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Effect of chemicals on post- harvest quality and storability of jamun fruits (*Syzygium cumini* L. cv. CISH J 42)

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Abstract
An experiment was conducted during 2018-19 in the Department of Fruit Science and Horticulture Technology, Odisha University of Agriculture and Technology, Bhubaneswar to determine the effect of chemicals and growth regulator in different concentrations such as $CaCl_2$ 1%, $CaCl_2$ 1.5%, Ca $(NO_3)_2$ 1%, Ca $(NO_3)_2$ 1.5%, GA_3 50 ppm, GA_3 100 ppm followed by perforated polythene packaging and polythene packaging without any chemical on physico-chemical property and shelf life of jamun fruits cv. CISH J 42. This experiment was carried out in ambient condition. From this experiment it was concluded that fruits treated with 1.5% $CaCl_2$ and kept in perforated polyethylene bag, maintained desirable physico-chemical parameters *viz*. total soluble solid (9.100%), reducing sugar (2.907%), total sugar (3.080%), titrable acidity (0.261%), sugar-acid ratio (13.793) as well as the desirable organoleptic quality which make them acceptable up to 6 days as compared to control.

Keywords: Jamun, post-harvest treatments, physico-chemical property, shelf life

1. Introduction

Jamun (*Syzygium cumuni* L.) has chromosome number 2n=40 (Chundawat, 1990) [4] and belongs to family Myrtaceae. It is a minor fruits having a great medicinal property as well as nutritional value. According to Banerjee *et al.* 2005 [2] jamun fruit is a rich source of antioxidant. By consuming jamun fruits diarrhoea and ulcers can be prevented. It also relieves constipation. Its consumption prevents anaemia due to an increase in RBC count. These fruits are popular for vitamin A content too, so it is used against eyesight defect in babies. Due to antibacterial properties jamun fruits are super effective in preventing various dental problems. Jamun fruits regulate blood pressure levels, which lowers the risk of heart attacks in the future substantially. Jamun fruits also have anti-inflammatory properties which prevent cholesterol oxidation during pregnancies. Jamun is found to have camo-protective and radioprotective properties thus prevents cancer. Small jamun fruits unfit for table use are found suitable for use in the beverage industry as they contain a high amount of acid tannins and anthocyanin (ICAR, 1986) [9]. It regulates the blood sugar levels and bring them down by 30% (Helmstaedter A., 2008) [7]. Jamun fruits are very perishable in nature which is a major hindrance in its marketing. Now a day's people are aware about the nutraceutical benefit of jamun. This leads to increase the demand of jamun fruits day by day. But due to its perishable nature the fruits were degraded its quality in the very next day of harvesting and also for which farmers are not interested to cultivate this crop commercially. Therefor there is a need to extend the shelf life of jamun fruits with desire marketable quality. So this experiment was to study the effect of chemicals on different physico-chemical parameters and storability of jamun fruits.

2. Materials and methods

This experiment was carried out in the month of May- July. Fruits are collected from an eight year old jamun tree cv. CISH J 42. This experiment was carried out in Completely Randomized Block Design with eight treatments and three replications. The treatments are T_1-$CaCl_2$ 1% + Perforated polythene bag, T_2-$CaCl_2$ 1.5% + Perforated polythene bag, T_3-Ca $(NO_3)_2$ 1% + Perforated polythene bag,T_4-Ca $(NO_3)_2$ 1.5% + Perforated polythene bag,T_5-GA_3 50 ppm + Perforated polythene bag, T_6-GA_3 100 ppm + Perforated polythene bag, T_7-Perforated polythene bag and T_8-Without any chemical in open plate (control). The reading for total soluble solid taken by refractometer and other parameters are analyse by following formulas:

$$Total\ acidity\ (\%) = \frac{titrated\ value\ \times normality\ of\ NaOH\ \times volume\ male\ up\ \times Equivalent\ weight\ of\ acidity (67)}{volume\ of\ titrating\ \times weight\ of\ sample \times 1000} \times 100$$

$$\text{Percentage of reducing sugar} = \frac{dilution\ factor\ (0.05) \times 100}{titrate\ value \times volume\ of\ the\ sample\ taken} \times 100$$

$$\text{Percentage total sugar} = \frac{dilution\ factor\ (0.05) \times 100}{titrte\ value\ \times volume\ of\ sample} \times 100$$

$$\text{Percentage non-reducing sugar}$$
$$(\%\ of\ total\ sugar - \%\ of\ reducing\ sugar) \times 0.95$$

