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IDENTIFICATION OF DESIRABLE PACKAGING MATERIAL FOR DEHYDRATED BANANA INFLORESCENCE AND BROCCOLI

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ABSTRACT

Packaging is a very important aspect of postharvest procedures. Also packaging of dehydrated horticultural commodities is equally important. In the following experiment different types of packaging materials were used to pack two dehydrated horticultural entities which were dehydrated banana inflorescence and broccoli florets. Prior to dehydration, samples of these were prepared by subjecting them to certain pretreatments and then dehydration was carried out in a hot air oven. After packaging of the dehydrated substances, storage was carried in ambient condition. Calculation of various attributes like rehydration ratio, coefficient of rehydration, percent water in the rehydrated material and moisture content (dehydrated produce) was done at timely intervals during the storage study. From the experiment it was concluded that the packaging material where combination of Laminated aluminum foil and Low-Density Polyethylene was used, was best suited for both the dehydrated produce as the materials packed inside it showed proper results for the mentioned attributes.

Keywords : banana inflorescence, broccoli, samples, dehydration, packaging.

Introduction

Packaging today has undergone many modified dimensions and terms. It is not that the art of packaging is very recent, but a bit of this practice is being followed from the earlier times, however today the need has been very much felt. It is a very ordinary art of work which in general is done after harvesting of the commodity. This helps in arranging the materials in proper dimensions so that they can be properly taken care of. Furthermore, handling these sorts of packaged items becomes very easy and they remain safe from any kind of wear and tear which may occur during the movement of the commodities from one place to another or during the time of storage (Burdon, 1997). When any kind of entity is subjected to packaging for example it may be vegetables or fruits, then it adds a practical dimension to the handling view point. Also, not only this when packaging is done, it helps in reducing the loss of water from the produces specifically to the type of leafy vegetables to a great

extent, thus reducing the wilting of leaves and maintaining the hygiene in an acceptable manner (Ares *et al.*, 2008a; Ares *et al.*, 2008b; Luo *et al.*, 2004). Packaging today serves a major role in minimizing the post-harvest losses to a certain extent. So, as it is very much understood that packaging is a very important and integral part of post-harvest operations. But as like of packaging of fresh or raw produce, equal and effective packaging is very much required for dehydrated items. So, the present study is mainly based on testing and concluding results with respect to three different types of packaging materials on two dehydrated but very much nutritionally important horticultural commodities viz. banana inflorescence and broccoli.

Materials and Methods

The present investigation was conducted in the Department of Post-Harvest Technology of Horticultural Crops, Faculty of Horticulture present under Bidhan Chandra Krishi Viswavidyalaya, located

in Mohanpur, District: Nadia during the academic year 2013-2016. For the purpose of carrying out of the experiment dehydrated samples of both banana inflorescence and broccoli were prepared. However fresh fruit for both of them were procured from farmers' field located nearby, grown with proper cultivation care. For dehydrated banana inflorescence the flowers from them were meticulously extracted in the laboratory and then from them the scale and the gynoecium portion were removed. Thereafter these flowers were dipped in a 0.2% citric acid solution for a period of 10 minutes after which hot water blanching was carried for another 4 minutes and finally dipping in cold water containing a solution of 0.1% potassium metabisulphite was done for another 10 minutes. Finally, the prepared samples were dehydrated in a hot air oven at a temperature of 50°C. In case of broccoli the overall process of preparation of dehydrated samples was same but with certain changes. The broccoli heads were chopped into small florets in the laboratory and then for them initial dipping was done in a solution of 0.2% calcium chloride followed by similar process of hot water blanching for 4 minutes and final dipping in 0.1% potassium metabisulphite for 10 minutes. However later on dehydration for broccoli florets were successfully carried out at a temperature of 55°C.

