

Effect of Storagibility on the Shelf Life of Green Chilli Powder Using Different Packaging Materials

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ABSTRACT:The experiment was conducted to evaluate the effect of packaging materials and storage conditions on the shelf life of Pusa Jwara green chilli variety. Green chili powders (*Capsicum annum*) produced by (lyophilize, Tray and sun Drying), packed in two packaging materials (High polypropylene and Flexible Packaging Foil) and stored under two temperatures (37 and 5 °C). Considering its change of moisture, Vitamin C, microbial contents and sensory evaluation without the addition of any chemical preservatives. The experiment used vitamin C, moisture content, microbial analysis and sensory evaluation to determine the shelf life during storage periods till 180 days. Green chili powder packaging in Flexible Packaging Foil after storage under 5 °C retained vitamin C and colour, under this condition the retention of shelf life and quality of green chilli can be extended up to 6 months without using any synthesis preservatives..

KEYWORDS:Chilli, Green chili, Packaging materials, Powder, Shelf life, Storage study .

I. INTRODUCTION

India has produced around 1628100 tons of chilli with area of 769210 ha during 2015-16 (Indian spices board, 2016). A large quantity of this chilli is lost due to lack of proper postharvest handling, transportation, packaging, and storage facilities. The postharvest loss of vegetables in the developing countries is about 20-50% and 5-25% in the developed countries (Amiruzzaman, 2000). Chilli is one of vegetable crop that can be spoiling by different way, so it is necessary to apply one of preservation methods to expend the shelf life of chillies.

Dried chilli is a spice product that is most widely used as condiments for colouring and flavouring in Asian cuisines (Jitbunjerdkul and Kijroongrojana, 2007; Toontom et al., 2010). Alsebaeai et al. (2016) found that lyophilize green chilli powders are rich in bioactive compound in comparison to other sample produced by different drying methods used in his study. Also Singh et al. (2016) reported that the green chilli powders obtained by lyophilize drying method was most acceptable in respect of color, flavor, pungency and texture followed by other drying methods such as sun, tray and vacuum.

Drying is one of the most cost and effective ways of preserving foods of all variety by applying the heat for removal of water. The most important reasons for popularity of dried products are longer shelf-life, product diversification as well as substantial volume reduction to decrease transportation cost. This could be further expanded by improvements in product quality and process applications (Simal, 1997). Shelf life is defined as the period between production and the time the food item loses its state of safe and satisfactory quality in terms of nutritional value, microbial status, flavor, texture, and appearance. The packaging material plays a fundamental role in maintaining the quality and shelf life of foods items. The package is an integral part of the preservation system and functions as an interface between the food

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and the external environment; the package should be designed and developed not only to contain the food product but also to protect it and add value to it, as its design may directly affect the purchase decision of the consumer (Da Cruz, 2007; Robertson, 2006; Sothornvit and Pitak, 2007). Packaging plays an important role in determining the stability of foods by influencing those factors which cause or contribute to food deterioration during storage. The nature of a package determines the composition of air inside the package, which in turn is known to affect the rate and extent of nutrient loss and microbial activity among other things (Sonneveld, 2000). The aim of this study was to determine the effect of Packaging and Storage Temperature on the Shelf Life of green chilli powder Pusa jwala variety.

II. MATERIALS AND METHODS

Green chilli Samples

Samples of green chilli, namely (*Pusa jwala*) is procured from local market in Varanasi, India, and the analysis was done in the lab of Centre of Food Science and Technology, Banaras Hindu University and Pharmaceutical Department, IIT, Banaras Hindu University, India.

Processing of green chilli powders

It was used for production of green chilli powders three methods (Sun, Tray and Lyophilize drying process) as it shows in (Fig. 1).

