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Differential blanching timing and storage techniques influence shelf-life of fresh pea

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Abstract

The influence of shelf-life of pea on different blanching and storage techniques were investigated to determine the quality and shelf life of pea. The experiment was carried out with 3 treatments of blanching timing such as 3 minutes, 5 minutes and 8 minutes and one untreated sample or unblanched pea was kept as control with fixed temperature 80 °Centigrade. 750 g of fresh pea is blanched in 1 ½ litre of water where 2 Tbsp of sugar was added. Blanched pea was undergone shock treatment with ice-cold water for 10 minutes. Pre-treated sample were stored in different storage techniques viz., deep freezer, room refrigerator, storage incubator and ambient storage atmosphere. The data were analysed with Least significant different (LSD) and Duncan's multiple range test to compare mean with 5% probability. The stored sample were evaluated in 4 points rating scales for percent pod-yellowing, pod-cracking, pod-shrivelling and pod-rottening. The result of the study shows significant effect (p<0.005) of blanching and storage on quality of pea pods and shows that pea blanched for 5 minutes in hot boiling water and stored in deep freezer have better shelf-life up to 90 days without altering its required quality.

Keywords: Pea, blanching, blanching timing, shelf-life

Introduction

Pea is most commonly the spherical shaped green or yellow colour seed pod of the flowering plant species Pisum Sativum. Botanically, pea pods are fruits since they contain seeds and develop from an ovary of a flower. Each pods contains several peas and belongs to Fabaceae family and also known as legume family. The area under pea cultivation in Assam was reported as 27 million ha in 2023 having production of 25 million tonnes by Department of agriculture and farmers welfare. In Assam it is mainly grown for green pods and immature seed which is liked for its sweet taste and consumed as vegetables. The matured pea seeds are used as pulses and sometimes grinded to flour for making multi grain chapatis.

100 g of green peas carry 81 calories, excellent source of folic acid and zero cholesterol. 100 g provides 16% of recommended daily levels of Folates. The nutritional composition of 100 g fresh pea gives 14.46 g carbohydrates (5%), fat 0.4 g (1%), dietary fibre 5.1 g (18%), calcium 25 mg (2%), iron 1.47 mg (8%), Potassium 244 mg (5%), Vitamin-A 38 mcg (4%), Vitamin-C 40 mg (44%).

Pea is mainly confined to cooler temperate zone and is grown extensively in temperate region of the world i.e., in-between tropic of cancer and Medi-terrain region. Pea favours cool climate with an average temperature range from 10-18C during its growth period, however seed germination hampered when the temperature at the time of planting is below 5C. Pea can tolerate frost at early stages of growth. In India, usually Rabi season crop sowing begins from October to November, in mid of the plains and March to May end at hilly areas. However, to get higher yield, it was recommended to sow pea seed in first week of November.

Fresh pea contains most of the vitamins and minerals but lost its essential nutrients with a day or two after harvest. Most of the individual prefer fresh pea and want to consume it all year round. Hence, frozen or canned fresh pea is the only option remains. Moreover, freezing the pea at the earliest after harvest keep all the nutrients intact and can be alternative to fresh pea.

Freezing of food is a quick, simple and popular way to increase the shelf life to an extent and preserve more nutrients than any other method. In the same context, Delgado and sun 2000 states that freezing technology is superior than canning and dehydration in terms of sensory attributes and nutritional properties are concerned. Constant freezing temperature also plays a vital role in terms of increased shelf-life and effects enzymatic reaction and quality of food stored for refrigeration. Freezing retards, the growth of bacteria, fungus, yeast and mould but does not stop it. Therefore, blanching is the appropriate techniques to deactivate enzymatic activities (Pervin *et al.*, 2017) [3]