By taking the ratio between total soluble solid and acidity present in the fruit we can calculate the 0Brix: acid ratio. It determines the test of a fruit. The jamun fruits treated with different chemicals at the end of the day of storage were tested and evaluated by a panel of judges to decide the best treatment with organoleptic acceptance.

3. Results

3.1 Total soluble solids

The data presented in table 1 revealed that the total soluble solids of fruits was significantly affected by various treatments. The total soluble solids content of fruits, increased up to 6th day of storage period. On the 2nd day the TSS of T_2 ($CaCl_2$ 1.5% with perforated polythene bag) is minimum followed by T_4 (Ca $(NO_3)_2$ 1.5% with perforated polyethylene bag) as compared to control. The minimum total soluble solids (9.100%) found in T_2 ($CaCl_2$ 1.5% with perforated polythene bag), which was significantly the lowest than rest of the treatments. This revealed that treatment with perforated polythene bag showed less total soluble solids as compared to treatment without perforated polythene bag.

Table 1: Effect of post-harvest treatments on the total soluble solids (percent) of jamun fruits

Treatment	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
T_1	7.000	7.400	8.000	8.900	0.000		
T_2	7.000	7.133	7.300	7.767	8.433	9.100	0.000
T_3	7.000	7.300	7.600	8.267	9.067	9.800	0.000
T_4	7.000	7.233	7.467	7.933	8.767	9.767	0.000
T_5	7.000	8.500	8.800	0.000			
T_6	7.000	7.433	8.367	9.050	0.000		
T_7	7.000	9.467	0.000				
T_8	7.000	9.867	0.000				
$SE_{(m)\pm}$		0.189	0.235	0.239	0.014	0.252	
CD at 5%		0.571	0.709	0.722	0.042	0.762	
CV (%)		4.069	16.634	17.671	1.219	3.796	

3.2 Titratable acidity

The acidity of fruits was significantly affected by different treatments. From the table 2 it was observed that treatments T_2 ($CaCl_2$ 1.5% with perforated polythene bag), T_3 ((Ca $(NO_3)_2$ 1% with perforated polyethylene bag) and T_4 (Ca $(NO_3)_2$ 1.5% with perforated polyethylene bag) are retained up to 6th day of storage with less titrable acidity as compared to others and the next day all fruits were spoiled. Both the control T_7 (without any chemical in perforated polythene bag) and T_8 (without any chemical in open plate) showed highest acidity (1.440%) on day 2 and next day fruits were completely spoiled.

Table 2: Effect of post-harvest treatments on the acidity (percent) of jamun fruits.

Treatments	Day 1	Day2	Day3	Day4	Day5	Day6
T_1	1.472	1.280	1.109	1.024		
T_2	1.472	1.152	1.131	0.896	0.789	0.261
T_3	1.472	1.280	1.131	1.024	0.960	0.341
T_4	1.472	1.152	1.088	0.917	0.832	0.725
T_5	1.472	1.344	0.363			
T_6	1.472	1.216	1.195	0.704		
T_7	1.472	1.408				
T_8	1.472	1.408				
$SE_{(m)\pm}$		0.017	0.046	0.045	0.010	0.043
CD at 5%		0.051	0.138	0.136	0.029	0.130
CV (%)		2.292	5.313	5.452	1.257	5.728

3.3 Reducing sugar

The result on reducing sugar content of the fruits presented in table 3 revealed significant variations both within and between the different treatments. It was found that on day 6th among three treatments T_2 ($CaCl_2$ 1.5% with perforated polythene bag), T_3 (Ca $(NO_3)_2$ 1% with perforated polyethylene bag) and T_4 (Ca $(NO_3)_2$ 1.5% with perforated polyethylene bag), treatment T_2 (2.907%) showed minimum reducing sugar which is at par with T_4 (2.971%) followed by T_3 (3.030%). Similarly T_7 (without any chemical in perforated polythene bag) showed less reducing sugar than T_8 (without any chemical in open plate) on the day before total spoilage of fruits.

