Process Standardization And Evaluation Of Green Peas (Pisum Sativum) Using Solar Dehydration Technology

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Abstract- **Fruits and vegetables play an important role in human nutrition, but due to their high perishable nature they cannot be stored for longer period. To store for long period, dehydration is one of the techniques developed which can persist for longer periods and are said to be rich sources of vitamins, minerals and anti-oxidants. Emerging trends in food processing is one of the major aspects in recent times, where the present study is to utilize the importance of value addition to improve the nutritive value of food product and increase the efficiency of its processing. Hence solar dehydration technology was found to be an efficient process having less energy consumption and maximum retention of nutritive value. The objective of this study is to standardize the pretreatment for maximum chlorophyll retention of green peas and evaluation of the standardized product using solar dehydration technology. With this objective, the process procedure for green peas was standardized where 0.1% sodium bicarbonate and 0.1% magnesium oxide were used in water blanching for 4min. Solar dehydrated green peas were developed with 10 sunny hours (49^0c-51^0c) of drying time with a yield of 11.758% and moisture content 5.788%. The dried products were packed in two different packaging materials i.e., Aluminium and Polypropylene pouches. Shelf life studies were conducted at ambient and accelerated storage conditions in two different packaging materials for about 6 months. The results revealed that the solar dried green peas which were pretreated with 0.1% sodium bicarbonate and 0.1% magnesium oxide solution and packed in Aluminium pouch have retained most of the nutrients viz., Vitamin C, Chlorophyll content, and physico chemical properties. Sensory evaluation of dried green peas showed that color and flavor were superior in Aluminium pouch when compared with the product packed in polypropylene pouch. Microbial load was also within the limits, which indicated that the product can be shelf stable for a period of 6 months. The dehydrated green peas are rehydrated and used in pulav, upma, biryani.**

Key words: **Standardization; Solar Dehydration; Green Peas; Color Retention;**

I. INTRODUCTION

Many processing techniques can be employed to preserve fruits and vegetables. Drying and dehydration is one of the most important operations that are widely practiced because of considerable saving in packaging, storage etc. Being a simple process, it facilitates processing of tropical fruits and vegetables such as banana, sapota, pineapple, mango, and leafy vegetables etc. with retention of initial fruit and vegetables characteristics viz., color, aroma and nutritional compounds **(Pokharkar & Prasad, 1998)**. It is less energy intensive than air or vacuum drying processes because it can be conducted at low or ambient temperature.

Moreover, the increasing demand of processed ready-to-eat (RTE) and ready-to-cook (RTC) products has resulted in increasing use of dried fruits and vegetable in convenience foods (Sharma et al. 2011; Take et al. 2012).

Solar dryers are devices that use solar energy to dry substances, especially food. Solar dryers are cabinet type dryers which operate on the principle of forced convective airflow in drying chamber.

Peas are starchy, but high in Dietary fiber, Protein, Vitamin A, Vitamin B_6, Vitamin C, VitaminK, Phosphorous, Magnesium, Copper, Iron and Zinc. The **pea** is most commonly the small spherical or the seed-pod of the pod ***Pisum sativum***. Each pod contains several peas.

The aim of this study is to enhance the shelf life of the Green peas by processing it into a dehydrated vegetable using solar dehydration technology which can be rehydrated and used in pulav, upma and biryani.

II. MATERIALS AND METHODS

Much attention has been given to the quality of dehydrated products. Drying methods and physicochemical changes that occur during dehydration seem to affect colour, texture, density,

porosity and sorption characteristics of dehydrated product (Abbot, 1999; Gabas et al., 1999; Lewicki and Lukaszub, 2000; Krokida et al., 2000; Telis et al., 2000). Food processing and preservation has an important role in the conservation and better utilization of fruits and vegetables. To avoid glut and utilize the surplus during the season, it is necessary to employ methods to extend the storage life, for better distribution. The aim of the study is to enhance the shelf-life of Green peas by processing it into a dehydrated product using solar drying technology and thereby increase the shelf-life of the product.

A. Raw Materials

Green peas (*Pisum sativum*), Sodium bicarbonate($NaHCO_3$), magnesium oxide(MgO).