Now once when the dehydrated samples for both banana inflorescence and broccoli were prepared, then both of them were subjected to packaging in three different types of packaging materials considered as treatments. viz. T₁ – Low Density Polyethylene (50 micron), T₂ – Laminated aluminium foil, T₃ – Laminated aluminium foil + Low Density Polyethylene (50 micron). After putting the materials in the packages, they were sealed and subsequent storage was carried out in ambient condition. The experiment had six replications and Completely Randomized Design was used to layout the study (Gomez and Gomez, 1984). Statistical analysis was done by the help of an online software (Sheoran *et al.*, 1984).

Following parameters were analyzed at timely duration during the study.

Rehydration Ratio: It was estimated by the following formula, as per A.O.A.C, 2000.

$$\text{Rehydration ratio} = \frac{\text{Drained weight of the rehydrated sample}}{\text{Weight of the dehydrated sample}}$$

Coefficient of rehydration: Again, the formula according to A.O.A.C, 2000 was used to estimate this.

$$\frac{(\text{Drained wt of dehydrated sample}) \times (100 - \text{Moisture content of sample before drying})}{(\text{Wt of dried sample taken for rehydration} - \text{Amount of moisture present in dried sample taken for rehydration})} \times 100$$

Percent water in the rehydrated material: Methods as per Ranganna, (2003) is used for the estimation of this parameter.

$$\frac{(\text{Drained wt of rehydrated material}) - (\text{Dry matter content in sample taken for rehydration})}{\text{Drained wt of rehydrated material}}$$

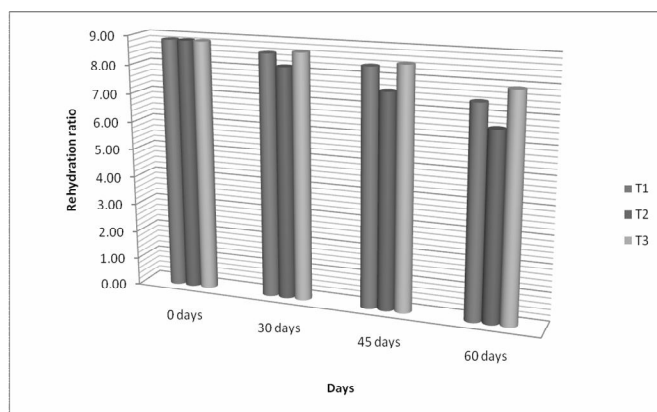
Moisture content (dehydrated produce): Calculations as per A.O.A.C, 2000 was used to estimate the parameter.

$$\text{Moisture content (\%)} = \frac{\text{Dry fruit weight} - \text{Dry fruit weight (after drying at 121°C)}}{\text{Dry fruit weight}} \times 100$$

Results and Discussion

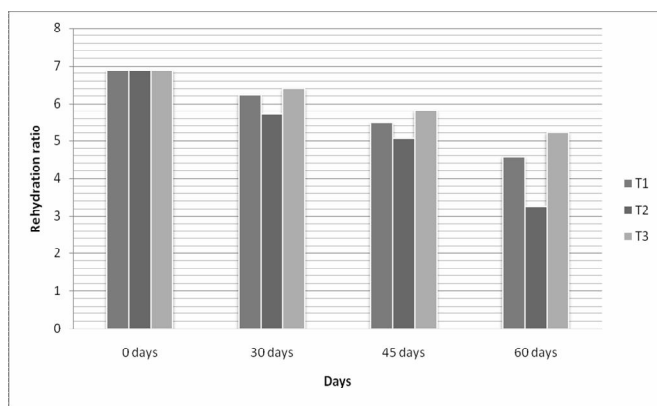
Rehydration ratio

The rehydration ratio at the initial day (0 DAS) for the dehydrated banana inflorescence (Fig. 1) packed in different packaging treatments recorded the maximum value of 8.86 %. Thereafter there was a reduction in the rehydration ratio during storage period for all the samples of dehydrated banana inflorescence packed in different packaging treatments. At next interval i.e. 30 days not much change in the rehydration ratio of dried banana inflorescence packed in different packaging treatments was seen, though dehydrated banana inflorescence packed in T₃ (Laminated aluminium foil + LDPE 50 micron) recorded the highest rehydration ratio. The rehydration ratio at 0 days of storage for dehydrated broccoli florets (Fig. 2) packed in different packaging treatments recorded the highest value of 6.88 %. Thereafter again, a decreasing pattern for rehydration ratio was observed for dehydrated broccoli florets also. Thus, same thing happened till the end of experiment for both dehydrated banana inflorescence and broccoli and at the end of storage dehydrated materials in T₃ (Laminated aluminium foil + LDPE 50 micron) had the highest rehydration ratio and dehydrated samples in T₂ (Laminated aluminium foil) recorded the comparative lower value.



