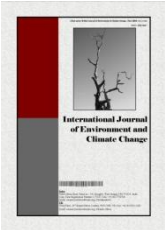

*International Journal of Environment and Climate Change*

***12(11): 3167-3176, 2022; Article no.IJECC.92584***
***ISSN: 2581-8627***
*(Past name: British Journal of Environment & Climate Change, Past ISSN: 2231–4784)*

# Effect of Sun Drying on Osmotic Dehydration of Beetroot (*Beta vulgaris L.*)

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***Authors' contributions***

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

***Article Information***

DOI: 10.9734/IJECC/2022/v12i111364

**Open Peer Review History:**
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/92584

***Original Research Article***

***Received 29 July 2022***
***Accepted 01 October 2022***
***Published 15 October 2022***

## ABSTRACT

An Experiment was conducted at the Postharvest laboratory, Department of Horticulture entitled with "Effect of osmotic dehydration of beetroot (*Beta vulgaris* L.) under sun drying" during the year 2021-2022 to determine the effect of sun drying on osmotic dehydration of beetroot slices for its evaluation of physio-chemical contents, shelf life, and sensory evaluation during total 60 days of storage period and to work out on the economics In this study, 10 treatments with varying amounts of salt, honey, sugar, and K2S2O5 were used, with 4 replications (10 days, 30 days, 45 days, and 60 days) of storage periods at ambient temperature. On the basis of results obtained during the investigation the best osmotic agent for drying of beetroot slice was T7 Treated beetroot slices (Sugar 200g/Kg + K2S2O5 0.5%) + Sun drying of beetroot slices) with pH (6.30), TSS (11.46), fat content (0.28), Protein content (2.41), weight (92.5g). T7 (Treated beetroot slices (Sugar 200g/Kg + K2S2O5 0.5%) + Sun drying of beetroot slices) was found to have the highest value for reducing sugar content, Flavour and Taste score, and overall acceptability. Treatment T7 also had the highest benefit-cost ratio (1.94).

*Keywords: K2S2O5; physio-chemical; sun drying; beetroot; organoleptic.*

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## 1. INTRODUCTION

Beetroot (chukundar), botanically known as *Beta vulgaris L*. is one of the well known plant belonging Amaranthaceae family includes approximately 1400 species divided into 105 genera. Members of this family are dicotyledonous. It is an erect annual herb with tuberous root stocks. There are basically four varieties of Beetroot namely known as Detroit dark red, Crimson Globe, Crosby Egyptian and early Wonder. It ranks among the ten most potent vegetables with respect to antioxidant property [1-4].

Osmotic dehydration is a method of partial removal of water in hypertonic solutions by soaking foods, mostly fruits and vegetables (Shi and Maguer 2002). The driving force for water diffusion from plant tissue into solution is the distinction between hypertonic solution osmotic pressures and plant tissue. Simultaneous counter- diffusion of solutes from solution to tissue is followed by the diffusion of water (Lazarides et al. 1995). Leakage of natural solutes from plant tissue happens because the plant tissue cell membranes responsible for Osmotic transportation are not completely selective, but this flow is negligible, although it may be essential for the organoleptic and nutritional characteristics of the product (Sahoo et al. 2007).

The osmotically dehydrated food can be further processed by freezing, vacuum drying and drying air (Nanjundaswamy et al. 1978). The prevalent osmotic agents are sugar, glucose, fructose, maize and sodium chloride, and this sodium chloride solution is widely used for fruit vegetables and sucrose solution. The primary industrial applications of osmotic dehydration are dehydrated fruits and vegetables, making candied products etc [5-9].

Dehydrated beetroot sample is used as a value added ingredient in a variety of products including pasta, smoothies, drinks, soup mixes, and so on [10,11]. Post-harvest losses can be reduced by converting the beetroot into powder, shreads, sweets, jam, preserved juice and pickle etc [12,13]. Beetroot, as new as it is, is delicious and nutritious. Among all vegetables, it is wealthy in vitamin C, A and K content [14]. As a healthy and nutritious vegetable, there is an increasing global demand for beetroot.
Intermediate moisture foods (IMFS) have become more common in latest years as a compared to foods that have been completely dehydrated [15-17]. Intermediate moisture (IM) has benefits over traditionally dried fruit and vegetables, where, instead of removing most of the water, just enough water is removed or bound by adding a humectant to delay microbial development [18].