B. Equipment & Miscellaneous

Gas Stove with Cylinder, Flame Kettle provided with stirrer, Stainless steel utensils, stainless steel knives & peelers, Solar Dryer, Containers, Sealing Machine & Flexible packing materials (polypropylene and aluminium pouches).

C. Standardization of Pretreatments for Solar Dehydration of Green Peas

The standardization of pretreatment for Green Peas was done based on retention of chlorophyll, yield, drying time and the rehydration characteristics of the dehydrated Green Peas.

Fruits and vegetables are generally deteriorated, as they contain enzymes in them. To deactivate those enzymes a pretreatment was given to them which is known as blanching or scalding. Blanching (scalding vegetables in boiling water or steam for a short time) is a must for almost all vegetables to be frozen. It stops enzyme actions which can cause loss of flavor, color and texture. Blanching cleanses the surface of dirt and organisms, brightens the color and helps retard loss of vitamins. It also wilts or softens fruits and vegetables and makes them easier to pack. The blanching time is very important and varies with the vegetable and size. Under blanching stimulates the activity of enzymes and is worse than no blanching. Over blanching causes loss of flavor, color, vitamins and minerals.

TABLE 2.3 - PRETREATMENTS FOR SOLAR DEHYDRATION OF GREEN PEAS

Pretreatment	Blanching method	Description
Control -1	Water	Submerged the Green peas in boiling water @ 90^0C for 2 minutes
KMS and Citric acid (1:2 ratio**)**	Water	Submerged the Green peas in boiling water containing KMS and Citric acid @ 90^0C for 2 minutes and dipping in cold water for 2 min
Sodium bicarbonate (0.1**%)**	Water	Submerged the Green peas in boiling water containing 0.1% Sodium Bicarbonate @90 ^{0}C for 2 minutes and dipping in cold water for 2 min
Magnesium oxide (0.1%)	Water	Submerged the Green peas in boiling water containing 0.1% Magnesium Oxide @90 ^{0}C for 2 minutes and dipping in cold water for 2 min
Sodium Bicarbonate (0.1%) + Magnesium oxide (0.1%)	Water	Submerged the Green peas in boiling water containing 0.1% Sodium Bicarbonate + Magnesium oxide (0.1%) @90 ^{0}C for 4 minutes
Control -2	Steam	Steam blanching the Green peas for 2 minutes and dipping in cold water for 4min
Sodium Bicarbonate (0.1%)	Steam	Steam blanching the Green peas for 2 minutes and dipping cold water containing 0.1% of Sodium Bicarbonate for 4min

D. Observations:

a)Chemical Changes of Chlorophyll:

- Acidic Conditions: The central magnesium ions are lost and the color changes from green to characteristic pheophytin olive green color.
- Alkaline Conditions: The methyl and phytyl esters attached to the nitrogen atoms are removed and produces chlorophyllin which is bright green in color.
- Neutral pH Conditions: Chlorophyll is insoluble in water.

b) Effect of chlorophyll on the pretreatments used for dehydration of Green Peas

- KMS and Citric acid *Water blanching*: When green peas were pretreated were water blanched which contains KMS and Citric acid (1:2) at 90^0C for 2 minutes the chlorophyll retention was less as the color changed from green olive green color as the nitrogen atoms are replaced by the hydrogen atoms and forms pheophytin in acidic conditions.
- Sodium bicarbonate (0.1%) *Water blanching*: When green peas were water blanched with 0.1% sodium bicarbonate at 90^0C for 2min and dipped in cold water the chlorophyll retention was good compared to the other blanching methods but due to less time of blanching and the cold water dipping because

of which the chemical pretreated was reduced the chlorophyll retention was not that acceptable.

