Current Horticulture 11(2): 67–70, May–August 2023 DOI: 10.48165/chr.2023.11.2.11

Standardization of dehydration techniques for vegetable cluster bean (*Cyamopsis tetragonoloba*)

PS Gurjar, A K Verma, Hanuman Ram*, R K Meena and D K Samadia

ICAR-Central Institute for Arid Horticulture, Beechhwal, Bikaner, Rajasthan, India

Received: 12 September 2021; **Accepted:** 4 October 2022

ABSTRACT

An experiment was conducted to standardized dehydration techniques for clusterbean (*Cyamopsis tetragonoloba* L.) pods at ICAR-CIAH, Bikaner, during 2020-21. The pods were blanched for different durations (3, 4, 5, 6 and 7 minutes) in boiling water to standardize blanching process. Five minutes blanching in boiling water followed by immediate dipping in cold water was found optimum for getting quality dehydrated product. Blanching treatment significantly enhanced the drying (5.67) and rehydration rate (4.65) and augmented rehydration capacity of dried pods. The dehydration recovery was 21.24% of fresh pods. The dried samples stored with HDPE pouches had low moisture content and high rehydration capacity than the samples stored with LDPE pouches. Thus, it is recommended that blanching is an essential process for quality pods. The HDPE pouches were found suitable packaging material for storage stability of dried pods.

Key Words: Dehydration, Blanching, LDPE, HDPE, Pods, Drying, Rehydration

Clusterbean (*Cyamopsis tetragonoloba* L.) is a rich source of soluble fiber content and minerals. Edible portion is a rich source od nutrition (Krishnakumar *et al*., 2016). The tender green pods which are used extensively for vegetable culinary both as green and dried pods (Samadia, 2012). Dried vegetables have great potential to use throughout the year (Samadia, 2016). Arid and semi arid region of India blessed with abundant and inexhaustible alternative energy source (Singh *et al*., 2019). However, quality of dehydrated vegetable like colour, texture and rehydration capacity are very much essential for commercialization of products. Blanching, chemical dipping and osmotic procedure are applied to fruits and vegetables. So far blanching treatment and dehydration procedure have not been standardized for clusterbean. Therefore, study was undertaken to standardize dehydration procedure, packaging and storage of dried clusterbean pods.

MATERIALS AND METHODS

Fresh green pods (10-12 days after setting) of clusterbean 'Thar Bhadavi' were harvested in morning hours from Vegetable Experimental Farm of ICAR-Central Institute for Arid Horticulture, Bikaner. Immediately after harvesting pods were brought to post-harvest laboratory, sorting, grading and washing were carried out and uniform-sized pods were utilized. Two experiments consisting of standardization of blanching treatment and storage and packaging of dried beans were done.

A known quantity (350 g) of green pods was taken in a muslin cloth and dipped in boiling (95 °C) water for 3, 4, 5, 6 and 7 minutes for blanching treatment. Thereafter pods were dipped immediately in cold water (26 °C) for 5 minutes to prevent overcooking. Then pods were removed from the cold water and kept for drying in perforated SS trays at room temperature. One lot of pods was dried without blanching and treated as the control.

The drying ratio was calculated by the following formula:

$$\text{Drying ratio} = \frac{\text{Weight of fresh material before drying}}{\text{Weight of dried material}}$$

Twelve beakers (six each for blanched and unbalanced samples) of each 500 ml capacity were taken and 300 ml of boiling water and 20 g of dried sample were poured into each beaker and kept for 60 minutes for rehydration. Weight of rehydrated

*Corresponding author : hramdhanari@gmail.com

samples was measured at 10 minutes interval for 60 minutes period. Surface moisture from rehydrated samples was removed properly by applying tissue paper before measuring weight. The rehydration ratio was calculated by following formula:

$$\text{Rehydration ratio} = \frac{\text{Weight of rehydrated materia}}{\text{Weight of dried material}}$$

Drying kinetics was determined by measuring sample weight by digital balance at regular interval and plotting graph of weight loss against time. Same way rehydration kinetics was determined by plotting curve of weight gain against time period during rehydration process (Ismail *et al.*, 2016).

Dried samples were packed in different packaging materials: LDPE (low density polyethylene) and HDPE (high density polyethylene) pouches. Packed samples were stored at ambient temperature up to 4 months for storage. The physicochemical analysis of stored products was carried out at an interval of 30 days during storage. Moisture content of pods during storage was determined using a hot air oven for uncrushed materials.