T₁ – LDPE 50 micron, **T₂** – Laminated aluminium foil, **T₃** – Laminated aluminium foil + LDPE 50 micron

Fig 1: Rehydration ratio of dehydrated banana inflorescence packed in different packaging treatments during storage

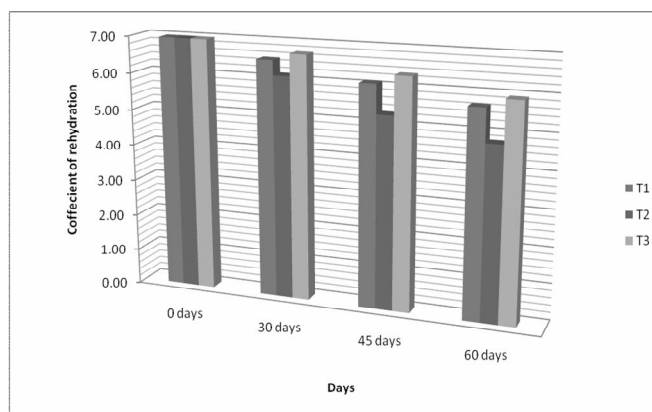


T₁ – LDPE 50 micron, **T₂** – Laminated aluminium foil, **T₃** – Laminated aluminium foil + LDPE 50 micron

Fig 2: Rehydration ratio of dehydrated broccoli packed in different packaging treatments during storage.

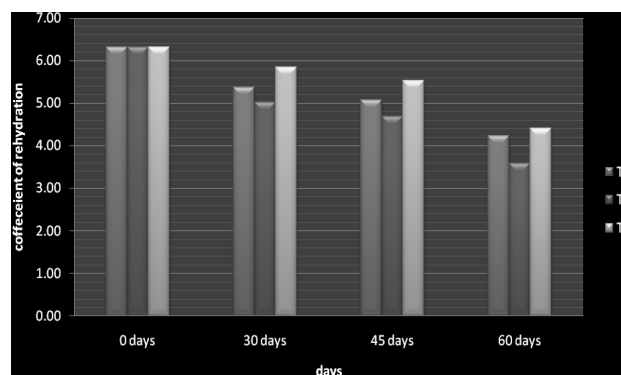
Coefficient of rehydration

The coefficient of rehydration decreased during the period of storage for dehydrated banana inflorescence (Fig. 3) and broccoli florets (Fig. 4) packed in different packaging treatments. Though the dehydrated materials packed in T₃ (Laminated aluminium foil + LDPE) showed the highest value of coefficient of rehydration followed by dehydrated substances packed in T₁ (LDPE 50 micron), but not much of difference was seen between them. However, the value of coefficient of rehydration for banana inflorescence and broccoli florets packed in T₂ (Laminated aluminium foil) remained significantly lower at the end of storage.



T₁ – LDPE 50 micron, **T₂** – Laminated aluminium foil, **T₃** – Laminated aluminium foil + LDPE 50 micron

Fig 3: Coefficient of rehydration of dehydrated banana inflorescence packed in different packaging treatments during storage