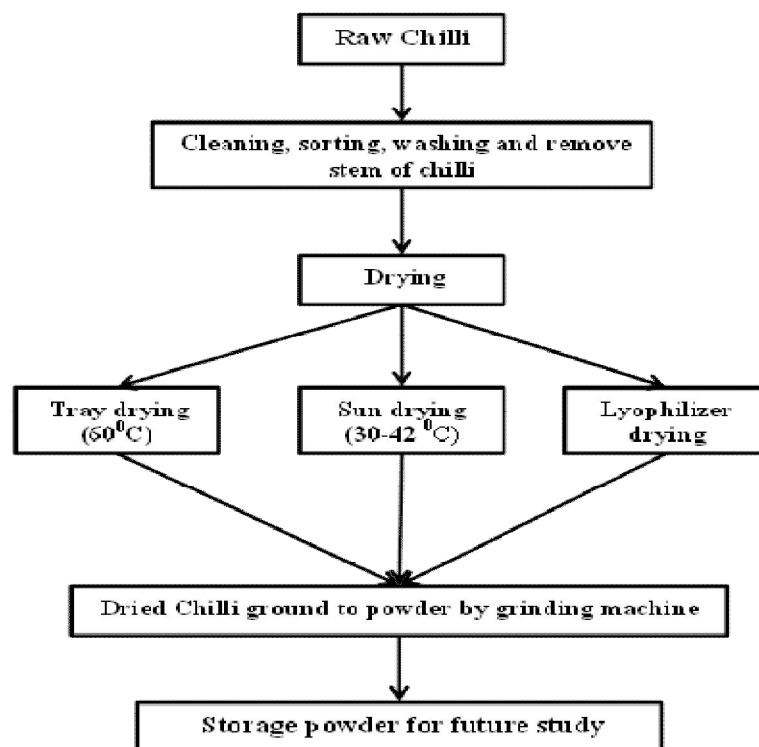


Fig 1 chart of production process of green chilli powders

Chemical analysis

The proximate analysis for the fresh and green chilli powder was done by determine the moisture, fat, ash and fiber contents as per method recommended by the Association of Official Analytical Chemists (AOAC, 1999; Ranganna, 1986). The percentage of protein present in the samples was determined by the Micro-kjeldhalmethod (Esayas et al., 2011). Reducing sugar was analyzed using the Nelson-Somogyi method (Ranganna, 1986) which is suitable for food

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with low reducing sugar. The concentration of reducing sugar was obtained using a spectrophotometer at 520 nm and a standard curve of glucose was used.

Packaging and Storage Conditions

Green chilli powders (50 g) were packed in High-density polyethylene bags (HDPE) and Flexible Packaging Foil (FPF). All samples were stored at (37 and 5 °C) for 6 months and analyzed on Day 0 and at 60 Days intervals until Days 180. Experiments were conducted in triplicate.

Moisture content

The moisture content of green chilli powders samples was determined with the air-forced oven drying method (105 °C), according to Method 44-15A of the American Association for Cereal Chemistry (AACC, 2000).

Ascorbic Acid

Ascorbic acid content was quantitatively determined according to Hill and Lewicki, (2007) by using 2, 6-dichlorophenol-indophenol method.

Microbial analysis

Total plate count and fungi count were determined as described by Atanda and Akano (1997).

Sensory evaluation

The overall acceptability (Colour, Flavour, Pungency) of the green chilli powders were evaluated by a panel of 15 experienced taste panelists described by Tummala et al., (2008). The scores were noted over a hedonic scale with a maximum score of 9 for “like extremely” and minimum of 1 for “dislike extremely”. The hedonic rating test in a scale of 1-9 marking was given as follows: dislike extremely (1), dislike very much (2), dislike moderately (3), dislike slightly (4), neither like nor dislike (5), like slightly (6), like moderately (7), like very much (8), like extremely (9).

Statistical Analysis

All the means of the triplicate values and standard deviations from the obtained data were calculated and statistically analyzed using SAS version 9.1. Meanwhile, Duncan’s multiple range tests was employed to determine the differences in the different compositions among the samples.

III. RESULTS AND DISCUSSIONS

Composition of fresh Green Chilli

The Raw green chilli was analyzed for moisture, protein, fat, ash and vitamin C and these results are presented in (Table 1). The fresh green chilli contained 87.37% moisture, 5.83 % protein, 1.77 % fat, 0.824 % Ash, 112.27 mg per % of vitamin C. Fiber 3.2667% and reducing sugar 6.15%. The results reported by Srivestavaet al., (1994) were similar to the proximate chemical composition of fresh green chilli contained 85.5 % moisture, 5.4 % protein, 1.1 % fat, 1.2 % mineral, 110 mg per % of vitamin C. The small variation may be due to varietal difference, soil property, growing condition, harvesting period, maturity stage, agro-ecological condition and methods of analysis.