Table 3: Effect of post-harvest treatments on reducing sugar content (percent) of jamun fruits.

Treatments	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
T_1	2.632	2.758	2.876	3.035		
T_2	2.632	2.684	2.718	2.758	2.809	2.907
T_3	2.632	2.789	2.886	2.925	3.000	3.030
T_4	2.632	2.713	2.758	2.804	2.858	2.971
R_5	2.632	2.842	2.857			
T_6	2.632	2.825	3.007	3.248		
T_7	2.632	3.029				
T_8	2.632	3.061				
$SE_{(m)\pm}$		0.053	0.102	0.113	0.004	0.107
CD at 5%		0.161	0.308	0.341	0.014	0.322
CV (%)		3.251	9.815	11.239	4.500	12.444

3.4 Total sugar
The data presented in table 4 indicated that total sugar content of fruits was significantly affected by various chemicals and growth regulator at different concentration with packaging material. The fruits of different treatment start spoiling after 2nd day of storage. On the 2nd day minimum total sugar percentage found in T_2 ($CaCl_2$ 1.5% with perforated polythene bag) (2.779%) followed by T_4 (Ca $(NO_3)_2$ 1.5% with perforated polyethylene bag) (2.815%) and the maximum total sugar percentage was found in T_8 (without any chemical in open plate) (3.194%) followed by T_7 (without any chemical in perforated polythene bag) (3.123%). The minimum total sugar on day 6th was T_2 ($CaCl_2$ 1.5% with perforated polythene bag) (3.080%) followed by T_4 (Ca $(NO_3)_2$ 1.5% with perforated polyethylene bag) (3.145%) and T_3 (Ca $(NO_3)_2$ 1% with perforated polyethylene bag) (3.185%).

Table 4: Effect of post-harvest treatments on total sugar content (percent) of jamun fruits.

Treatment	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
T_1	2.688	2.831	2.984	3.163		
T_2	2.688	2.779	2.836	2.885	2.965	3.080
T_3	2.688	2.864	2.966	3.007	3.132	3.185
T_4	2.688	2.815	2.885	2.947	3.031	3.145
T_5	2.688	2.941	2.959			
T_6	2.688	2.896	3.126	3.391		
T_7	2.688	3.123				
T_8	2.688	3.194				
$SE_{(m)\pm}$		0.047	0.105	0.117	0.004	0.111
CD at 5%		0.143	0.317	0.353	0.011	0.335
CV (%)		2.792	9.993	11.504	4.395	12.837

3.5 Non-reducing sugar
The perusal of table 5 found significance difference among the eight treatment where the whole fruits were spoiled in different day. On 2nd day T_8 (without any chemical in open plate) has high non-reducing sugar (0.134%) followed by T_4 (Ca $(NO_3)_2$ 1.5% with perforated polyethylene bag) (0.102%) where the whole fruit spoiled in the next day. The figure shows that the non-reducing sugar gradually increased day by day. On the 6th day T_4 (Ca $(NO_3)_2$ 1.5% with perforated polyethylene bag) showed high non-reducing sugar (0.174%) which is at par with T_2 ($CaCl_2$ 1.5% with perforated polythene bag) (0.173%) followed by T_3 (Ca $(NO_3)_2$ 1% with perforated polyethylene bag) (0.154%).

Table 5: Effect of post-harvest treatments on non-reducing sugar (percentage) during storage of jamun fruits.