Value addition and conservation can be a best solution of reducing these food losses. These losses can be avoided by converting the commodities into various value added products and by developing efficient, economic as well as environmentally friendly technologies [19-23].

This study was taken up to asses the best osmotic agent for drying of beetroot slices for evaluation of qyality and to estimate the economics of various treatments.

## 2. MATERIALS AND METHODS

### 2.1 Experimental Site

The experimental work for preparation of osmotically dehydrated beetroot slices was conducted at the post-harvest laboratory of Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during 2021-2022.

### 2.2 Materials Used

Fresh beetroots were procured from the local farmer's field of Prayagraj district for the preparation of osmotically dehydrated beetroot slices. All the chemicals used in the study were collected from department laboratories. The instruments such as weighing machine, steel containers, PH meter Refractometer , knife etc. are used for the osmotically dehydrated beetroots .

### 2.3 Methods

The beetroots were washed, peeled, and sliced into pieces before being treated with several osmotic agents (treatment combinations)-sugar, honey, salt, and. K2S2O5 Solutions prepared by adding water and osmotic agents according to the treatments and beetroot slices were immersed for 25 min with them for osmosis. After that, the osmotically treated beetroot slices were sun dried for 48-72 hours. Dehydrated ready-to-eat beetroot slices were collected in Polypropylene pouches and stored for 60 days to

evaluate its storage life, which included proximate and organoleptic analyses.

## 2.4 pH Estimation

The pH was determined using a pH meter; the pH meter was standardized using standard buffer of pH 4.The sample was taken in a beaker, the electrodes of the pH meter were dipped into it for 1 minute and the pH was recorded. The electrodes of the pH meter were washed with distilled water after each determination.

## 2.5 Total Soluble Solid (TSS)

The total soluble solids in beetroot leathers were determined by weighing the ground sample and mixing in 20 ml distilled water and kept for 1 hour. After standing it was centrifuged at 5000 rpm for 5 min (by using research centrifuge R-24). The supernatant was taken in petri dish and evaporated to solid form with constant weight.

**Table 1. Treatment details are as follows**

| Treatment notation | Treatment combination |
|---|---|
| $T_0$ | Untreated beetroot + Sun drying of beetroot slices |
| $T_1$ | Treate beetroot (Sugar 200g/Kg) + Sun drying of beetroot slices |
| $T_2$ | Treated beetroot (Honey 200g/Kg) + Sun drying of beetroot slices |
| $T_3$ | Treated beetroot (Salt 5g/Kg) + Sun drying of beetroot slices |
| $T_4$ | Treated beetroot (Sugar 200g/Kg +K2S2O5 0.2%) + Sun drying of beetroot slices |
| $T_5$ | Treated beetroot (Honey 200g/Kg +K2S2O5 0.2%) + Sun drying of beetroot slices |
| $T_6$ | Treated beetroot (Salt 5g/Kg +K2S2O5 0.2%) + Sun drying of beetroot slices |
| $T_7$ | Treated beetroot (Sugar 200g/Kg +K2S2O5 0.5%) + Sun drying of beetroot slices |
| $T_8$ | Treated beetroot (Honey 200g/Kg +K2S2O5 0.5%) + Sun drying of beetroot slices |
| $T_9$ | Treated beetroot (Salt 5g/Kg +K2S2O5 0.5%) + Sun drying of beetroot slice |