Table 1.Chemical composition of fresh green chilli

Compounds	Raw green chilli
Moisture (%)	85.69±0.74 ^a
Ash (%)	0.824±0.12 ^a
Reducing sugar (mg)/ g	1.77±0.02 ^a
Protein (%)	5.83±0.21 ^a
Fiber (%)	3.27±0.12 ^a
Fat (%)	6.15±0.33 ^a
Ascorbic acid mg/100g	112.27±0.35 ^a
Total Phenol Content (mg/100gm)	13.25±0.50 ^a

* Each value is Mean ± Standard Deviations (n = 3).

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Composition of Green Chilli powders

The quality of green chilli powders was depended on the methods drying processing viz -Lyophilize Tray and Sun. The chemical parameter like- moisture, ash, protein, fat and vitamin C were analyzed. The results are presented in (Table 2).

The moisture was found in all green chilli powders range from 7.34- 9.53%.The results were agreement with reported by Krishnamurthy and Natarajan (1973). The ash content of green chilli powders was significantly different among all the samples ($P \leq 0.05$). The finding was agreed with Raina and Teotia (1985) who found that it was ranged from 4.53 to 7.39 %.The protein content was also found significantly different among the samples ($P \leq 0.05$). The results were presented varied from 14.60 and 16.85%. It was noticed that protein was also reported 15.4% in dry chilli per 100 g by Srivastava et al. (1994) within range to our findings. The fat content of green chilli powder were found moreless similar to reported (6.2%) by Srivastava et al. (1994). The ascorbic acid contents of all of dried green chilli found significantly different among the samples ($P \leq 0.05$). The ascorbic acid contents of all dried green chilli varied between 70.57 and 165.20 mg/100 g. The variations were due to difference in treatments, preparation and drying methods applied.

Table 2.Chemical composition of green chilli powders

Compounds	samples		
	LGCP	TGCP	SGCP
Moisture content (%)	8.99±0.08 ^a	7.34 ±0.11 ^b	8.23±0.20 ^c
Ash (%)	6.80±0.15 ^a	7.37±0.71 ^b	9.01±0.25 ^c
Fat (%)	5.23 ±0.60 ^a	6.50±0.62 ^a	4.83 ±0.30 ^a
Protein (%)	16.87±0.20 ^a	15.17±0.05 ^b	15.10 ±0.26 ^c
Ascorbic acid mg/100g	165.20±0.20 ^a	130.50±0.10 ^a	90.70±0.30 ^a
Fiber (%)	25.67±0.11 ^a	25.63±0.11 ^b	25.47±0.23 ^b
Reducing sugar (mg)/ g	80.62±0.32 ^a	81.19±0.32 ^a	96.80±0.32 ^b

* Each value is Mean ± Standard Deviations (n = 3).

Different superscripts in row are significantly different ($P < 0.05$).

LGCP: Lyophilize Green Chilli Powder

TGCP: Tray Green Chilli Powder

SGCP: Sun Green Chilli Powder

Shelf Life of Green Chilli Powder

The sample of green chilli powders was separately packaged in (High density polyethylene and Flexible Packaging Foil) stored at 37 and 5 °C for storage studies. After that studied the moisture, vitamin C, microbial contents and sensory evaluation of powder during storage.

Moisture Content during Storage

The initial moisture content of lyophilize, Tray and sun dried green chilli were 9.53, 7.54 and 8.52% respectively. The moisture content varied marginally in all the green chili powder samples packed in different packaging materials during the storage period of 180 days, and the results are reported in (Fig. 2). It was observed that the samples did not cross 11.7% even after the storage period of 180 days in both HDPE and FPF pouches. The slight increase in moisture content during storage period was due to porosity of packaging materials and hygroscopic nature of green chilli powder.