- ✗ Magnesium oxide (0.1%) *Water blanching*: When green peas were, water blanched with the 0.1% magnesium oxide at 90^0C for 2min the results showed same as 0.1% sodium bicarbonate pretreated green peas.
- ✓ Sodium bicarbonate (0.1%) + Magnesium oxide (0.1%) *Water blanching*: When green peas were water blanched which contains 0.1% sodium bicarbonate + 0.1% magnesium oxide at 90^0C for 4min the chlorophyll retention was acceptable where alkaline conditions were produced as a result the methyl and phytyl esters attached to the nitrogen atoms are removed and produces chlorophyllin which is bright green in color with less drying time and low moisture content.
- ✗ Sodium bicarbonate (0.1%) *Steam blanching*: When the green peas were steam blanched for 2minutes and dipped in 0.1% sodium bicarbonate the chlorophyll was lost after drying because the pretreatment was not that effective when compared with the water blanching in chlorophyll retention and the product obtained was olive green in color.
- ✗ Magnesium oxide (0.1%) *Steam blanching:* When the green peas were steam blanched for 2 minutes and dipped in the solution containing 0.1% magnesium oxide the results were same as the result of sodium bicarbonate (0.1%)

Hence, depending on all these aspects solar dehydration of green peas water blanched at 90 ^{0}C for 4 minutes using sodium bicarbonate (0.1%) + magnesium oxide (0.1%) was standardized in my experiment.

Procurement of Whole Green peas from local market
↓
Sorting & Grading based on quality and physical appearance
↓
Washing for 2 to 3 times to remove adhering dust, chemicals etc.
↓
Separating the pea seeds from pods
↓
Hot water blanching for 4min which contains 0.1 % sodium bicarbonate + 0.1% Magnesium Oxide
↓
Load it into stainless steel trays and dry in a solar cabinet air dryer to a moisture content of 7% for about 15 hours
↓
Immediately pack the dried peas in Standby pouches and label
↓
Store in cool and dry place

Flow Chart I- Process procedure for solar dehydration of green peas (0.1 % sodium bicarbonate + 0.1% magnesium oxide)

E. Storage:

The storage evaluation for standardized product was carried out at two different conditions i.e., Ambient **(Amb) {1Month => 1Month}** storage conditions (37^0C, 65% RH) and Accelerated **(Acc) {1Month => 3Months}** storage conditions (60^0C, 95% RH) in two different packaging materials i.e. Aluminium (Al) and Polypropylene (PP) for a period of about 6 months and the product is tested in all aspects for the assurance of its acceptability and storage.

F. Product Analysis:

a)Physico Chemical Properties Of Solar Dehydrated Green Peas

Knowledge of the physico-chemical properties of food is fundamental in analyzing the characteristics of food during its processing. The study of these food properties and their responses to process conditions are necessary because they influence the treatment received during the processing and because they are good indicators of other properties and qualities of food. In the present investigation, certain physico-chemical properties of the developed product were analysed to ensure the quality of the products.

- Estimation of Moisture Content: Referred from [7]
- Estimation of Titrable Acidity: Referred from [7]
- Estimation of Reducing Sugars & Total Sugars: Referred from [7]

b) Nutritive Analysis of Solar Dehydrated Green Peas

- Estimation of Ascorbic acid: Referred from [7]
- Estimation of Total Carotenoids: Referred from [7]
- Estimation of Total Phenols & Total Flavonoids: Referred from [12]
- Estimation of chlorophyll: Referred from [1]

c) Sensory Evaluation

Sensory evaluation based on 9–point hedonic scale of all the prepared samples was done by taste panel. The tasting panel was consisting of 10 members. Sensory evaluation is done to know the acceptability of the product. This sensory evaluation helps in ensuring the quality of the product. They were asked to evaluate the color, appearance, flavor, taste, texture and overall acceptability by a scoring rate, 9 means like extremely, 8 means like very much, 7 means like moderately, 6 means like slightly, 5 means neither like nor dislike, 4 means dislike slightly, 3 means dislike moderately, 2 means dislike very much and 1 means dislike extremely. The different

preferences as indicated by scores were evaluated by statistical methods.

III. RESULTS AND DISCUSSION

A. Drying data:

First, a comparative study was carried out to evaluate the best pretreatment solar dehydration of green peas in terms of drying time, yield obtained, nutritive and sensory properties.

Solar dehydration of green peas pretreated with 0.1% sodium bicarbonate and 0.1% magnesium The technical drying data is tabulated as follows:

oxide (water blanching) was found to be superior in its quality, chlorophyll retention and sensory properties when compared with the other pretreatements and the dehydration techniques.