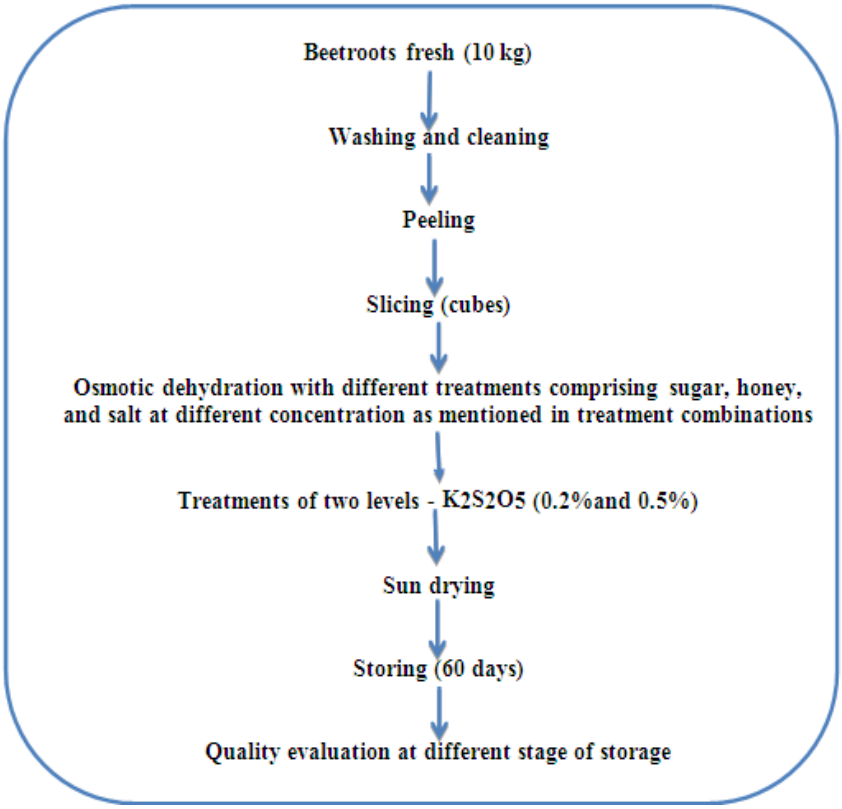


**Fig. 1. The flowchart of preparation of osmotically dehydrated Beetroot slices**

Weight of total soluble solids was recorded in grams and expressed as gram per 100 g sample. Refract meter was also used to measure T.S.S.

## 2.6 Sensory Evaluation

Prepared fruit bars packed in polythene pouches were evaluated for appearance and colour, flavour and taste, body and texture and overall acceptability by a panel of 15 semi-trained judges (Larmond, 1970). The samples were rated on 9 point Hedonic Scale.

## 2.7 Statistical Analysis

The data recorded during the course of experimental investigation were subjected to statistical analysis of "Analysis of variance" technique (Fisher and Yates, 1967) for drawing conclusion. The significance and non-significance of the treatments were judged with the help of 'F' (Variance ratio) test the significant differences between the means were tested with the critical differences at 5% probability level.

## 3. RESULT AND DISCUSSIONS

The chapter deals with research finding of the study together with relevant discussion. The results are presented with the objective of study.
Composition of Fresh Dehydrated beetroots-

The proximate chemical composition of fresh beetroots per 100 gm as 4 to 6 % moisture content, 1.52 to 1.86% protein, 0.15 to 0.20% fat, and 1 to 1.6% minerals. A small variation is observed due to temperature used during drying and storage.

At 10 day of storage of osmotically dehydrated beetroot, mean pH value was observed to be 6.14, C.V. was recorded with value of 2.68 while S.E. (d) was recorded to be 0.09. Significantly minimum pH was recorded in treatment T2 5.20 followed by T5 5.30. However, significantly maximum pH was recorded T9 with value of 6.80. After 30 days of storage mean pH value was observed to be 5.86, C.V. was recorded with value of 2.36 while S.E. (d) was recorded to be 0.08. Significantly minimum pH was recorded in treatment T2 with value of 4.89 followed by T5 5.04. However, significantly maximum pH was recorded T9 with value of 6.53.After 45 days of storage of osmotically dehydrated beetroot, mean pH value was observed to be 5.06, C.V. was recorded with value of 2.08 while S.E. (d) was recorded to be 0.07. Significantly minimum pH was recorded in treatment T2 4.88.

At 10 day of storage of osmotically dehydrated beetroot, mean Fat Content value was observed to be 0.60, C.V. was 3.40 while S.E. (d) was recorded 0.01. Significantly maximum Fat Content was recorded T2 with value of 1.21 followed by 1.04. However, minimum Fat Content was recorded in treatment T0with value of 0.19. After 30 days of storage mean Fat Content value was observed to be 0.90, C.V. was 3.05 while S.E. (d) was 0.02. , maximum Fat Content was recorded with value of 1.82 followed by T1 with value of 1.27. However, significantly minimum Fat Content was recorded in treatment T0 with value of 0.27. At 45 days of storage mean Fat Content value was observed to be 0.89, C.V. was recorded with value of 3.67 while S.E. (d) was recorded to be 0.02. Significantly maximum Fat Content was recorded T2 with value of 1.48.