Vitamin C during Storage

The vitamin C content of green chilli powder was slightly decreased during storage period and the results are presented in (Fig. 3). The initial vitamin C content of the lyophilize drying, Tray drying and sun drying vacuum drying were 165.20, 130.50 and 90.70 mg per 100g respectively. Vitamin C was decreased in all conditions. This loss is due to the oxidation of residual air layer trapped within the packet. Garrot, (1986) observed that ascorbic acid loses could be occurred by enzymatic oxidation, thermal degradation and diffusion. Two main reasons of vitamin C reduction i.e. oxidative reactions by enzymes such as cytochrome oxidase, ascorbic acid oxidase and peroxidase, aerobic and non-enzymatic anaerobic reactions. Our findings were agreed with Khatun, (2012) who reported that the vitamin C content of green chilli powder was decreased by 25% during storage at 37 °C for sun and mechanically dried samples. The

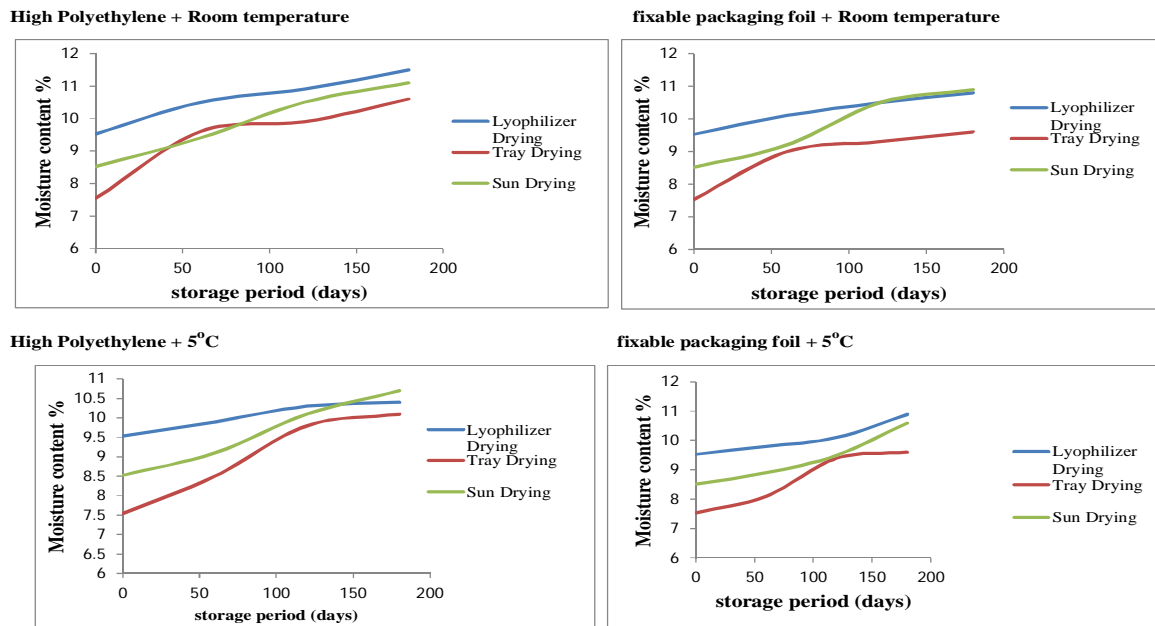
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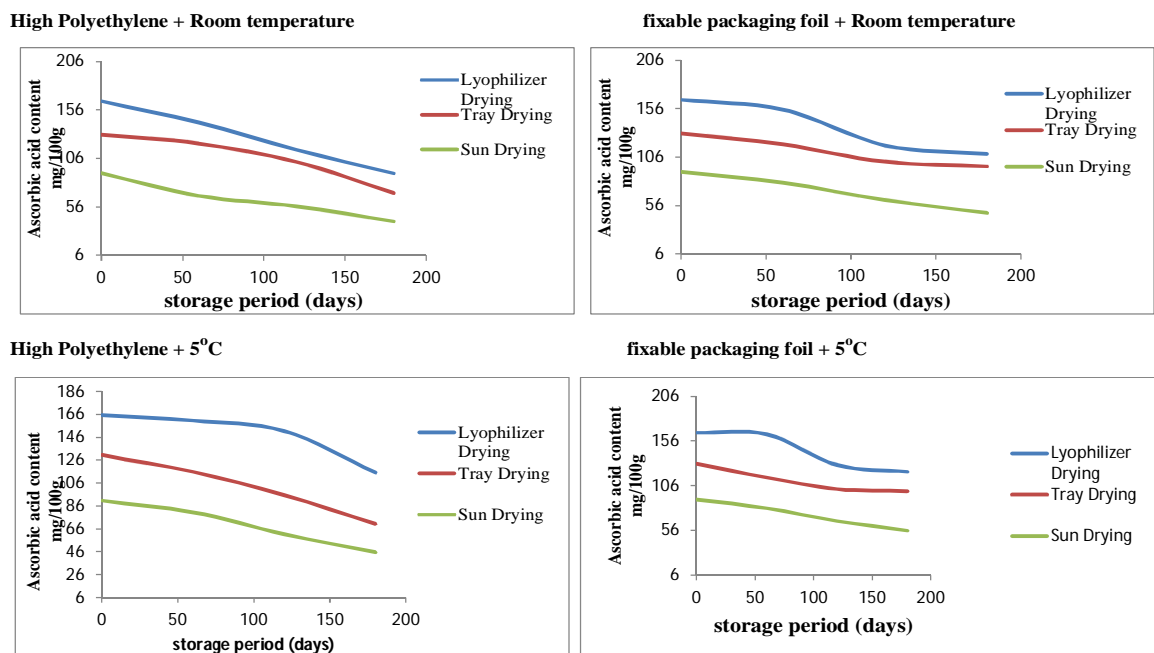
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evaluation of the effect of packaging materials showed that the samples packaged in aluminum foil retained more vitamin C and had longer shelf life in comparison to polyethylene packaging samples.



