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# Effect of Uni-Packaging on the Post Harvest Behavior of Citrus Fruits in N.W.F.P.

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**Abstract:** A 45 days storage experiment was conducted to investigate the effect of Uni-Packaging treatments on the shelf life of citrus fruits. Different treatments were polyethylene bags of 0.0254mm, 0.0508mm thickness and control. The result showed that the uni-packaging had no significant effect on the pH of citrus fruit. Weight loss increased significantly as storage increased. Maximum weight loss observed in control and minimum weight loss in thick packaging (0.0508mm). The T.S.S increased during storage but individual packaging had non-significant effect on the T.S.S. Ascorbic acid decreased from 1.59-0.63% during storage. The organoleptic properties evaluation revealed that individual packaging had significant effect on the external appearance, taste and texture. Thick packaging perform significant effect in prolonging the shelf life of citrus fruit.

**Key words:** Citrus fruits, N.W.F.P., uni-packaging, polyethylene packaging

## Introduction

Pakistan is one of the leading citrus grown countries. It occupies approximately 30% of total area under fruit orchards. According to available statistics the total area under cultivation is 194.400 hectares with the production of 20002.60 tons annually (Anonymous 2000). After Punjab maximum citrus fruit is produced in N.W.F.P. Malta (citrus Sinensis. 0.5 back) citrus fruit have assumed special importance due to their being very rich source of Vit. C. Malta can be stored in the cold storage for 8-10 weeks. After which spoilage and decay occur. During storage excessive weight loss due to transpiration can adversely affect the quality of fruit as it result in deformation (Ben-Yehoshua *et al*., 1979). Film packaging has been extensively tried to restrict weight loss, 0.0155 thick high density polyethylene sheets greatly reduced fruit weight loss under uncontrolled room conditions (Golomb *et al.,* 1984). The weight loss was significantly reduced by seal packaging with low density polyethylene film ranging from 20-40um in thickness (Purvis, 1984). The physico-chemical characteristics of know mandarins stored at perforated wooden boxes lined with tissue paper, wax paper or polyethylene of 0.33mm thickness both refrigerated 6± 100 temperature. They observed that fruits maintained best characters in polyethylene film where as other living material did not check shriveling to excessive weight loss (Farooqi *et al.,* 1975). Polyethylene bags maintained good organoleptic properties of pear studying the storage in a modified atmosphere (Kolev, 1977). The ascorbic and citric acid content loss in unwrapped and unwaxed fruits, where as sugar content and sugar acid ratio increased (Ahmed, 1979). In light of these findings this study was made on the effect of polyethylene film on physico- chemical characteristics of oranges.

## Materials and Methods

The experiment was carried out at the Nuclear Institute for Food and Agriculture Peshawar during the month of 2003. Mature oranges were purchased from the local market and carried to the laboratory. After sorting and washing under tap water and fruits were dried under fan. The clean dried fruits were divided in to two lots and one of them again divided in to three lots for chemical analysis. One lot kept open (control) the remaining two lots were separately uni-packed in sealed polyethylene bags of thickness 0.0254mm and 0.0508mm. Second big lot specified for the measurement of wt. loss was also divided into three lots and kept in cartons at prevailing uncontrolled room temperature two week intervals for the pH, weight loss, total soluble solids, vitamin “C” Acidity (A.O.A.C, 1984) and organoleptic properties (Krum, 1955).

Data was analyzed through randomized complete block design for this experiment using Duncan’s multiple range tests for ranking.

## Results and Discussion

The statistical analysis or result pertaining to pH of citrus fruit showed that different uni-packaging treatments did not affect pH. The mean values recorded for samples where 4.94 ($T_0$) 4.86 ($T_1$) and 4.81 ($T_2$), results are given in Table 1. The difference in pH during storage is quite negligible. The pH value of citrus juice changes very slightly during ripening (Braver Man, 1933) weight loss is mainly influenced when moisture content of the fruit decreased which may affect the quality of fruits. Different

Table 1: Effect of uni-packaging treatments and storage intervals on the pH of citrus fruits

| Treatments | Storage in days | | | | Mean |
|---|---|---|---|---|---|
| | 0 | 15 | 30 | 45 | |
| Control | 4.80 | 4.98 | 4.98 | 5.00 | 4.94a |
| $T_1$ | 4.80 | 4.86 | 4.88 | 4.90 | 4.86a |
| $T_2$ | 4.80 | 4.76 | 4.80 | 4.87 | 4.81a |
| Mean | 4.80a | 4.87a | 4.89a | 4.92a | |