Treatment	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
T_1	0.057	0.073	0.108	0.127		
T_2	0.057	0.094	0.118	0.127	0.155	0.173
T_3	0.057	0.075	0.080	0.082	0.132	0.154
T_4	0.057	0.102	0.127	0.143	0.173	0.174
T_5	0.057	0.099	0.101			
T_6	0.057	0.071	0.119	0.143		
T_7	0.057	0.094				
T_8	0.057	0.134				
$SE_{(m)\pm}$		0.020	0.008	0.010	0.008	0.010
CD at 5%		N S	N S	N S	N S	N S
CV (%)		6.736	1.153	1.388	1.140	1.409

3.6 Sugar: acid ratio
The perusal of figure 1 reveals that sugar: acid ratio gradually increase up to 6th day till the fruits were spoiled. There is significant difference between the sugars: acid ratio of different treatments. The treatment T_2 ($CaCl_2$ 1.5% with perforated polythene bag) had the maximum (13.793%) sugar: acid ratio followed by T_4 (Ca $(NO_3)_2$ 1.5% with perforated polyethylene bag) (13.542%) and T_3 (Ca $(NO_3)_2$ 1% with perforated polyethylene bag) (9.570%) on day 6 of storage.

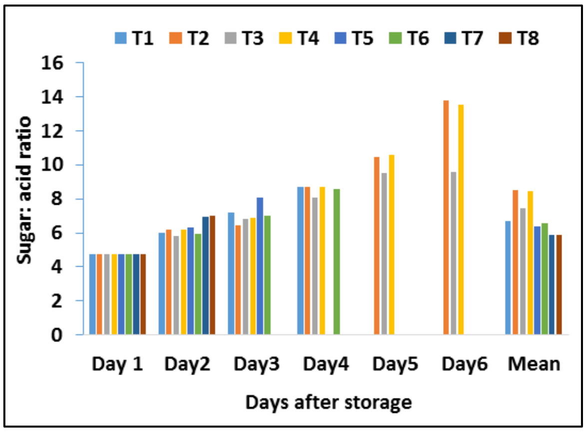

Fig 1: Effect of post-harvest treatments on sugar: acid ratio during storage of jamun fruits.

3.7 Organoleptic quality
During organoleptic quality evaluation, a panel of judges were satisfied with the taste of jamun fruits of each treatment every day. Table 6 represent the organoleptic score of different treatments. It was found that all treatments scored point 8 in Hedonic scale (like very much). The table reveals that there is no significant difference between the treatments.

Table 6: Organoleptic quality evaluation on a 9-point Hedonic scale for different treatments

Treatments	Day 1	Day2	Day3	Day4	Day5	Day6
T_1	7.667	7.778	7.667	7.667		
T_2	7.667	7.778	7.778	7.667	7.778	7.889
T_3	7.667	7.778	7.667	7.667	7.778	7.667
T_4	7.667	7.667	7.778	7.667	7.778	7.889
T_5	7.667	7.778	7.667			
T_6	7.667	7.778	7.667	7.667		
T_7	7.667	7.667				
T_8	7.667	7.778				
SE(m)±	0.333	0.213	0.028	0.044	0.011	0.022
CD at 5%	N S	N S	N S	N S	N S	N S
CV (%)	7.531	6.421	1.851	3.237	1.011	1.964

4. Discussion
4.1 Total soluble solids
The analysed data presented with respect to the total soluble solid content of jamun fruits in the preceeding chapter exhibited significant difference among the treatments. The fruits treated in $CaCl_2$ and subsequently kept in perforated bag exhibited the minimum total soluble solid percentage of 7.133% as compared to the control (9.867%) on 2nd day. This indicate that the total soluble solids increase in a faster rate. This is due to the conversion of the polysaccharide to monosaccharide block (glucose, fructose etc.). Similar result was also reported by Rajkumar *et al.* (2005) [13] and Ayar *et al.* (2011) [1],