Blanching is a cooking process in which foods especially fruits and vegetables scaled in boiling water and are removed after a brief time interval and finally plunged into ice cold water or placed into cold running water to stop the heating process and slower enzymatic reactions called shocking or refreshing treatment. Blanching can be done

with different method such as dipping in hot boiling solution containing acid or salt, hot water or steam for few second or minutes. The timing of hot water treatment followed by ice cold is differ with size and kind of vegetables and fruits. The enzymes are responsible for growth, ripening or over-ripening leads to spoilage of vegetables/fruits, develop off-flavour and discolour and thus unappetizing in short time. Blanching of pea pods neutralized enzymes such as polyphenol oxidases, catalase, peroxidase and phenolase and reduce rate of deterioration i.e., colour, texture and flavour changes in the product (K. Choudhury *et al*., 2020) [4]. Therefore, pre-treatment of fruits and vegetables are important for extended shelf-life before freezing. However, under blanching may active some enzymes and over blanching destroys essential nutrients, flavour and colour.
Therefore, the present study was undertaken to standardized suitable pre-treatment timing before freezing to access the quality and shelf life of pea.

Materials and Methods

The experiment was conducted in the farmer's field of Kokrajhar district under Krishi Vigyan Kendra, Kokrajhar.

Sample selection

Pea was collected from pea field established specifically for the purpose of the study named Ballamguri village of Kokrajhar District under Gossaigoan Sub-division. The experiment was started from the month of first week of November and pea are harvested in January in a year. The area during cultivation had average of 21.3 degrees centigrade temperature and relative humidity of 85%. Pea used in this experiment are grown organically and are fresh, greenish and firm and physical appearance of the pea is appealing. Pea was hand shelled and sound, matured and disease-free pea pods were selected and pea found with visual-defects were identified and discard. Further, pre-treatment procedure was followed by boiling 1 (one) Liter of water where 2 Tbsp (10 g) of sugar is added. 750 g of fresh pea pods were added in the boiling water (temperature- 80 degree centigrade) with different blanching timing 3 minutes, 5 minutes and 8 minutes. Then shock treatment was given through transferring the blanched hot pea immediately into 1½ Liter of ice-cold water to lower the temperature for 10 minutes. The pea was then taken out from the water and pet dry and subject to air dry under electric fan for 15 minutes and packed in commercially available vented container.

Treatments

T_1- Fresh pea blanched for 3 min in open pan and stored in DF/RR/SI/ASE.
T_2- Fresh pea blanched for 5 min in open pan and stored in DF/RR/SI/ASE.
T_3- Fresh pea blanched for 8 min in open pan and stored in DF/RR/SI/ASE.
T_4- Fresh pea without blanching. (control) and stored in DF/RR/SI/ASE.

Constant

Water for boiling-1 Liter
Sugar 2 Tbsp
Fresh Pea-750 g
Temp. – 80 degrees centigrade.
Ice cold water- 1 ½ liter
Shock treatment- 10 minutes
Air dry- 15 minutes.
Variety- Azad Pea-3 and local Pea.

Storage Treatment

Four traditionally available storage condition were utilized to store pea which is Deep freezer (Temperature 0 degree C, 90% relative humidity), Room refrigerator (Temperature 12 degree C, 85% RH), Storage incubator (Temperature 16 degree C, 80% RH) and ambient storage environment (Temperature 30 degree C, 80% RH).

Table 1: Rating scale used for overall freshness of pea

Rating Descriptor		Percent	Rating
4	Excellent	0	Overall experience excellent, pod green and crisp, no major defects.
3	Good	25	Overall experience good, some pods showing sign of yellowing/blackening at the tips, few defects, acceptable crispiness of the pods.
2	Acceptable	50	Appearance of the limits of being acceptable, Pod flaccid, Pod tip brown/black, some with brown streaks, several/many defects.
1	Unacceptable	75	No freshness, pod with black streaks and brown grooves.
0	poor	100	Musty odour, pod brown, dry or slimly decayed, many streaks and black

Source: Overall freshness in terms of pod life, yellowing, cracking, shrivelling and rottening quality.

Each storage condition has 4 replicates of blanched and unblanched samples. RH maintained within the bag was less than 95% and each sample was held separately in commercially available vented container of size of 720 X 580 X 150 mm. The container was stalked in appropriate storage condition in dark and measures was taken for no free water accumulation during storage.