Since the green peas were water blanched which contains 0.1% sodium bicarbonate and 0.1% magnesium oxide for 4 minutes, the chlorophyll content was retained maximum when compared with the other chemical pretreatments and the solar dehydrated green peas without pretreatment.

TABLE II – DRYING DATA FOR GREEN PEAS

S.No	Name of the Product	Drying conditions				Finished product	
		Loading capacity (kg/m^2)	*Ambient temp (^oC)*	*Cabinet temp (^oC)*	*Time (hrs)*	*Moisture %*	*Yield %*
1.	Control -1 Solar dehydrated (Water blanching)	3.5	37 – 39	42 – 52	11	5.5202	10.787
2.	KMS and Citric acid	3.5	32-38	43-55	11	7.409	10.889
3.	Sodium bicarbonate (0.1%)	3.5	30-39	45-53	10	11.282	10.304
4.	Magnesium oxide (0.1%)	3.5	31-37	42-49	11	8.745	9.365
5.	Sodium bicarbonate (0.1%) + 0.1% Magnesium Oxide	3.5	33-35	49-51	10	5.788	11.758
6.	Control -2 (Steam blanching)	3.5	34-38	42-49	11	6.258	11.159
7.	Sodium bicarbonate (0.1%) (Steam blanching)	3.5	34-38	42-49	10	7.256	10.254

B. Physico Chemical Properties:

TABLE III - COMPARATIVE STUDY ON PHYSICO CHEMICAL PARAMETERS OF FRESH GREEN PEAS AND SOLAR DEHYDRATED GREEN PEAS (0.1% $NaHCO_3$ + 0.1% MgO) PACKED IN ALUMINIUM POUCH AT AMBIENT STORAGE CONDITIONS FOR 30 DAYS

Parameters	Fresh green peas	0^{th} Day		30 Days							
				Control				Pretreated			
		Control	*Pretreated*	*Amb (Al)*	*Amb (PP)*	*Acc (Al)*	*Acc (PP)*	*Amb (Al)*	*Amb (PP)*	*Acc (Al)*	*Acc (PP)*
Moisture Content (%)	76.80	5.79	5.68	5.76	5.89	5.81	5.61	5.756	5.83	5.67	5.74
Ash (%)	0.98	3.669	3.51	3.68	3.56	3.64	3.69	3.80	3.88	3.60	3.91
Acid insoluble ash (%)	0.10	0.15	0.15	0.13	0.13	0.11	0.12	0.10	0.13	0.14	0.12
Total soluble solids (%)	11.37	19.85	19.53	19.94	19.82	19.59	19.74	19.08	19.03	19.80	19.84
Acidity (%) (as citric acid)	0.63	1.31	1.27	0.70	0.69	0.62	0.63	1.29	1.21	1.25	1.18
Reducing Sugars (%)	0.59	-	-	-	-	-	-	-	-	-	-

Total sugars (%)	7.65	6.99	6.45	6.42	6.17	6.17	5.58	5.58	5.61	5.49	5.58
Rehydration ratio	-	1:2.7	1:2.9	1:2.5	1:2.7	1:2.8	1:2.7	1:2.6	1:2.6	1:2.6	1:2.7

TABLE IV- COMPARATIVE STUDY ON PHYSICO CHEMICAL PARAMETERS OF FRESH GREEN PEAS AND SOLAR DEHYDRATED GREEN PEAS (0.1% $NaHCO_3$ + 0.1% MgO) PACKED IN ALUMINIUM POUCH AT AMBIENT STORAGE CONDITIONS FOR 60 DAYS