Changes in moisture content of green chilli powders during storage
Fig. 2. Changes in moisture content of green chilli powders during storage



Changes in ascorbic acid content mg/100g of green chilli powders during storage
Fig 3. Changes in ascorbic acid content mg/100g of green chilli powders during storage

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3.3.3 Microorganisms during Storage

Viable load of the green chilli powder during storage of six months are shown in (Table 3.4.). The results show the viable load of green chilli powder packed in both HDPE and FPF pouches storage under 5 °C were less than sample storage under 37 °C. There were no growths observed of E. coli in all green chilli powders samples during the storage time. There were no growths found of YMC during storage in LGCP and TGCP samples in comparison to the SGCP and VGCP. The growth of YMC was found due to the condition of drying process and bioactive compound of green chilli powders.

Table 3.The effect of storage time and packaging materials on the TPC in green chilli powder

Degree of storage	Packaging material	Days of storage	samples		
			LGCP log ₁₀ cfu/g	TGCP log ₁₀ cfu/g	SGCP log ₁₀ cfu/g
37 °C	HDPE	0	1.88±0.13 ^a	2.73±0.38 ^b	2.95±0.45 ^b
		60	2.99±0.19 ^a	3.34±0.12 ^b	3.20±0.07 ^b
		120	3.02±0.21 ^a	3.63±0.07 ^b	3.34±0.13 ^b
		180	3.77±0.49 ^a	3.91±0.43 ^a	3.90±0.43 ^a
	FPF	0	1.88±0.13 ^a	2.73±0.38 ^b	2.95±0.45 ^b
		60	2.38±0.19 ^a	2.93±0.18 ^a	2.99±0.71 ^a
		120	3.09±0.09 ^a	3.32±0.15 ^b	3.34±0.26 ^b
		180	3.71±0.18 ^a	3.93±0.08 ^a	3.94±0.38 ^a
5 °C	HDPE	0	1.88±0.13 ^a	2.73±0.38 ^b	2.95±0.45 ^b
		60	1.99±0.08 ^a	2.84±0.52 ^b	2.90±0.26 ^b
		120	2.46±0.50 ^a	2.80±0.32 ^b	3.05±0.13 ^b
		180	2.01±0.13 ^a	3.00±0.10 ^b	3.16±0.27 ^b
	FPF	0	1.88±0.13 ^a	2.73±0.38 ^b	2.95±0.45 ^b
		60	2.01±0.08 ^a	2.70±0.52 ^b	3.11±0.53 ^c
		120	2.42±0.74 ^a	3.10±0.32 ^b	3.04±0.16 ^b
		180	2.97±0.62 ^a	3.00±0.48 ^a	3.10±0.73 ^a

* Each value is Mean ± Standard Deviations (n = 3).

Different superscripts (small letter) in rows are significantly different (P < 0.05).