The Data were collected in triplicate, the mean values with standard deviations were reported. Significant mean difference at 95% confidence level (α =0.05) was identified through use of WASP 2.0 software developed by ICAR-Central Coastal Agricultural Research Institute, Goa.

RESULTS AND DISCUSSION

There was significant difference in drying ratio in blanched and unblanched samples. Maximum drying ratio was observed in samples blanched for 7 minutes duration while minimum drying ratio was noticed in the control (unblanched) (Fig. 1). However, difference in drying ratio was non-significant among all blanched samples. High-drying ratio in blanched samples may be due to softening of tissues due to heat treatment which facilitate easy removal of moisture from the product. Similar observations were also reported by Shete *et al*. (2015) in green peas; Rajeshwari *et al*. (2013) and Manzoor*et al*. (2019).

Blanching process showed significant effect on rehydration ratio of dried pods. Significant difference was observed in rehydration ratio of blanched and unblanched samples. Maximum rehydration ratio (4.65) was calculated in samples blanched for 5 minutes duration, followed by 4 minutes duration (4.15) and minimum value of rehydration ratio (3.15) was noticed in unblanched samples (Fig. 1). Blanching duration also showed significant effect on rehydration ratio. Samples blanched for 3 and 4 minutes period had significantly lower value of rehydration ratio compared to samples blanched for 5, 6 and 7 minutes. However, non-significant difference was observed among samples blanched for 5, 6 and 7 minutes. Higher RR in blanched samples may be attributed to cellular and structural disruption caused during blanching which might have contributed to the increase in RR of pods. Similar results were also observed by Al-Amin *et al*. (2015). Blanching of green pods for five minutes was found ideal for retaining colour, texture and sufficient reconstitution capacity in dried product.

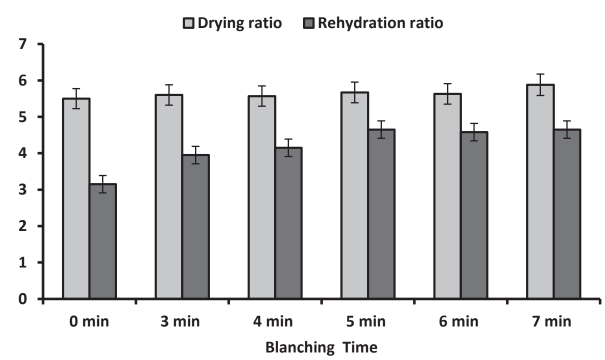


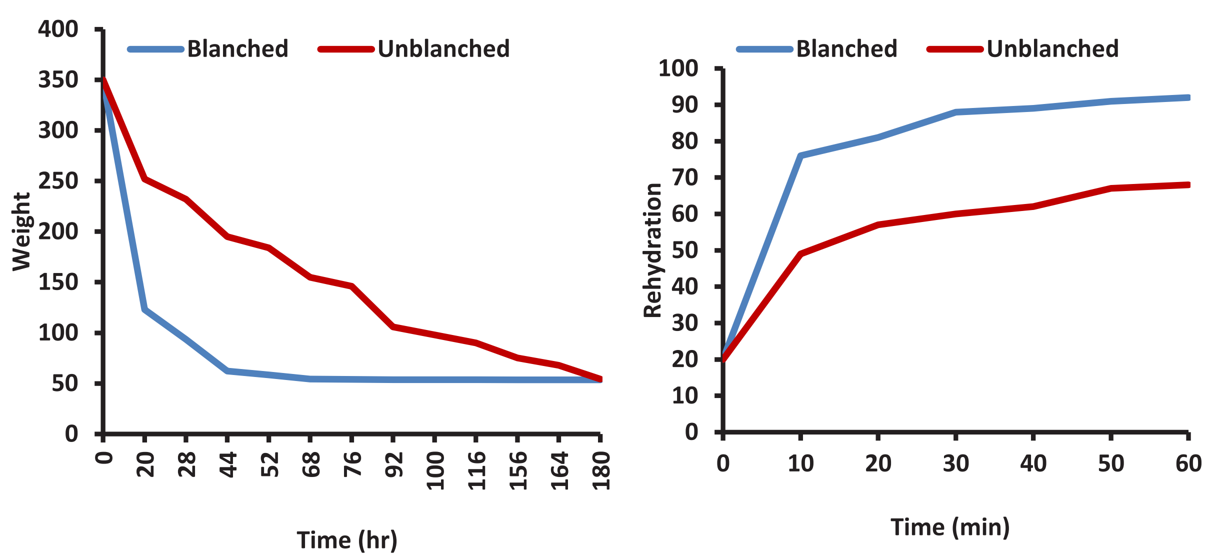
Fig. 1: Effect of blanching time on drying and rehydration ratio of clusterbean pods