$T_1$= Polyethylene bags of thickness 0.0254mm. $T_2$= Polyethylene bags of thickness 0.0508mm

Table 2: Effect of uni-packaging treatments and storage intervals on the Weight loss of citrus fruits

| Treatments | Storage in days | | | | Mean |
|---|---|---|---|---|---|
| | 0 | 15 | 30 | 45 | |
| Control | 167.77 | 158.20 | 136.63 | 120.50 | 145.78a |
| $T_1$ | 154.24 | 152.55 | 140.66 | 118.10 | 141.39b |
| $T_2$ | 140.70 | 139.23 | 138.13 | 136.26 | 138.58c |
| Mean | 154.24a | 149.99b | 138.47c | 124.95d | |

$T_1$= Polyethylene bags of thickness 0.0254mm. $T_2$= Polyethylene bags of thickness 0.0508mm

Table 3: Effect of uni-packaging treatments and storage intervals on the Ascorbic acid of citrus fruits

| Treatments | Storage in days | | | | Mean |
|---|---|---|---|---|---|
| | 0 | 15 | 30 | 45 | |
| Control | 59.40 | 50.50 | 41.47 | 40.20 | 47.89c |
| $T_1$ | 59.40 | 51.40 | 50.00 | 49.50 | 52.58b |
| $T_2$ | 59.40 | 59.40 | 52.30 | 50.40 | 55.38a |
| Mean | 59.40a | 53.77b | 47.92c | 46.70d | |

$T_1$= Polyethylene bags of thickness 0.0254mm. $T_2$= Polyethylene bags of thickness 0.0508mm

Table 4: Effect of uni-packaging treatments and storage intervals on the Acidity of citrus fruits

| Treatments | Storage in Days | | | | Mean |
|---|---|---|---|---|---|
| | 0 | 15 | 30 | 45 | |
| Control | 1.59 | 0.55 | 0.51 | 0.45 | 0.78c |
| $T_1$ | 1.59 | 0.78 | 0.71 | 0.68 | 0.94b |
| $T_2$ | 1.59 | 0.98 | 0.90 | 0.75 | 1.05a |
| Mean | 1.59a | 0.77b | 0.71c | 0.63d | |

$T_1$= Polyethylene bags of thickness 0.0254mm. $T_2$= Polyethylene bags of thickness 0.0508mm

Table 5: Effect of uni-packaging treatments and storage intervals on the Total Soluble Solids of citrus fruits

| Treatments | Storage in Days | | | | Mean |
|---|---|---|---|---|---|
| | 0 | 15 | 30 | 45 | |
| Control | 11.00 | 11.20 | 11.53 | 12.00 | 11.43a |
| $T_1$ | 11.00 | 11.00 | 11.20 | 11.60 | 11.20a |
| $T_2$ | 11.00 | 11.10 | 11.30 | 11.60 | 11.25a |
| Mean | 11.00b | 11.10b | 11.34b | 11.73a | |

$T_1$ = Polyethylene bags of thickness 0.0254mm. $T_2$ = Polyethylene bags of thickness 0.0508mm

treatments and storage intervals had highly significant effect ($p<0.05$) on weight loss. The mean value for weight loss are 145.78,141.39 and 138.58 for $T_0$ , $T_1$ and $T_2$ mean values for 0, 15, 30 and 45 days storage period were 154.24, 149.99, 138.47, and 122.95 respectively. Weight loss significantly increased with increase in storage period, results are given in Table 2. The uni-packaging in polyethylene bags played key role in controlling weight loss. Kawada and Albrigo (1979) found that polyethylene bags were superior in term of

restricting weight loss. Albrigi *et al*. (1981); Farooqi (1975); Purvis (1985) and Ahmed (1979) produce similar results. Ascorbic acid determined the samples showed significant decrease. Ascorbic acid prior to experiment was 59.4mg/100grams which decreased with different treatments. To had maximum loss in ascorbic acid content 47.89mg/100grams while the minimum loss for $T_1$ 52.38mg/100grams and 55.36mg/100grams for $T_2$ the ascorbic acid decreased significantly with increase in storage period ($P<0.05$) maximum loss in ascorbic acid 46.70mg/100grams found after 45 days intervals (Table 1) Min (1977) found that ascorbic acid decreased during storage results are given in Table 3. Acidity in the samples showed significant decrease ($P<0.05$). Acidity prior to the experiment was 1.59% which decreased with different treatments. Control ($T_0$) treatment had maximum loss in acidity (0.78%) while minimum loss 0.94% observed for $T_1$. acidity also decreased with increase in the storage period (significantly $P<0.05$). The maximum loss in acidity (0.63%) was found after 45 days interval results are given in Table 4. The acid of citrus fruits constituents of citric acid, malic acid. The bio-chemical constituents degrade due to respiration Sheikh (1979) observed the reduction in total acidity while studying the preservation of mangos with maximum emulsion. Min (1977) Ahmed *et al*. (1979) produced same results.