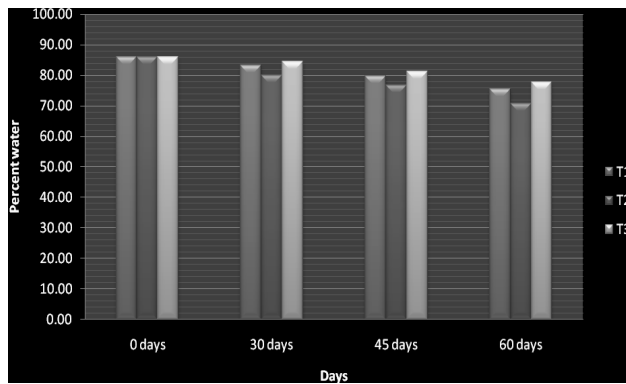


T₁ – LDPE 50 micron, **T₂** – Laminated aluminium foil, **T₃** – Laminated aluminium foil + LDPE 50 micron

Fig 4: Coefficient of rehydration of dehydrated broccoli packed in different packaging treatments during storage

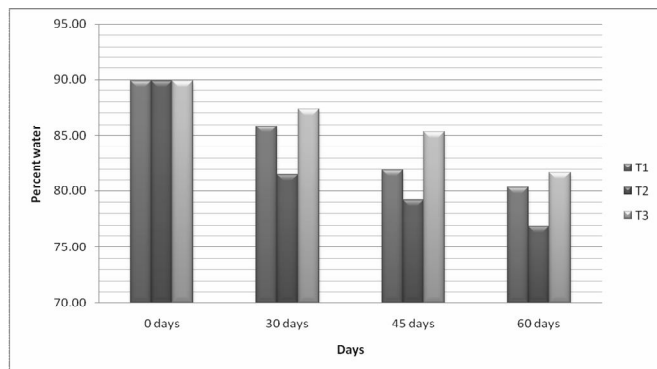
Percent water in rehydrated material

There was not much of a change in the water uptake or percent water in rehydrated material for dehydrated banana inflorescence (Fig. 5) packed in different packaging treatments at 30 days of storage. But later on, the values for percent water uptake decreased. At the end of storage dehydrated banana inflorescence packed in T₃ (Laminated aluminium foil + LDPE 50 micron) and T₁ (LDPE 50 micron) showed almost equal amount of water uptake and dehydrated banana inflorescence packed in T₂ (Laminated aluminium foil) recorded a lesser amount of water uptake of 70.75%. Similar kind of results were obtained for dehydrated broccoli florets (Fig. 6) where also at the end of the study T₃ (Laminated aluminium foil + LDPE 50 micron) was considerably the best packaging substance for retaining significant higher values of percent water uptake for dehydrated broccoli florets packed in it during storage.



T₁ – LDPE 50 micron, T₂ – Laminated aluminium foil, T₃ – Laminated aluminium foil + LDPE 50 micron

Fig 5: Percent water in rehydrated material of dehydrated banana inflorescence packed in different packaging treatments during storage



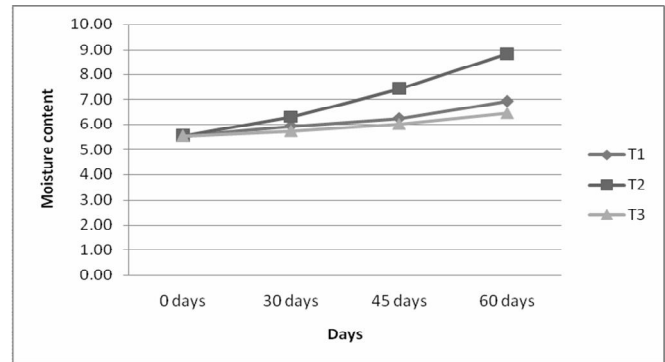
T₁ – LDPE 50 micron, T₂ – Laminated aluminium foil, T₃ – Laminated aluminium foil + LDPE 50 micron

Fig 6: Percent water in rehydrated material of dehydrated broccoli packed in different packaging treatments during storage