4.2 Titratable acidity
Almost all the fruits and vegetables contain different type of acid out of which one is predominant. The acids may be organic or inorganic acid. In jamun the gallic acid and mallic acid are the major causes of acidity. As the fruits advanced towards ripening the acidity get changes and get diluted. So the sugar: acid ratio is a criterion for judging the maturity of many fruits. During preparation of preserve products the acidity is estimated for addition of artificial acidic compounds. The test is a resultant of proper sugar-acid blend, therefore acidity plays important role in deciding the test of any ripe fruit use for processing purpose. As per data recorded the acidity is changed day by day in the storage. In the treated fruits the amount of acidity get reduced gradually as time advances. At 6th day of storage the amount of acidity was reduced significantly lowest (0.261%) in the fruits treated with $CaCl_2$ and kept in perforated polythene bag. The decrease in acidity may be due to conversion of acids to sugars. Similar decrease in acidity due to calcium sprays was also reported by Singh *et al.* (1993) [14] and Ayar *et al*. (2011) [1].

4.3 Sugars
The unripe fruits contain a lot of carbohydrate in the form of polysaccharides. When the fruit advances towards ripening these long chain polysaccharides break into monosaccharide blocks creating sweetness in fruit. The monosaccharide are the reducing sugars whereas the polysaccharide contain both reducing sugar and non-reducing sugar. Hence estimation of sugar is not only a factor of maturity indices but decides the test of the fruit.
In the present experiment the fruits which are treated with chemicals has increase in the reducing sugar content in a slower rate than the control treatment. The same trend have also been observed while estimating the total sugar in the laboratory. The highest reducing sugar percentage was observed in 2nd day in the control (3.061%) as compare to the treated ones. The fruits treated with $CaCl_2$ 1.5% with perforated polythene bag, $Ca(NO_3)_2$ 1.5% with perforated polythene bag and $Ca(NO_3)_2$ 1% with perforated polythene bag exhibited the reducing sugar (2.907%, 2.971% and 3.030%) and total sugar (3.080%, 3.145% and 3.185%) respectively which was at par at 6th day of storage. This indicated that the untreated controls have broken down the polysaccharide chain or starch immediately due to higher rate of respiration in climacteric fruit like jamun. The less increment in sugar contents during storage by the treated fruits was due to less weight loss that caused less dehydration of the fruits. It is well known that the changes in sugar content during storage are very much related with total soluble solids. An increase in sugars during storage was probably due to conversion of starch and polysaccharides in to soluble sugars and dehydration of fruits. This corroborates the findings of Bhat *et al.* (1997) [3] Khader *et al.* (1988) [11], Kumar and Nath (1993) [12], Hoda *et al*. (2000) [8] and Dhemre and Wasker (2003) [5].

4.4 Sugar: Acid ratio
The balance between sweetness and acidity is a basic precept in man's judgment of the quality of many fruits. The studies on quality of different fruits have often found good relationship between °brix level, acidity, and/or °Brix: acidity ratio and consumer acceptability. Hence, the factor of sugar–acid balance in fruits is an important quality criterion of consumer acceptance. The sugar concentration (°brix) and acidity are usually satisfactory indices in many fruits, wherein increasing sugar concentration and decreasing titratable acidity occurs in the ripening processes. This experiment reveals the same pattern of change in sugar: acidity ratio i.e. the sugar: acid ratio is increasing day by day up to 6th day and the next day all fruits were spoiled. The sugar: acid ratio of the eight treatments were found within the range of 4.744 to 13.793. The maximum sugar: acid ratio found in $CaCl_2$ 1.5% with perforated polythene bag (13.793) on 6th day followed by $Ca(NO_3)_2$ 1.5% with perforated polythene bag on 6th day of storage. This may be due to the increasing in sugar concentration and decrease in acid content of fruits day by day. This type of result was also found by Gong *et al.* (2015) [6], Jayasena and Cameron (2008) [10].