Quality Analysis

Overall freshness of the pea was evaluated using 0-4 scale as shown in Table-1. Weight loss is determined as a percent of original sample weight.
Mid-term assessment in between every month was done to measure percent pod yellowing during storage, percent pod cracking, percent pod shrivelling, Pod rottening, weight loss and sensory quality.

Statistical Analysis

Statistical analysis was done using random sampling design with 4 replica per treatment. There were 16 combination of storage condition (DF (deep freezer), RR (Room Refrigerator), SI (Storage Incubator), ASE (ambient storage environment). Least significant different (LSD) and Duncan's multiple range test was used to compare mean with 5% probability.

Result and Discussion

Pea pods looks appealing, green, fresh, firm, crisp and had excellent overall appearance on the onset of experiments as shown in Figure-1.

Fig 1: A). Without blanching, B). Blanching for 3 min, C). Blanching for 5 minutes, D). Blanching for 8 min

Influence of storage condition and blanching timing on percent pod yellowing

The percent pod yellowing in pea was found less in DF followed by RR > SI > ASE while that of the blanching timing ranked 5 min blanching > 3 min blanching > 8 min blanching > unblanched pea. It was found that increase in storage temperature is directly proportional to yellowing of pods and vice-versa. Water deficits induces stress and cause increase ethylene production which cause yellowing in pea pods. This agrees with the findings of Babatola L.A *et al*., 2008 [5].

Table 2: Influence of storage condition and blanching timing on percent pod yellowing of pea.

Treatments	Time sequence						
	Initial	15 days	30days	45 days	60 days	75 days	90 days
Blanching Timing							
3 min blanched	0.0	0.0	0.0	10.3	21.6	45.2	52.3
5 min Blanched	0.0	0.0	0.0	0.0	0.0	0.2	0.5
8 min Blanched	0.0	0.0	0.3	11.6	31.2	36.6	41.2
Unblanched	0.0	21.2	48.3	69.6	77.2	100.0	100.0
LSD (5% probability)	-	0.285	0.235	1.611	1.294	10.412	9.526
Storage							
DF (0 °C, 95% RH)	0.0	0.0	0.0	0.2	0.6	0.8	0.8
RR (12 °C, 85% RH)	0.0	15.5	22.6	24.9	28.1	30.8	45.2
SI (16 °C, 80%)	0.0	33.2	48.7	75.9	100.0	100.0	100.0
ASE (30 °C, 80% RH)	0.0	75.0	100.0	100.0	100.0	100.0	100.0
LSD (5% probability)	-	3.596	10.098	9.555	13.729	14.031	13.789

*DF-Deep freezer, RR-Room refrigerator, SI-Storage incubator, ASE- ambient storage environment. Interaction (Storage condition X differential blanching timing: Non-significant at Probability ≤ 0.05.

Influence of storage condition and blanching timing on percent pod cracking

Pod cracking in pea is found to be less in pre-treated pea blanched for 5 min followed by 3 minutes. Peas blanching for 8 minutes and unblanched pea (control) have more pod cracking and slimly decayed and unfit for consumption. Therefore, it can be stated that pea blanched for 5 minutes and 3 minutes and stored in DF and RR are suitable for consumption then pea stored in SI and ASE as have less pod cracking.

Table 3: Influence of storage condition and blanching timing on percent pod cracking.

Treatments*	Time sequence						
	Initial	15 days	30days	45 days	60 days	75 days	90 days
Blanching Timing							
3 min blanched	0.0	0.0	0.2	10.3	33.3	45.5	54.6
5 min Blanched	0.0	0.0	0.0	12.3	22.2	26.6	30.0
8 min Blanched	10.3	33.3	56.6	75.5	100.0	100.0	100.0
Unblanched	0.0	0.0	21.2	33.3	45.6	75.9	100.0
LSD (5% probability)	0.375	0.999	0.945	0.714	9.913	10.086	14.107
Storage							
DF (0 °C, 95% RH)	0.0	25.0	25.5	25.5	25.5	25.5	25.5
RR (12 °C, 85% RH)	0.0	25.0	25.5	25.5	25.5	25.5	25.5
SI (16 °C, 80%)	0.0	25.0	45.6	45.6	54.7	76.6	100.0
ASE (30 °C, 80% RH)	0.0	35.5	45.5	58.3	60.0	75.1	100.0
LSD (5% probability)	-	3.177	0.964	0.973	3.385	9.742	13.732

*DF-Deep freezer, RR-Room refrigerator, SI-Storage incubator, ASE- ambient storage environment. Interaction (Storage condition X differential blanching timing: Non-significant at Probability ≤ 0.05.