Table 4.The effect storage time and packaging materials on the total YMC in green chilli powder

Degree of storage	Packaging material	Days of storage	samples		
			LGCP log ₁₀ cfu/g	TGCP log ₁₀ cfu/g	SGCP log ₁₀ cfu/g
37 °C	HDPE	0	ND	ND	0.96±0.08 ^a
		60	ND	ND	0.95±0.09 ^a
		120	ND	ND	0.43±0.08 ^a
		180	ND	ND	0.87±0.05 ^a
	FPF	0	ND	ND	0.96±0.02 ^a
		60	ND	ND	0.95±0.04 ^a
		120	ND	ND	1.45±0.10 ^a
		180	ND	ND	1.81±0.13 ^a
5 °C	HDPE	0	ND	ND	0.96±0.04 ^a
		60	ND	ND	0.23±0.07 ^a
		120	ND	ND	0.43±0.05 ^a
		180	ND	ND	1.10±0.04 ^a
	FPF	0	ND	ND	0.96±0.09 ^a
		60	ND	ND	0.95±0.01 ^a
		120	ND	ND	1.05±0.07 ^a
		180	ND	ND	1.05±0.05 ^a

ND= Not Detected

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Sensory Scores during Storage

Overall acceptability for the prepared chutney of green chili powders with the other spices are presented in (Table 5). More panelists accepted the green chili powders prepared from Lyophilize green chilli powder, the powders retained a better green color, which had a characteristic flavor for these samples as compared to those powders produced by tray and sun drying methods during the storage period of 180 days.

Table 5. Rating score of green chilli powder for overall acceptability

Temperature storage	Packaging material	Days of storage	samples		
			LGCP	TGCP	SGCP
37 °C	HDPE	0	8.80±0.07 ^a	7.67±0.14 ^b	7.20±0.34 ^c
		60	7.55±0.33 ^a	7.05±0.56 ^b	6.34±0.13 ^c
		120	5.83±0.22 ^a	5.03±0.42 ^b	4.54±0.14 ^c
		180	4.31±0.15 ^a	4.17±0.21 ^a	2.79±0.10 ^b
	FPF	0	8.80±0.07 ^a	7.67±0.14 ^b	7.20±0.34 ^c
		60	7.66±0.76 ^a	7.21±0.40 ^b	6.52±0.31 ^c
		120	6.91±0.58 ^a	6.09±0.34 ^b	4.99±0.20 ^c
		180	4.52±0.64 ^a	4.37±0.30 ^a	2.9±0.32 ^b
5 °C	HDPE	0	8.80±0.07 ^a	7.67±0.14 ^b	7.20±0.34 ^c
		60	7.99±0.24 ^a	7.15±0.16 ^b	6.84±0.19 ^b
		120	7.01±0.55 ^a	6.04±0.68 ^b	5.21±0.38 ^c
		180	6.7±0.96 ^a	5.57±0.97 ^b	5.15±0.16 ^c
	FPF	0	8.80±0.07 ^a	7.67±0.14 ^b	7.20±0.34 ^c
		60	8.21±0.63 ^a	7.56±0.34 ^b	6.90±0.41 ^c
		120	7.86±0.58 ^a	6.49±0.13 ^b	5.58±0.30 ^c
		180	6.82±0.39 ^a	5.67±0.22 ^b	5.24±0.22 ^b

* Each value is Mean ± Standard Deviations (n = 3).

Different superscripts (small letter) in rows are significantly different (P < 0.05).

IV. CONCLUSIONS

Green chili powder produced by Lyophilize method is the best for quality and shelf life for 180 days of storage at ambient temperature and 5 °C considering its physical appearance, marketable quality, change of chemical parameters and microbial contents without the addition of any chemical preservatives. Storage green chilli powder packed in FPF under 5 °C found the best product. The powders made by Lyophilize method showed better values in terms of overall sensory quality than the other powders in both packaging materials during the storage period of 180 days. It found the at 37 °C of LGCP, TGCP and SGCP samples packaged in FPF can be stored up to 120 days, while the LGCP, TGCP and SGCP samples packaged in FPF can be stored at 5 °C up to 180 days.