At 10 day of storage mean Protein Content value was be 1.97, C.V. was recorded with value of 2.76 while S.E. (d) was recorded to be 0.03. Significantly maximum Protein Content was recorded T9 with value of 2.75 followed by T8 2.42. However, significantly minimum Protein Content was recorded in treatment T1 1.34. At 30 days of storage mean Protein Content value was observed to be 2.57, C.V. was recorded with value of 2.18 while S.E. (d) was recorded to be 0.03. Significantly maximum Protein Content was recorded T9 with value of 3.65 followed by T8 with value of 3.10. However, significantly minimum Protein Content was recorded in treatment T1 1.68**.** At 45 days of storage of mean Protein Content value was 2.61, C.V. was recorded with value of 1.93 while S.E. (d) was recorded to be 0.03. Significantly maximum Protein Content was recorded T9 3.74 followed by T7 with value of 3.25. significantly minimum Protein Content was recorded in treatment T1 1.88.After 60 days of storage of osmotically dehydrated beetroot, mean Protein Content value was observed to be 2.63, C.V. was recorded with value of 3.09 while S.E. (d) was recorded to be 0.05.Significantly maximum Protein Content was recorded T9 with value of 3.86 followed by T8 with value of 3.42. However, significantly minimum Protein Content was recorded in treatment T1 (1.94).

**Table 2. Effect of various treatment combinations on pH of osmotically dehydrated sundried beetroot slices at different days of storage**

| | Treatment combination | pH | | | |
|---|---|---|---|---|---|
| | | Storage period (Days) | | | |
| | | 10 Days | 30 days | 45 days | 60 days |
| $T_0$ | Untreated beetroot + Sun drying of beetroot slices | 5.80 | 5.33 | 5.12 | 4.90 |
| $T_1$ | Treated beetroot (Sugar 200g/Kg) + Sun drying of beetroot slices | 6.90 | 6.45 | 6.13 | 5.88 |
| $T_2$ | Treated beetroot (Honey 200g/Kg) + Sun drying of beetroot slices | 5.20 | 4.98 | 4.88 | 4.60 |
| $T_3$ | Treated beetroot (Salt 5g/Kg) + Sun drying of beetroot slices | 6.50 | 6.27 | 6.04 | 5.85 |
| $T_4$ | Treated beetroot (Sugar 200g/Kg +$K_2S_2O_5$ 0.2%) + Sun drying of beetroot slices | 6.60 | 6.25 | 6.06 | 5.80 |
| $T_5$ | Treated beetroot (Honey 200g/Kg +$K_2S_2O_5$ 0.2%) + Sun drying of beetroot slices | 5.30 | 5.04 | 4.90 | 4.75 |
| $T_6$ | Treated beetroot (Salt 5g/Kg +$K_2S_2O_5$ 0.2%) + Sun drying of beetroot slices | 6.60 | 6.42 | 6.20 | 6.07 |
| $T_7$ | Treated beetroot (Sugar 200g/Kg +$K_2S_2O_5$ 0.5%) + Sun drying of beetroot slices | 6.30 | 6.09 | 5.84 | 5.67 |
| $T_8$ | Treated beetroot (Honey 200g/Kg +$K_2S_2O_5$ 0.5%) + Sun drying of beetroot slices | 5.40 | 5.23 | 5.09 | 4.86 |
| $T_9$ | Treated beetroot (Salt 5g/Kg +$K_2S_2O_5$ 0.5%) + Sun drying of beetroot slices | 6.80 | 6.53 | 6.37 | 6.08 |