The initial weight of cluster bean pods used in drying experiment was 350 g for both blanched and unblanched. The weight of blanched samples rapidly reduced with passing of time as compared to unblanched samples. Initial 20 hr of drying, 65% weight loss was observed in blanched samples, while in unblanched pods 28% loss in weight was noticed. Drying was achieved in 44 hr period in blanched samples, while unblanched pods took 180 hr for drying to acceptable moisture level. This phenomenon can be explained that in addition to the enzyme inactivation blanching resulted in tissue softening, subsequently resulting in faster moisture removal by enhancing moisture transfer from inside the samples to surface. Thus, higher heat absorption by blanched samples resulted in higher product temperature and relatively faster rate and consequently shorter drying time. Our findings are corroborated with these of Manzoor *et al*. (2019).

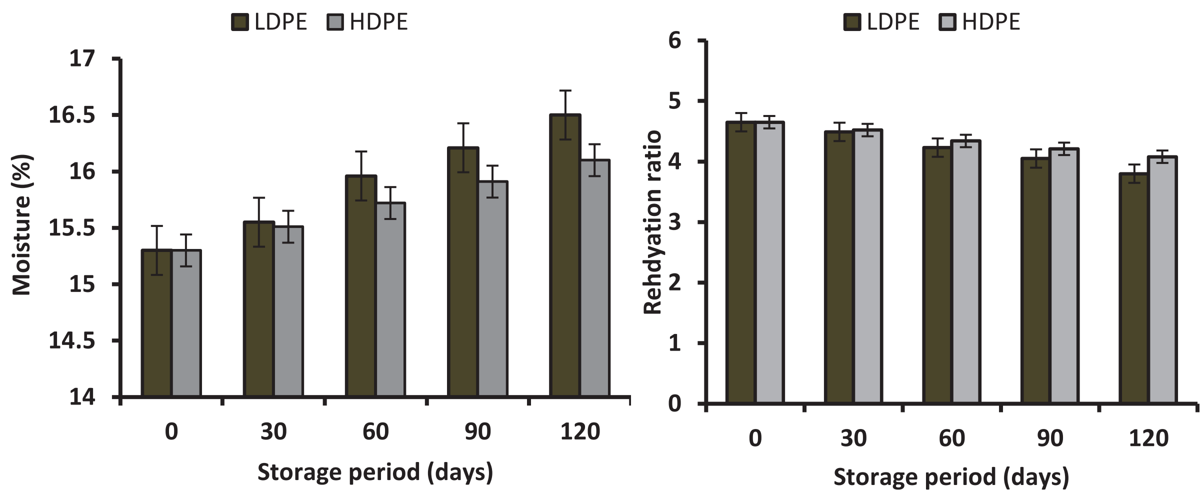
The amount and rate of water absorbed determine the sensorial properties and the preparation time required by the consumer (Ulloa *et al*., 2013). Rapid water uptake was observed both in blanched and unblanched samples during initial 10 minutes of rehydration. However, in blanched samples rehydration rate was significantly high as compared to unblanched pods (Fig. 2a and b). In later stages rehydration rate was declined and followed flat pattern in both the samples. The total weight gain at the end of rehydration process was significantly high in blanched pods (4.6 times) as compared to unblanched (3.4 times). The rapid rehydration rate in initial period was because of high water activity gradient between the sample and surrounding media (water) and as time passes, this difference reduced with consequent lower rate of rehydration. The decline in rehydration rates at later stages is related to the lower water absorption presumably because of the filling of water in free capillaries and intercellular spaces present in tissues of dehydrated pods. Similar rehydration patterns for a variety of legumes have been reported previously (Ulloa *et al*., 2013).

As the days of storage progressed, moisture content of all dried pods samples packed in LDPE and HDPE increased significantly ($p \leq 0.05$) (Fig 3a and b). This increase in moisture content might be due to hygroscopic nature of dried pods that absorb the atmospheric moisture during storage. Seevaratnam *et al*. (2012) also reported similar behaviour during storage of green leafy vegetables and Krishnakumar *et al*. (2016) during storage of dried cluster beans. With regard to packaging materials, a significant difference was found between HDPE and LDPE, rate of increase in moisture was significantly low in samples packed in HDPE as compared to LDPE during storage. At the end of storage period moisture (%) was high in dried pods stored in LDPE (16.5%) and significantly less in HDPE stored pods (16.1%) This effect might be attributed to less permeability of HDPE film to water vapor compared to LDPE. Singh *et al*. (2018) were also reported similar results during storage of dry dates at room temperature.

