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# Storage quality of minimally processed potato as influenced by cube size, polythene gauge and vacuum

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**Abstract**
Minimally processed products requires visually acceptable and appealing. The products must have fresh appearance reasonably free of defects and must be of consistent quality throughout the storage and handling. The aim this work was to study the effect of cube size, polythene gauge and vacuum on storage quality of minimally processed potato. Among all the combinations, the potato cubes with 2 $cm^3$ cube sizes, 200 gauge polythene bags and with vacuum packaging recorded better storage quality compared to 1 $cm^3$ cube sizes, 100 gauge polythene bag without vacuum packaging.

**Keywords:** storage quality, processed potato, polythene gauge, vacuum

## 1. Introduction

Potato (*Solanum tuberosum* L.) is one of the unique and most potential crops having high productivity, supplementing major food requirement in the world. It is rich in carbohydrates, proteins, phosphorus, calcium, vitamin C,-carotene and has high protein calorie ratio. Amongst the world's important food crops, the ratio of protein to carbohydrate (1:8.72) is higher in potato than in many cereals and other tuber crops (Marwaha, 1999) [6]. Fresh potatoes are used in preparation of several dishes individually or in combination with other foods. Further, it is a valued raw material for processing industry. The most popular processed products of potato are chips, french fries, powder, cubes, slices and starch. Minimally processed vegetables have become widely accepted in restaurants, catering services, salad bars and consumer packs for home.

Processing is a fast growing factor within world potato economy. Due to the increased demand for convenience food and the expanding institutional market, the consumption of processed potato products is of increasing importance. The most popular processed products of potato are chips, French fries, powder, cubes, slices, starch. The shelf-life of minimally processed fruits and vegetables is usually controlled by microbial spoilage, physiological aging, biochemical changes and loss of nutritionalquality.

Physiological aging is a general loss in quality, resulting eventually in decay or tissue death. It is driven by respiration, transpiration and complex physicochemical and biochemical modifications that mainly affect flavour, colour and texture (Mencarelli and Massantini, 1994; [7] Barry-Ryan and O'Beirne, 1997) [2].

It is estimated that over 50 percent losses in processed potato products occur as a result of enzymatic browning. Browning of peeled potatoes is perceived to be unaesthetic to consumers and reduce product quality and shelf-life. Brown discolourations in foods are complex because of the large number of secondary reactions that may occur (Sapers, 1993) [12]. To enhance the shelf life of minimally processed potato stored under ambient conditions an investigation was carried out to study the effect of cube size, polythene gauge and vacuum on storage quality of minimally processed potato.

## 2. Materials and Methods

Potato tubers of variety Kufri jyothi was selected washed and peeled. Potato cubes of two different sizes 1 $cm^3$ and 2 $cm^3$, free from blemishes, physical injuries were selected and treated with 2 % potassium metabisulphite for ten minutes. The cubes after treatment were shade dried to remove excess moisture adhering them. Then they were packed in two different gauges (100 & 200 guages) of packaging material with and without vacuum were implemented the treatments as follows: $T_1$– $C_1P_1V_1$ – 1 $cm^3$ cube packed in 100 gauge polyethylene bag with vacuum, $T_2$– $C_1P_1V_2$ – 1 $cm^3$ cube packed in 100 gauge polyethylene bag without vacuum, $T_3$– $C_1P_2V_1$ – 1 $cm^3$ cube packed in 200 gauge polyethylene bag with vacuum,$T_4$– $C_1P_2V_2$ – 1 $cm^3$ cube packed in 200 gauge polyethylene bag without vacuum, $T_5$– $C_2P_1V_1$ – 2 $cm^3$ cube packed in 100 gauge polyethylene bag with vacuum, $T_6$– $C_2P_1V_2$ – 2 $cm^3$ cube packed in 100 gauge polyethylene bag without vacuum, $T_7$– $C_2P_2V_1$ – 2 $cm^3$ cube packed in 200 gauge polyethylene bag with vacuum, $T_8$– $C_2P_2V_2$ – 2 $cm^3$ cube packed in 200 gauge polyethylene bag without vacuum, The above samples were evaluated every day until end of shelf life.

### 2.1 Observations recorded

The detailed observations on change in biochemical parameters *viz.*, TSS, titrable acidity, ascorbic acid, total sugar, reducing sugar, non-reducing sugars, starch and total phenols were recorded at the interval of every second day during entire storage period. Reducing sugar, total sugar and starch were estimated by the method suggested by Sadasivam and Manicham (1992) [9] and the total acidity and ascorbic acid were estimated by titration methods. Total phenols were estimated by procedure given by Malik and Singh (1980) [4].

## 3. Results and discussion

Results indicated that the TSS was decreased gradually throughout the storage period irrespective of the treatment. The cubes with treatments $T_3$ (1 $cm^3$ cube packed in 200 gauge polyethylene bag with vacuum) and $T_7$ (2 $cm^3$ cube packed in 200 gauge polyethylene bag with vacuum) could maintain significantly higher levels of TSS even up to the end of storage period. This might be due to slower utilization of sugars and other acids by checking the activity of enzymes. Similar results were obtained by Singh *et al.* (2007) [13], who opined that, the slight decline in TSS due to utilization of total sugars to metabolic transformation in soluble compounds and more conversion of organic acids into sugar. This finding was also in close conformity with results of Sandhu and Parhawak (2002) [11].