Parameters	**Fresh green peas**	**0th Day**		**60 Days**							
				Control				**Pretreated**			
		Control	*Pretreated*	*Amb (AL)*	*Amb (PP)*	*Acc (Al)*	*Acc (PP)*	*Amb (Al)*	*Amb (PP)*	*Acc (Al)*	*Acc (PP)*
Moisture Content (%)	76.80	5.79	5.68	6.24	6.24	7.22	7.21	6.48	6.42	7.064	7.03
Ash (%)	0.98	3.669	3.51	3.58	3.53	3.50	3.54	3.61	3.73	3.56	3.52
Acid insoluble ash (%)	0.10	0.15	0.15	0.13	0.12	0.11	0.12	0.11	0.13	0.141	0.12
Total soluble solids (%)	11.37	19.85	19.53	19.08	19.24	19.22	19.17	19.18	19.24	19.06	19.21
Acidity (%) (as citric acid)	0.63	1.31	1.27	0.70	0.69	0.68	0.69	1.29	1.22	1.19	1.19
Reducing Sugars (%)	0.59	-	-	-	-	-	-	-	-	-	-
Total sugars (%)	7.65	6.99	5.78	6.18	6.19	6.12	6.11	5.54	5.51	5.47	5.47
Rehydration ratio	-	1:2.7	1:2.9	1:2.5	1:2.7	1:2.8	1:2.7	1:2.6	1:2.6	1:2.6	1:2.7

C. Nutritional Parameters:

TABLE V - COMPARATIVE STUDY ON NUTRITIONAL PARAMETERS OF FRESH GREEN PEAS AND SOLAR DEHYDRATED GREEN PEAS (0.1% $NaHCO_3$ + 0.1% MgO) IN TWO DIFFERENT PACKAGING MATERIALS FOR 30 DAYS

Parameters	**Fresh green peas**	**0th Day**		**30th Day**							
				Control				**Pretreated**			
		Control	*Pretreated*	*Amb (Al)*	*Amb (PP)*	*Acc (Al)*	*Acc (PP)*	*Amb (Al)*	*Amb (PP)*	*Acc (Al)*	*Acc (PP)*
Vitamin – C (mg/100g)	9	13.25	15.25	12.53	12.54	11.39	11.39	13.62	13.62	12.49	12.48
Carotenoids (µg/100g)	7.872	50.64	57.21	47.25	47.25	45.29	42.61	56.72	56.22	54.22	54.99
Chlorophyll (mg/100g)	0.762	6.67	9.13	6.65	6.42	6.19	6.11	9.53	9.62	9.12	9.20
Crude fiber (%)	1.990	3.785	3.951	3.69	3.57	3.55	3.37	3.51	3.59	3.74	3.66
Fat(%)	0.1	0.3	0.35	0.27	0.26	0.29	0.27	0.30	0.31	0.30	0.32
Phenols (µg/g)	70.89	124.05	131.69	110.9	113.0	101.6	109.6	126.9	123.9	111.47	114.7
Flavonoids (µg/g)	1.005	2.978	3.526	1.525	1.526	1.45	1.46	3.69	3.15	2.77	2.10

Calcium (mg/100g)	4.2	9.15	12.26	8.72	8.74	8.27	8.07	11.39	9.27	9.01	9.27
Potassium (mg/100g)	3.6	9.26	10.82	8.29	8.27	8.82	8.28	9.67	9.55	8.27	8.08
Iron (mg/100g)	2.8	6.97	7.53	6.31	6.33	6.39	6.39	7.12	7.56	7.38	7.87

TABLE VI - COMPARATIVE STUDY ON NUTRITIONAL PARAMETERS OF FRESH GREEN PEAS AND SOLAR DEHYDRATED GREEN PEAS (0.1% $NaHCO_3$ + 0.1% MgO) IN TWO DIFFERENT PACKAGING MATERIALS FOR 60 DAYS