Moisture content

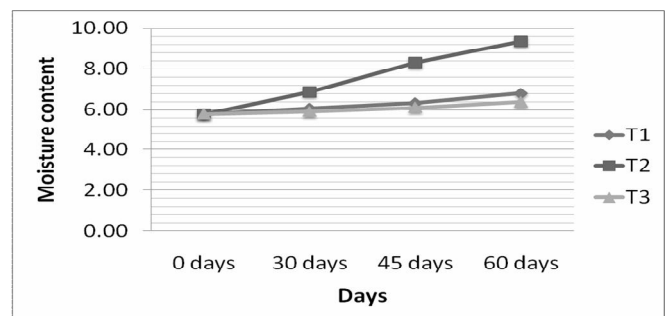
The moisture levels at the initial day of storage or packaging for dehydrated banana inflorescence (Fig. 7) and broccoli florets (Fig. 8) packed in different packaging treatments were at lower levels. Thereafter the moisture content increased during the storage period for all the samples packed in different packaging treatments. Lowest levels of moisture or least moisture uptake was seen for dehydrated materials packed in T₃ (Laminated aluminium foil + LDPE 50 micron) followed by dehydrated banana inflorescence broccoli florets packed in T₁ (LDPE 50 micron). These two packaging treatments maintained a steady rate in moisture uptake during storage, however a drastic increase was seen in the moisture value for both the dehydrated samples packed in T₂ (Laminated aluminium foil). Lastly at the end of the experiment, the moisture content of dehydrated banana inflorescence packed in T₂ (Laminated aluminium foil) rose to 8.84 % as compared to 6.46 % for dehydrated

banana inflorescence packed in T₃ (Laminated aluminium foil + LDPE 50 micron). For dehydrated broccoli florets packed in T₂ (Laminated aluminium foil) it rose to 9.37% as compared to 6.39 % for dehydrated broccoli florets packed in T₃ (Laminated aluminium foil + LDPE 50 micron).



T₁ – LDPE 50 micron, T₂ – Laminated aluminium foil, T₃ – Laminated aluminium foil + LDPE 50 micron

Fig 7: Moisture content of dehydrated banana inflorescence packed in different packaging treatments during storage



T₁ – LDPE 50 micron, T₂ – Laminated aluminium foil, T₃ – Laminated aluminium foil + LDPE 50 micron

Fig 8: Moisture content of dehydrated broccoli packed in different packaging treatments during storage

Packaging with Laminated aluminium foil + LDPE 50 micron was recorded with the best maintenance of the physical attributes for the dehydrated produce followed by LDPE 50 micron and Aluminium foil showed the less acceptable levels. Samples packed in Laminated aluminium foil + LDPE 50 micron had higher levels of the physical parameters (rehydration ratio, coefficient of rehydration and percent water in rehydrated material) when compared to samples packed in LDPE 50 micron and Aluminium foil at the end of the storage. The reason behind this may be because of lesser gain of moisture by the samples which are packed in this particular type of material. In the previous experiment conducted by Singh and Sagar, (2010) they also got similar type of results when leaves of drumsticks and curry leaves were being packed by different types of materials. Furthermore, in the experiment conducted by Wickramarachchi and

Ranamukhaarachchi, (2005) reported superior results for dehydrated banana slices when packed and stored for a period of month in laminated Laminated aluminium foil along with High Density Polyethylene. The material helped in maintaining various organoleptic attributes of dehydrated banana slice for that particular period. Also, during the storage period, the moisture content of both the dehydrated materials increased. Same kind of increase in moisture content for dehydrated vegetables has been found in previous works of Negi and Roy, (2001); Singh and Sagar, (2010); Singh *et al.*, (2003) and Bajaj *et al.*, (1993).

Conclusion

From the experiment it was obtained that the packaging material T₃ (Laminated aluminium foil + LDPE 50 micron) was the best packaging combination as dehydrated banana inflorescence and broccoli florets packed in it maintained significant higher amounts of rehydration ratio, coefficient of rehydration, percent water in rehydrated material and gained lesser moisture throughout the storage. T₁ (LDPE 50 micron) was considered as the second-best packaging material for dehydrated banana inflorescence and broccoli florets. T₂ (Laminated aluminium foil) showed non satisfactory results as dehydrated banana inflorescence and broccoli florets packed in this material retained least values of rehydration ratio, coefficient of rehydration, percent water in rehydrated material and gained maximum moisture throughout the storage period.

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