REFERENCES

1. AACC. (2000). Approved Methods of American Association of Cereal Chemists, 5th ed.; American Association for Cereal Chemistry: St. Paul, MN, USA.
2. ALsebaei M., Chauhan, A., Arvind, Singh, RP., Yadav, P., Fatma, S., Maurya, KK. (2016). Effect of Thermal Treatment on the Bioactive Compounds in Green Chilli International Journal of Agricultural Science and Research (IJASR) Vol. 6, Issue 6, 187-194, ISSN(P): 2250-0057; ISSN(E): 2321-0087.
3. Amiruzzaman, (2000). Postharvest Technology/Management (vegetables). A consultancy report. AVRDC-USAID Bangladesh Project. Pp. 193.
4. AOAC. (1999). Official Methods of Analysis of the Association of Official Analytical Chemists, 15th ed. Association of Official Analytical Chemists, Arlington VA, 1058-1059.
5. Atanda, O., Akano, D. (1997). The Incidence of Different Types of Microorganisms and Aflatoxin Content of Dry "Tatase" Pepper (Capsicum annum L.) Stored for Sale in Dry Season. Nigerian Journal of Microbiology. 11.36-38
6. Da Cruz A., Faria, JAF., Van Dender, A. (2007). Packaging system and probiotic dairy foods. Food Research International 40: 951-956.
7. Esayas, K., Shimelis, A., Ashebir, F., Negussie, R., Tilahun, B., Gulelat, D., (2011). Proximate composition, mineral content and antinutritional factors of some capsicum (capsicum annum) varieties grown in Ethiopia. Bulletin of the Chemical Society of Ethiopia, 25(3), 451-454.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 9, September 2017

8. Garrot, G. (1986). Capsicum production, technology, chemistry and quality, part-II, processed products, standards, world production and trade. *CRC Crit. Rev. in Food Science & Nutrition* 23(3), 201–288.
9. Hill, T., Lewicki, P. (2007) *STATISTICS: Methods And Applications*; Stat Soft: Tulsa, OK, USA,.
10. Indian spices board (2016). <http://www.indianspices.com/search/node/cilli>
11. Jitbunjerdkul, S., Kijroongrojana, K. (2007). Formulation of thai herbal nam prik. *Songkanakarinn journal of science and technology* 29(3), 837-846.
12. Khatun, HA. (2012). The processing of green chilli powder The Faculty of Agricultural Engineering and Technology, Bangladesh Agricultural University, Mymensingh.
13. Krishnamurthy, K., Natarajan, CP. (1973). Color and its changes in chillies. *Indian Food Packer*, January–February, pp.39-44.
14. Raina, BL., Teotia, MS. (1985). Evaluation of chillies (*Capsicum annum L.*) grown in Jammu and Kashmir. *Indian Food Packer*, 39, 6-10.
15. Ranganna, S. (1986). *Hand Book of Analysis and Quality Control for Fruits and Vegetables Products*. Second edition, Tata, McGraw Hill Publishing Company Ltd, New Delhi, pp. 258-261.
16. Robertson. (2006). *Food Packaging Principles and Practice*, 2nd edn. Boca Raton, Florida: CRC Press.
17. Simal, S., Dey., Rosell. (1997). Simple modeling of air drying curves of fresh and osmotically predehydrated apple cubes. *Journal of food engineering*. 33 (1-2), 139-150.
18. Singh, A., Chauhan, AK., Singh, RP., Yadav, P., Alsebaei, MAQ. (2015) Development of Production Technology to Manufacture of Green Chilli Powder Proceeding - Kuala Lumpur International Agriculture, Forestry and Plantation, Hotel Putra, Kuala Lumpur, Malaysia. ISBN 978-967-11350-7-5.
19. Sonneveld, K. (2000). What drives (food) packaging innovation? *Packaging Technology and Science* 13: 29–35.
20. Sothornvit R., Pitak N. (2007). Oxygen permeability and mechanical properties of banana 5 lms. *Food Research International* 40: 365–370.
21. Srivestava, RP., Sanjeev, K. (1994). *Fruits and vegetable preservation (principle and practices)*, Appendices-V, p.381-382.
22. Toontom, N., Meenune, M., Posri, W. (2010). Consumer preference on flavor profiles and antioxidant information of a Thai Chilli paste. *British food journal*, 112 (11), 1252-1265.
23. Tummala, J., Galla, N., Dubasi, G., (2008). Physicochemical changes during processing and storage of green chilli (*capsicum annum L.*) powders. *Journal of food processing and preservation*, 32, 868–880.