Influence of storage condition and blanching timing on percent pod shrivelling

Pod shrivelling increases with increases in storage days. Hench, blanched pea when stored in SI and ASE are good up to 45 days and 30 days respectively but as the storage tome increases the pod shrivelling increases and make it unacceptable. This finding agrees with the report from Babatola, L.A *et al*., 2008 [5] that moisture loss is common from 2-4%, which cause wilting, or shrivelling as witness in the storage condition. Moreover, temperature fluctuation in storage condition also effects pod shrivelling.

Table 4: Influence of storage condition and blanching timing on percent pod shrivelling.

Treatments*	Time sequence						
	Initial	15 days	30 days	45 days	60 days	75 days	90 days
Blanching Timing							
3min blanched	0.0	0.0	0.0	0.3	13.3	25.5	25.5
5 min Blanched	0.0	0.0	0.0	0.0	0.2	1.6	5.0
8 min Blanched	0.0	0.0	16.6	25.5	25.5	25.5	25.5
Unblanched	0.0	0.10	21.2	33.3	55.6	75.9	100.0
LSD (5% probability)	-	0.065	0.632	0.609	1.148	1.573	9.597
Storage							
DF (0 °C, 95% RH)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RR (12 °C, 85% RH)	0.0	0.0	0.0	0.0	10.0	25.5	25.5
SI (16 °C, 80%)	0.0	25.0	45.6	45.6	54.7	56.6	57.2
ASE (30 °C, 80% RH)	0.0	35.5	45.5	58.3	70.0	75.1	100.0
LSD (5% probability)	-	1.385	0.394	1.033	4.187	2.519	9.751

Influence of storage condition and blanching timing on percent pod rottening

Influence of Pod rottening is directly proportional to perfect blanch timing. Under blanching activates some enzymes and decrease shelf-life of pea in any storage condition. Whereas perfect blanching timing i.e., 5 minutes and stored in Deep freezer increases the shelf-life of fresh pea. Over blanched cause cracking at the time of cooking and absorb more moisture and thus are more susceptible to rottening, cracking, wilting etc cause rottening in any storage condition. The deep freezer treated pea does not rot up to 90 days of storage and is ranked increased shelf-life preservation followed by RR>SI>ASE.

Table 5: Influence of storage condition and blanching timing on percent pod rottening.

Treatments*	Time sequence						
	Initial	15 days	30 days	45 days	60 days	75 days	90 days
Blanching Timing							
3 min blanched	0.0	0.0	0.0	25.3	30.3	45.5	45.5
5 min Blanched	0.0	0.0	0.0	0.0	0.2	1.6	5.0
8 min Blanched	0.0	0.0	16.6	25.5	25.5	55.5	75.5
Unblanched	0.0	19.10	31.2	43.3	59.6	75.0	100.0
LSD (5% probability)	-	1.804	1.470	1.074	2.162	1.866	9.040
Storage							
DF (0 °C, 95% RH)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RR (12 °C, 85% RH)	0.0	0.0	0.0	0.0	10.0	25.5	25.5
SI (16 °C, 80%)	0.0	25.0	47.6	55.6	60.7	66.6	75.2
ASE (30 °C, 80% RH)	0.0	35.5	45.5	58.3	70.0	75.1	100.0
LSD (5% probability)	-	1.236	1.130	1.033	4.187	2.519	9.684

Conclusion

Differential blanching timing and storage condition is directly proportional to the shelf life of pea. Quality of pea could be best preserved when pea blanched for 5 mins followed by shock treatment for 10 minutes in ice-cold water and stored in deep freezer followed by room refrigerator then in SI and ASE.

Conflict of Interest

The author declares that there is no conflict of interest.

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