**Table 3. Effect of various treatment combinations on Fat content of osmotically dehydrated beetroot at different days of storage (in g/100g)**

| Treatment notation | Treatment combination | Fat content (g/100g) | | | |
|---|---|---|---|---|---|
| | | Storage period (Days) | | | |
| | | 10 Days | 30 days | 45 days | 60 days |
| $T_0$ | Untreated beetroot + Sun drying of beetroot slices | 0.19 | 0.27 | 0.12 | 0.18 |
| $T_1$ | Treated beetroot (Sugar 200g/Kg) + Sun drying of beetroot slices | 1.00 | 1.27 | 1.35 | 1.42 |
| $T_2$ | Treated beetroot (Honey 200g/Kg) + Sun drying of beetroot slices | 1.21 | 1.82 | 1.48 | 1.89 |
| $T_3$ | Treated beetroot (Salt 5g/Kg) + Sun drying of beetroot slices | 0.46 | 0.87 | 0.68 | 0.57 |
| $T_4$ | Treated beetroot (Sugar 200g/Kg +$K_2S_2O_5$ 0.2%) + Sun drying of beetroot slices | 0.78 | 1.08 | 0.89 | 1.01 |
| $T_5$ | Treated beetroot (Honey 200g/Kg +$K_2S_2O_5$ 0.2%) + Sun drying of beetroot slices | 1.04 | 1.24 | 1.32 | 1.14 |
| $T_6$ | Treated beetroot (Salt 5g/Kg +$K_2S_2O_5$ 0.2%) + Sun drying of beetroot slices | 0.31 | 0.67 | 0.77 | 0.78 |
| $T_7$ | Treated beetroot (Sugar 200g/Kg +$K_2S_2O_5$ 0.5%) + Sun drying of beetroot slices | 0.28 | 0.63 | 0.87 | 1.00 |
| $T_8$ | Treated beetroot (Honey 200g/Kg +$K_2S_2O_5$ 0.5%) + Sun drying of beetroot slices | 0.54 | 0.76 | 0.81 | 0.89 |
| $T_9$ | Treated beetroot (Salt 5g/Kg +$K_2S_2O_5$ 0.5%) + Sun drying of beetroot slices | 0.21 | 0.43 | 0.65 | 0.55 |

**Table 4. Effect of various treatment combinations on Protein content of osmotically dehydrated beetroot at different days of storage (in g/100g)**

| | Treatment combination | Protein content (g/100g) | | | |
|---|---|---|---|---|---|
| | | Storage period (Days) | | | |
| | | 10 Days | 30 days | 45 days | 60 days |
| $T_0$ | Untreated beetroot + Sun drying of beetroot slices | 1.54 | 2.30 | 2.36 | 2.48 |
| $T_1$ | Treated beetroot (Sugar 200g/Kg) + Sun drying of beetroot slices | 1.34 | 1.68 | 1.88 | 1.94 |
| $T_2$ | Treated beetroot (Honey 200g/Kg) + Sun drying of beetroot slices | 1.41 | 1.98 | 2.11 | 2.05 |
| $T_3$ | Treated beetroot (Salt 5g/Kg) + Sun drying of beetroot slices | 2.08 | 2.89 | 2.68 | 2.75 |
| $T_4$ | Treated beetroot (Sugar 200g/Kg +$K_2S_2O_5$ 0.2%) + Sun drying of beetroot slices | 1.65 | 2.01 | 1.88 | 2.12 |
| $T_5$ | Treated beetroot (Honey 200g/Kg +$K_2S_2O_5$ 0.2%) + Sun drying of beetroot slices | 2.12 | 2.53 | 2.18 | 2.22 |
| $T_6$ | Treated beetroot (Salt 5g/Kg +$K_2S_2O_5$ 0.2%) + Sun drying of beetroot slices | 2.00 | 2.58 | 2.85 | 2.39 |
| $T_7$ | Treated beetroot (Sugar 200g/Kg +$K_2S_2O_5$ 0.5%) + Sun drying of beetroot slices | 2.41 | 3.01 | 3.25 | 3.12 |
| $T_8$ | Treated beetroot (Honey 200g/Kg +$K_2S_2O_5$ 0.5%) + Sun drying of beetroot slices | 2.42 | 3.10 | 3.19 | 3.42 |
| $T_9$ | Treated beetroot (Salt 5g/Kg +$K_2S_2O_5$ 0.5%) + Sun drying of beetroot slices | 2.76 | 3.65 | 3.74 | 3.86 |