The main constituents of total soluble solids are sugars. The mean values for total soluble solids content recorded for samples $T_0$, $T_1$ and $T_2$ where 11.43°, 11.20°, 11.25° respectively. Although total soluble solids increase significantly with increase in the storage interval results are in Table 5. This showed that uni-packaging of citrus fruits used showed non significant effect and storage intervals had highly significant ($P<0.05$) effect on total soluble solids of the samples. The result showed negligible difference among result of these treatments. Sattar and Rehman (1967) found no significant changes in total soluble solids in oranges stored in polyethylene bags. The numbering of organoleptic evaluation was arranged on the 10 points. The 10 number indicated liked extremely and 0 showed disliked extremely. Uni-packaging treatments during storage had significant effect ($P<0.05$) on the external appearance on citrus fruits. The mean value for external appearance for $T_0$, $T_1$ and $T_2$ where 4.3, 5.1 and 5.5 respectively. Similarly the mean values in relation to storage intervals also showed significant differences ($P<0.05$). The mean values for the 15, 30 and 45 days were 6.6, 4.8 and 3.4 respectively given in Table 6.

The uni-packaged treatments during storage had significant effect ($P<0.05$) on the taste of citrus fruits. The mean values for $T_0$, $T_1$ and $T_2$ were 4.1, 4.9 and 6.0 respectively. The mean value during storage intervals of 15, 30 and 45 days 6.6, 4.8 and 3.4 respectively and also show significant difference given in Table 7.

Table 6: Effect of uni-packaging treatments and storage intervals on the External appearance of citrus fruits

| Treatments | Storage in days | | | Mean |
|---|---|---|---|---|
| | 15 | 30 | 45 | |
| Control | 6.7 | 4.2 | 1.9 | 4.3c |
| $T_1$ | 6.7 | 4.9 | 3.6 | 5.1b |
| $T_2$ | 6.5 | 5.4 | 4.7 | 5.5a |
| Mean | 6.6a | 4.8b | 3.4c | |

$T_1$ = Polyethylene bags of thickness 0.0254mm. $T_2$ = Polyethylene bags of thickness 0.0508mm

Table 7: Effect of uni-packaging treatments and storage intervals on the Taste of citrus fruits

| Treatments | Storage in days | | | Mean |
|---|---|---|---|---|
| | 15 | 30 | 45 | |
| Control | 6.3 | 3.9 | 2.2 | 4.1c |
| $T_1$ | 6.5 | 5.0 | 3.1 | 4.9b |
| $T_2$ | 7.1 | 5.9 | 5.0 | 6.0a |
| Mean | 6.6a | 4.9b | 3.4c | |

$T_1$ = Polyethylene bags of thickness 0.0254mm. $T_2$ = Polyethylene bags of thickness 0.0508mm

Table 8: Effect of uni-packaging treatments and storage intervals on the Texture of citrus fruits

| Treatments | Storage in days | | | Mean |
|---|---|---|---|---|
| | 15 | 30 | 45 | |
| Control | 6.2 | 3.6 | 1.7 | 3.8c |
| $T_1$ | 6.7 | 4.9 | 3.1 | 4.9b |
| $T_2$ | 6.8 | 5.3 | 4.6 | 5.6a |
| Mean | 6.6a | 4.6b | 3.1c | |

$T_1$ = Polyethylene bags of thickness 0.0254mm. $T_2$ = Polyethylene bags of thickness 0.0508mm

The uni-packaging treatments during storage had significant ($P<0.05$) on the texture of the fruit. The mean texture score for $T_0$, $T_1$ and $T_2$ were 3.8, 4.9 and 5.6 and for storage intervals were 6.6, 4.4 and 3.1 respectively, also showed significant difference results are given in Table 8.

Conclusion based on these results are oranges treated with relatively thick individuals polyethylene packaging reduced weight loss and maintained acidity and ascorbic acid content as compare to others.

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