4.5 Organoleptic quality
Organoleptic analysis is a scientific discipline that analyses and measure human response to the composition of food or product made by the sense of taste, smell, touch and hearing when food is eaten. The quality of the jamun fruits depends on the chemical reactions that occur, and are characterized by organoleptic qualities. The organoleptic quality can be described by a set of attributes, including fruit appearance, taste, aroma and texture. These attributes must be preferred by the consumers due to their flavour or aroma, in other words, characteristics that will allow obtaining an excellent fruit quality that will please the consumer and will have good

marketing. The results of sensory evaluation revealed that, the consumers' degree of liking (based on "overall acceptability" scores in 9 point Hedonic scale) varied from "Dislike extremely" with 1 point to "Like extremely" with 9 point. There were no significant differences between the treatments and all treatments scored point 8 (like very much) in Hedonic scale on 2nd day. As it is coterminous with the perishability hence the treatments $CaCl_2$ 1.5% with perforated polythene bag, Ca $(NO_3)_2$ 1.5% with perforated polythene bag and Ca $(NO_3)_2$ 1% with perforated polythene bag continued the same quality for 6 days as compared to control which retained the quality for 2 days only. It indicated that, the organoleptic quality deteriorated to inconsumable level in rotten fruits.

5. Conclusions

The findings of this experiment is that fruit should be treated with $CaCl_2$ 1.5% and packed in perforated polyethylene bag. Fruits treated with this treatment showed little change in TSS, sugars and acidity content as compared to control as well as it maintain satisfactory organoleptic quality. Thus it is recommended that fruits should be treated with $CaCl_2$ 1.5% just after harvest and packed in perforated polyethylene bags can be kept at ambient temperature conditions with an extended shelf life from two days to six days. However it needs a further verification after continuing the research for another season.

6. Referance

1. Ayar K, Singh S, Chadva JC. Effect of post-harvest treatments on quality of jamun (Syzygium cuminii (L.) Skeels) fruit during storage. The Asian Journal of Horticulture. 2011; 6(2):297-299.
2. Banerjee A, Dasgupta N, Bratati D. *In vitro* study of antioxidant activity of Syzygium cumini (L.) Skeels fruit. Food Chemistry. 2005; 90(4):727-733.
3. Bhat AR, Sofi AG, Mir MA, Gani MR. Effect of pre-harvest sprays of calcium and potassium on some quality characteristic of cherry cv. Makhmali. Indian Journal of Horticulture. 1997; 54:19-24.
4. Chundawat BS. Arid Fruit Culture, Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi, 1990, 165-171.
5. Dhemre JK, Waskar DP. Effect of post-harvest treatments on shelf-life and quality of mango in evaporative cool chamber and ambient conditions. Journal of Food Science and Technology. 2003; 40(3):316-318.
6. Gong R, Yang W, Wang Z, Liao M, Liang G. Study on the sugar-acid ratio and relevant metabolizing enzyme activities in navel orange fruits from different eco-regions. Revista Brasileira de Fruticultura. 2015; 37(4):835-844.
7. Helmstaedter A. Syzygium cumini (L.) Skeels against diabetes – 125 years of research. Pharmazie. 2008; 63(2):91-101.
8. Hoda MN, Yadav GS, Singh S, Singh J. Storage behaviour of mango hybrids. Indian Journal of Agricultural Science. 2000; 71:469-472.
9. ICAR. Research Highlight, 1985, ICAR, New Delhi, 1986, 27p
10. Jayasena V, Cameron I. °Brix/acid ratio as a predictor of consumer acceptability of crimson seedless table grapes. Journal of Food Quality. 2008; 31:736-750.
11. Khader SESA, Singh BP, Khan SA. Effect of GA_3 as a post-harvest treatment of mango fruit on ripening, amylase and peroxidase activity and quality during storage. Scientia Horticulturae. 1988; 36(3-4):261-266.
12. Kumar S, Nath V. Storage stability of aonla fruits- A comparative study of zero energy cool chamber versus room temperature. Journal of Food Science Technology. 1993; 30:202-203.
13. Rajkumar M, Karuppaiah P, Kandasamy R. Effect of calcium and gibberellic acid on post-harvest behaviour of papaya cv. Co-2. Indian Journal of Horticolture. 2005; 64(2):327-331.
14. Singh BP, Tandon DK, Kalra, SK. Changes in postharvest quality of mangoes affected by pre-harvest application of calcium salts. Scientia Horticulturae. 1993; 54:211-219.