Parameters	**Fresh green peas**	**0th Day**		**60th Day**							
				Control				**Pretreated**			
		Control	*Pretreated*	*Amb (Al)*	*Amb (PP)*	*Acc (Al)*	*Acc (PP)*	*Amb (Al)*	*Amb (PP)*	*Acc (Al)*	*Acc (PP)*
Vitamin – C (mg/100g)	9	13.25	15.25	11.59	11.60	10.44	10.44	12.73	12.45	11.56	11.55
Carotenoids (µg/100g)	7.87	50.64	57.21	49.75	45.38	46.77	43.38	54.55	52.69	52.98	51.64
Chlorophyll (mg/100g)	0.762	6.67	9.13	6.50	6.37	6.33	6.14	9.11	9.10	9.02	9.07
Crude fiber (%)	1.990	2.785	3.251	2.61	2.54	2.50	2.32	3.19	3.15	3.09	3.10
Fat(%)	0.1	0.3	0.35	0.25	0.26	0.28	0.28	0.29	0.29	0.29	0.31
Phenols (µg/g)	70.89	124.05	131.69	109.1	109.0	99.16	101.82	101.8	113.9	97.043	104.2
Flavonoids (µg/g)	1.005	2.978	3.526	1.12	1.14	1.15	1.13	2.96	2.59	2.22	1.56
Calcium (mg/100g)	4.2	9.15	12.26	5.861	6.632	6.185	6.980	8.893	8.436	8.919	8.903
Potassium (mg/100g)	3.6	9.26	10.82	8.16	7.68	8.79	8.76	9.20	9.17	8.99	9.02
Iron (mg/100g)	2.8	6.97	7.53	6.159	6.967	6.26	6.16	7.93	7.052	7.71	7.09

D. Microbial Assay:

Measured volume of different dilutions of samples is plated on suitable nutrient media, such as nutrient agar or yeast extract agar plates and the number of colonies counted. The total viable count per milliliter or gram is calculated. The results are tabulated as follows:

TABLE VII - COMPARISON BETWEEN MICROBIAL PARAMETERS OF FRESH GREEN PEAS AND SOLAR DEHYDRATED GREEN PEAS (0.1% $NaHCO_3$ + 0.1% MgO) IN TWO DIFFERENT PACKAGING MATERIALS FOR 30 DAYS

Microbial Parameter	**Fresh green peas**	**0th day**		**30th Day**							
				Control				**Pretreated**			
		Control	*Pretreated*	*Amb (Al)*	*Amb (PP)*	*Acc (Al)*	*Acc (PP)*	*Amb (Al)*	*Amb (PP)*	*Acc (Al)*	*Acc (PP)*
Total plate count	1200	91.25	94.21	94.25	95.32	98.26	97.14	97.36	96.58	97.15	98.26
E.coli	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil

TABLE VIII - COMPARISON BETWEEN MICROBIAL PARAMETERS OF FRESH GREEN PEAS AND SOLAR DEHYDRATED GREEN PEAS (0.1% $NaHCO_3$ + 0.1% MgO) IN TWO DIFFERENT PACKAGING MATERIALS FOR 60 DAYS

Microbial Parameter	Fresh green peas	0th day		60th Day							
				Control				Pretreated			
		Control	*Pretreated*	*Amb (Al)*	*Amb (PP)*	*Acc (Al)*	*Acc (PP)*	*Amb (Al)*	*Amb (PP)*	*Acc (Al)*	*Acc (PP)*
Total plate count	1200	91.25	94.21	99.73	98.62	99.72	93.27	99.17	98.27	99.11	98.01
E.coli	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil

E. Sensory Evaluation:

TABLE IX - COMPARISON BETWEEN SENSORY PROPERTIES OF FRESH GREEN PEAS AND SOLAR DEHYDRATED GREEN PEAS (0.1% $NaHCO_3$ + 0.1% MgO) PACKED IN ALUMINIUM AND POLYPROPYLENE POUCHES AND STORED AT AMBIENT AND ACCELERATED STORAGE CONDITIONS FOR 30 DAYS