The RR showed significantly ($p \leq 0.05$) decreasing trend with increase in storage period. Initial 30 days of storage had non-significant difference in RR of dried pods stored in LDPE and HDPE pouches. However, during later period significant reduction in RR was observed in pods stored in LDPE pouches. At the end of storage period, RR of HDPE storage pods was 4.08, while in LDPE it was 3.80. The HDPE film showed higher values of RR than LDPE which might be due to less absorption of moisture in HDPE during storage (Pavani and Aduri, 2018) and (Manzoor *et al*. 2019).



Figs (2a and 2b). Drying kinetics and rehydration kinetics of blanched and unblanched pods



Figs 3a and b. Changes in moisture (%) and rehydration ratio during storage of dried pods

CONCLUSION

Thus, it is concluded that five minutes blanching in boiling water is optimum for getting quality dried pods. The HDPE pouches were found superior over LDPE pouches for 120 days storage at room temperature.

REFERENCES

Al-Amin M, Hossain M S and Iqbal A. 2015. Effect of pre-treatments and drying methods on dehydration and rehydration characteristics of carrot. *Universal Journal of Food and Nutrition Science* **3**(2): 23-28.

Ismail O, Figen AK and Piskin S. 2016. Open sun drying of green bean: influence of pretreatments on drying kinetics, colour and rehydration capacity. *Heat Mass Transfer* **55**: 456-61.

Krishnakumar P, Kailappan R, Nambi EV. 2016. Effect of various storage condition on quality of dried cluster bean (*Cyamopsis tetragonoloba*). *Proceedings of the 10th International Conference on Controlled Atmosphere and Fumigation in Stored Products (CAF2016)*, Navarro S, Jayas D S and Alagusundraram K (Eds). CAF Permanent Committee Secretariat, Winnipeg, Canada.

Manzoor N, Dar AH, Khan S, Hakeem, HR and Makroo HA. 2019. Effect of Blanching and Drying Temperatures on Various Physico-chemical Characteristics of Green Beans. *Asian Journal of Dairy and Food Research* **38**(3): 213-23.

Pavani KV and Aduri P. 2018. Effect of Packaging Materials on Retention of Quality Characteristics of Dehydrated Green Leafy Vegetables during Storage. *International Journal of Environment, Agriculture and Biotechnology* **3**(1): 45-49.

Rajeswari R, Pushpa B, Naik K R and Shobha N. 2013. Dehydration of Amaranthus leaves and its quality evaluation. *Karnataka Journal of Agricultural Sciences* **26**(2): 276-80.

Samadia DK. 2012. 'Thar Bhadvi': New Cluster Bean *Indian Horticulture* **57**(4): 15-16.

Samadia DK.2016. Horticulture based crop production site management approach (HBCPSMA) – an innovative concept for doubling farm income under dry-lands. *Journal of Agriculture and Ecology* **1**: 1-9.

Seevaratnam V, Banumathi P, Premalatha M R., Sundaram SP and Arumugam T. 2012. Effect of packaging materials on retention of quality characteristics of selected dehydrated green leafy vegetables during storage.*World Journal of Dairy & Food Sciences* **7**(2): 190-194.

Shete Y V, More M M, Deshmukh S S and Karne S C. 2015. Effects of pretreatments and drying temperatures on quality of dried green peas. *International Journal of Agricultural Engineering* **8**(2): 220-226.

Singh AK, Singh S, Saroj PL, Mishra, DS, Yadav V and Raj Kumar (2019). Cultivation of underutilized fruit crops in hot semi-arid regions: developments and challenges — a review, *Current Horticulture* **8**(1): 12–23.

Singh RS, Bhargava R and Sharma BD (2020). Effect of hot water treatment on dry date preparation from date palm (*Phoenix dactylifera*) cultivars in arid region. *Current Horticulture* **8**(2):41–43.

Ulloa JA, Bonilla-Sánchez CR, Ortíz-Jiménez MA, Rosas-Ulloa P, Ramírez-Ramírez JC and Ulloa-Rangel BE. 2013. Rehydration properties of precooked whole beans (*Phaseolus vulgaris*) dehydrated at room temperature. *CyTA - Journal of Food* **11**(1): 94-99.