, it could be concluded that all the recipes of rose apple syrup were found to be organoleptically acceptable not only at the time of preparation but also throughout the storage period of 3 months under cold storage condition. The syrup prepared from rose apple fruit pulp was significantly superior concerning the overall acceptability of the product. The maximum overall acceptability at the day of preparation was shown by the treatment T_6 (9.0) and

the minimum by the treatment T_1 (6.0). At the 90^{th} day the maximum overall acceptability was observed in T_1 (5.2) and the maximum was recorded on T_6 (8.4). Therefore the syrup recipe treatment T_6 i.e. rose apple juice + 55% sugar syrup was found to be the best recipe for rose apple syrup with the highest organoleptic score for colour, taste, aroma and overall acceptability.

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