S.No	Parameter	0th Day		30th Day							
				Control				Pretreated			
		Control	*Pretreated*	*Amb (Al)*	*Amb (PP)*	*Acc (Al)*	*Acc (PP)*	*Amb (Al)*	*Amb (PP)*	*Acc (Al)*	*Acc (PP)*
1.	**Colour**	6	8	6.1	6	6	6	8	8	8	7.9
2.	**Appearance**	6	7	6	6	6	6	7	7	7	7
3.	**Taste**	6.5	7.5	6.5	6.4	6.5	6.3	7.5	7.4	7.6	7.5
4.	**Texture**	7	7.2	6.9	6.8	6.8	6.9	7.2	7.3	7.1	7
5.	**Flavour**	7.5	7	7.5	7.4	7.4	7.2	7	7	7	7
6.	**Overall acceptability**	6.9	7.5	6.9	6.9	6.8	6.9	7.5	7.5	7.5	7.5
S.No	**Parameter**	**0th Day**		**30th Day**							
				Control				**Pretreated**			
		Control	*Pretreated*	*Amb (Al)*	*Amb (PP)*	*Acc (Al)*	*Acc (PP)*	*Amb (Al)*	*Amb (PP)*	*Acc (Al)*	*Acc (PP)*
1.	**Colour**	6	8	6.1	6	6	6	8	8	8	7.9
2.	**Appearance**	6	7	6	6	6	6	7	7	7	7
3.	**Taste**	6.5	7.5	6.5	6.4	6.5	6.3	7.5	7.4	7.6	7.5
4.	**Texture**	7	7.2	6.9	6.8	6.8	6.9	7.2	7.3	7.1	7
5.	**Flavour**	7.5	7	7.5	7.4	7.4	7.2	7	7	7	7
6.	**Overall acceptability**	6.9	7.5	6.9	6.9	6.8	6.9	7.5	7.5	7.5	7.5

TABLE X - COMPARISON BETWEEN SENSORY PROPERTIES OF FRESH GREEN PEAS AND SOLAR DEHYDRATED GREEN PEAS (0.1% $NaHCO_3$ + 0.1% MgO) PACKED IN ALUMINIUM AND POLYPROPYLENE POUCHES AND STORED AT AMBIENT AND ACCELERATED STORAGE CONDITIONS FOR 60 DAYS

S.No	Parameter	0th Day		60th Day							
				Control				Pretreated			
		Control	*Pretreated*	*Amb (Al)*	*Amb (PP)*	*Acc (Al)*	*Acc (PP)*	*Amb (Al)*	*Amb (PP)*	*Acc (Al)*	*Acc (PP)*
1.	**Colour**	6	8	6.1	6.1	6	6	7.9	7.8	8	7.9
2.	**Appearance**	6	7	6	6	6	6	7	7	7	7
3.	**Taste**	6.5	7.5	6.3	6.4	6.2	6.3	7.5	7.5	7.6	7.5
4.	**Texture**	7	7.2	6.5	6.7	6.8	6.9	7.2	7.3	7.1	7
5.	**Flavour**	7.5	7	7.5	7.4	7.3	7.2	7	7	7	7
6.	**Overall acceptability**	6.9	7.5	6.8	6.9	6.9	6.9	7.5	7.5	7.3	7.3

IV. CONCLUSIONS

From the above study on dehydration of green peas solar dehydrated green peas pretreated with 0.1% sodium bicarbonate and 0.1% magnesium oxide was the best dehydration technique based of sensory evaluation (colour, taste, overall acceptability) compared to the other pretreatments and the dehydration techniques. Shelf life analysis were carried out for the solar dehydrated green peas with pretreatment and without pretreatment at ambient and accelerated conditions in two different packaging materials i.e. aluminium and polypropylene for a period of 6 months to evaluate the best packaging material and the shelf stability of the product. The moisture content was found to be increasing as the shelf life increasing, but aluminium pouches were comparatively stable. Acidity, reducing sugars and total sugars were decreased slightly as the shelf life increased and aluminium has minimum losses compared to the poly propylene packaging in both ambient and the accelerated conditions. The nutrient retention was found to be higher in solar dehydrated green peas which were pretreated with sodium bicarbonate and magnesium oxide where chlorophyll retention was superior compared to the untreated green peas. Vitamin C was drastically reduced because it is heat sensitive. Bio-active compounds such as phenols and flavonoids were found to be decreased slightly. The sensory properties of the solar dehydrated green peas revealed that the green peas pretreated with sodium bicarbonate and magnesium oxide was superior in terms of color, appearance, taste and texture compared to the untreated solar dehydrated green peas. Results revealed that the solar dehydrated green peas pretreated with sodium bicarbonate and magnesium oxide packed in aluminium pouches had shown the better chlorophyll retention with less nutritional losses compared to the untreated solar dehydrated green peas and were shelf stable for a period of 6 months. The dehydrated green peas are rehydrated and used in pulav, upma, biryani.

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