**Table 5. Effect of various treatment combinations on weight of osmotically dehydrated beetroot at different days of storage (g)**

| Treatment notation | Treatment combination | Weight (g) | | | |
|---|---|---|---|---|---|
| | | Storage period (Days) | | | |
| | | 0 Days | 30 days | 45 days | 60 days |
| $T_0$ | Untreated beetroot + Sun drying of beetroot slices | 76.50 | 72.10 | 70.50 | 68.70 |
| $T_1$ | Treated beetroot (Sugar 200g/Kg) + Sun drying of beetroot slices | 85.10 | 81.30 | 79.70 | 77.80 |
| $T_2$ | Treated beetroot (Honey 200g/Kg) + Sun drying of beetroot slices | 95.30 | 92.70 | 90.30 | 88.90 |
| $T_3$ | Treated beetroot (Salt 5g/Kg) + Sun drying of beetroot slices | 80.50 | 77.10 | 75.70 | 73.60 |
| $T_4$ | Treated beetroot (Sugar 200g/Kg +$K_2S_2O_5$ 0.2%) + Sun drying of beetroot slices | 89.30 | 86.10 | 83.90 | 81.50 |
| $T_5$ | Treated beetroot (Honey 200g/Kg +$K_2S_2O_5$ 0.2%) + Sun drying of beetroot slices | 97.10 | 96.50 | 95.10 | 94.60 |
| $T_6$ | Treated beetroot (Salt 5g/Kg +$K_2S_2O_5$ 0.2%) + Sun drying of beetroot slices | 82.40 | 80.70 | 77.90 | 74.70 |
| $T_7$ | Treated beetroot (Sugar 200g/Kg +$K_2S_2O_5$ 0.5%) + Sun drying of beetroot slices | 92.50 | 89.80 | 88.10 | 85.90 |
| $T_8$ | Treated beetroot (Honey 200g/Kg +$K_2S_2O_5$ 0.5%) + Sun drying of beetroot slices | 98.20 | 97.70 | 96.10 | 85.30 |
| $T_9$ | Treated beetroot (Salt 5g/Kg +$K_2S_2O_5$ 0.5%) + Sun drying of beetroot slices | 83.30 | 81.50 | 80.10 | 78.70 |

**Table 6. Effect of various treatment combinations on overall acceptability of osmoticallydehydrated sundried beetroot slices at different days of storage**

| Treatmentnotation | Treatment combination | Overall acceptability | | | |
|---|---|---|---|---|---|
| | | Storage period (Days) | | | |
| | | 0 Days | 30 days | 45days | 60 days |
| $T_0$ | Untreated beetroot + Sun drying of beetroot slices | 5.99 | 6.12 | 6.21 | 6.34 |
| $T_1$ | Treated beetroot (Sugar 200g/Kg) + Sun drying of beetroot slices | 7.09 | 7.24 | 7.34 | 7.45 |
| $T_2$ | Treated beetroot (Honey 200g/Kg) + Sun drying of beetroot slices | 7.37 | 7.64 | 7.80 | 7.89 |
| $T_3$ | Treated beetroot (Salt 5g/Kg) + Sun drying of beetroot slices | 6.17 | 6.48 | 6.57 | 6.66 |
| $T_4$ | Treated beetroot (Sugar 200g/Kg +$K_2S_2O_5$ 0.2%) + Sun drying of beetroot slices | 7.97 | 8.09 | 8.12 | 8.36 |
| $T_5$ | Treated beetroot (Honey 200g/Kg +$K_2S_2O_5$ 0.2%) + Sun drying of beetroot slices | 7.83 | 8.17 | 8.41 | 8.66 |
| $T_6$ | Treated beetroot (Salt 5g/Kg +$K_2S_2O_5$ 0.2%) + Sun drying of beetroot slices | 6.88 | 7.12 | 7.27 | 7.56 |
| $T_7$ | Treated beetroot (Sugar 200g/Kg +$K_2S_2O_5$ 0.5%) + Sun drying of beetroot slices | 8.00 | 8.27 | 8.42 | 8.68 |
| $T_8$ | Treated beetroot (Honey 200g/Kg +$K_2S_2O_5$ 0.5%) + Sun drying of beetroot slices | 8.01 | 8.19 | 8.38 | 8.47 |
| $T_9$ | Treated beetroot (Salt 5g/Kg +$K_2S_2O_5$ 0.5%) + Sun drying of beetroot slices | 6.86 | 7.08 | 7.16 | 7.86 |