There was a gradual decrease in the titrable acidity content in the potato cubes with the progress of storage period. However among the treatments, $T_7$ (2 $cm^3$ cube packed in 200 gauge polyethylene bag with vacuum) recorded maximum retention of acidity at the end of shelf life this might be due to less utilization of organic acids and lower conversion of sugar during ambient storage. The loss in acidity might be due to the activity of carboxylase and mallic enzyme which were closely associated with respiration rate (Neal and Hulume, 1958) [8] or might be due to utilization of acids during respiration (Dutta *et al.*, 1960) [3]. The decrease in total titrable acidity content during storage probably indicated the fact of internal utilization of some of the organic acids during respiration. Gradual decrease in ascorbic acid content of potato cubes was observed throughout the storage period irrespective of the treatment. The cubes with treatments $T_7$ (2 $cm^3$ cube packed in 200 gauge polyethylene bag with vacuum) maintain significantly higher ascorbic acid content even up to the end of storage period due to less oxidative reduction of ascorbic acid in presence of molecular oxygen by ascorbic acid oxidase (Mapson, 1970) [5].

Reducing sugars were increased gradually throughout the storage period irrespective of the treatment. However lowest sugar content was recorded in $T_7$ (2 $cm^3$ cube packed in 200 gauge polyethylene bag with vacuum) this might be due to lower rate of respiration in higher gauge (200) polyethylene bags making least permeability to water vapour transmission, low oxygen and light sensitivity, thereby maintained good quality till the end of storage. The results were in agreement with the findings of Balasubramanyam and Anandswamy (1979) [1] in potato.

Among the treatments, $T_3$ (1 $cm^3$ cube packed in 200 gauge polyethylene bag with vacuum),$T_5$(2 $cm^3$ cube packed in 100 gauge polyethylene bag with vacuum) followed by $T_7$ (2 $cm^3$ cube packed in 200 gauge polyethylene bag with vacuum) was found to be better in maintaining significantly lower levels of non-reducing sugar this might be due to lower rate of respiration in higher gauge (200 gauge) polyethylene bags making least permeability to water vapour transmission, low oxygen and light sensitivity, thereby maintained good quality till the end of storage. The results were in agreement with the findings of Balasubramanyam and Anandswamy (1979) [1] in potato. The treatment $T_{10}$, $T_3$ (1 $cm^3$ cube packed in 200 gauge polyethylene bag with vacuum), $T_5$(2 $cm^3$ cube packed in 100 gauge polyethylene bag with vacuum) followed by $T_7$ (2 $cm^3$ cube packed in 200 gauge polyethylene bag with vacuum) was found to be better in maintaining significantly lower levels of total sugars with higher starch content.

Starch content of the potato cubes declined as storage period progressed irrespective of the anti-browning chemical treatment imposed and storage temperatures. However, significantly higher levels of starch content was recorded with the potato cubes treated with $T_7$ (2 $cm^3$ cube packed in 200 gauge polyethylene bag with vacuum). This might be due to less activities of enzyme invertase as compared to potato cubes in lower gauge polyethylene bags (100 gauge). Similar results were obtained by Young and Dennis (1996) [14] and recorded higher level of starch content in the potato noodles packed in higher gauge.

Phenol content increases gradually in all the treatments as the storage period increases. However lowest phenol content was recorded in 2 $cm^3$ cube sizes were packed in 200 gauge with vacuum, this might be due to lower destruction of tissues during minimal processing operations Saltveit (1989) [10].

## 4. Conclusion

Minimally processed fresh cut potato cubes are a basic ingredient for ready to use vegetable and it is having increasing demand and success in the market. These minimally processed cut potatoes are highly susceptible to browning, To enhance the shelf life of minimally processed potato stored under ambient conditions an investigation was carried out to study the effect of cube size, polythene gauge and vacuum on storage quality of minimally processed potato. From the present investigation, it can be concluded that minimally processed potato, 2 $cm^3$ cube sizes, 200 gauge polythene bag and with vacuum packaging recorded better quality parameters as compared to the 1 $cm^3$ cube sizes, 100 gauge polythene bag and without vacuum packaging.

**Table 1:** Effect of cube size, polythene gauge and vacuum on Bio-Chemical characteristics of potato cubes at the end of storage.

| Treatment | TSS (°Brix) | Titratable acidity (%) | Ascorbic acid (mg 100g$^{-1}$) | Reducing sugars (%) | Total Sugars (%) | Non-reducing sugars (%) | Starch (%) | Total phenols (mg 100g$^{-1}$) |
|---|---|---|---|---|---|---|---|---|
| $T_1$ | 3.16 | 0.19 | 9.29 | 0.322 | 0.564 | 0.242 | 10.03 | 47.26 |
| $T_2$ | 2.66 | 0.17 | 8.85 | 0.281 | 0.556 | 0.282 | 9.82 | 48.10 |
| $T_3$ | 3.60 | 0.23 | 9.20 | 0.314 | 0.512 | 0.198 | 9.95 | 46.33 |
| $T_4$ | 3.06 | 0.18 | 8.89 | 0.229 | 0.506 | 0.277 | 8.96 | 48.26 |
| $T_5$ | 3.56 | 0.25 | 9.53 | 0.312 | 0.525 | 0.213 | 10.82 | 43.43 |
| $T_6$ | 3.06 | 0.19 | 9.13 | 0.248 | 0.547 | 0.300 | 9.98 | 44.53 |
| $T_7$ | 3.60 | 0.27 | 9.93 | 0.310 | 0.525 | 0.215 | 11.20 | 43.30 |
| $T_8$ | 3.10 | 0.20 | 9.20 | 0.233 | 0.516 | 0.283 | 10.04 | 44.86 |
| C.D at 5% | 0.337 | 0.034 | 0.035 | 0.003 | 0.003 | 0.003 | 0.035 | 0.035 |
| SE (m)± | 0.037 | 0.017 | 0.024 | 0.005 | 0.005 | 0.005 | 0.015 | 0.015 |

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