**Fig. 2. An overview of osmotically dehydrated and sun dried beetroot of some different treatment combinations (Laboratory, Department of Horticulture at NAI, SHUATS, Prayagraj during 2021-22)**

At 10 day of storage of, mean weight value was observed to be 88.02 g, C.V. was recorded with value of 3.91 while S.E. (d) was 2.33. Significantly maximum weight was recorded $T_8$ with value of 98.20 g followed by $T_5$ with value of 97.10 g. After 30 days of storage, mean weight value was observed to be 85.55 g, C.V. was recorded with value of 3.62 while S.E. (d) was recorded to be 2.24. Significantly maximum weight was recorded for $T_8$ with value of 97.7 g followed by with value of 96.50 g. However, significantly minimum weight was treatment $T_0$ 72.10 g. After 45 days of storage of mean weight value was observed to be 83.74 g, C.V. was recorded 3.53 while S.E. (d) was 2.17. maximum weight was with value of 96.10 g followed by $T_5$ with value of 95.10 g. minimum weight was recorded in treatment $T_0$ with value of 70.50 g. After 60 days of storage weight value was observed to be 80.97 g, C.V. was recorded with value of 3.46 while S.E. (d) was recorded to be 2.10. Significantly maximum weight was recorded $T_5$ with value of 94.60 g followed by $T_2$ with value of 88.90 g. minimum weight was recorded in treatment $T_0$

### 3.1 Packaging Material and Storage Time on the Flavor of the Dehydrated Beetroot

There was no significant difference in flavour on the samples of dehydrated beetroot within 60 days of storage. The flavour of dehydrated beetroot packed in polyethylene bags were retained lower and flavour become slightly changed after 60 days of storage [24-27]. Flavour is the important organolaptic property of dehydrated beetroot which enhances the product acceptability.

### 3.2 Economics

Maximum gross returns, net returns and benefit: cost ratio was observed in the treatment T7 (Treated beetroot (Sugar 200g/Kg +K2S2O5 0.5%) + Sun drying of beetroot slices) and recorded the best treatment among all the other treatments. As the economics is the need of the farmers while taking decision regarding the adoption of the post-harvest processing techniques and scientific knowledge, as T7 (Treated beetroot (Sugar 200g/Kg +K2S2O5 0.5%) + Sun drying of beetroot slices) gave the highest gross return, net return, and cost benefit value, addition by this method in beetroot can be promoted. minimum B.C ratio was found in $T_5$ Treated beetroot (Honey 200g/Kg +K2S2O5 0.2%) + Sun drying of beetroot slices (0.39).

## 4. CONCLUSION

On the basis of results obtained during the present investigation the best osmotic agent for drying of beetroot slice was treatment combination $T_7$ (Treated beetroot (Sugar 200g/Kg +K2S2O5 0.5%) + Sun drying of beetroot slices). $T_7$ (Treated beetroot (Sugar 200g/Kg +K2S2O5 0.5%) + Sun drying of beetroot slices) had maximum value for Flavour and Taste score, overall acceptability also for its appearance of dark red coloured dried slices .it had also a good shelf life compared to the treatments $T_2$ ,$T_5$,$T_8$ with osmotic agent honey.

The maximum Benefit cost ratio (1.94) was found for $T_7$ (Treated beetroot (Sugar 200g/Kg +K2S2O5 0.5%) + Sun drying of beetroot slices).

The study requires additional research to prevent colour loss and loss of betalain content of beetroot during storage. This study paved the way for beetroot process optimization with its natural colour, flavour, and texture, with the potential for a longer shelf life. Because the beetroot sample contains betalain as a red pigment, it can be used as a colourant in the food industry. Because beetroot has a high iron and antioxidant content, it can be used to fortify a variety of foods, including yoghurt. Beetroot may be widely used in the beverage and bakery industries to make juice, cookies, beetroot candy, halwa, beetroot gulab jamun, and so on.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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