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EFFECT OF TEMPERATURE AND OSMOTIC TREATMENTS ON QUALITY OF STORED PINEAPPLE SLICES DRIED UNDER CABINET TRAY DRYER

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Abstract

Pineapple is largely consumed around the world in the form of canned pineapple slices, chunk and dice, pineapple juice, fruit salads, sugar syrup, alcohol, citric acid, pineapple chips and pineapple puree. It mainly contains water, carbohydrates, sugars, vitamins A & C, carotene and refreshing sugar-acid balance and a very rich source of vitamin C and organic acids. The investigation was carried out using different drying temperatures and pretreatments. Storage study was also carried out for a period of 3 months for pineapple slices packed in HDPE bags. The effect on dehydrated pineapple samples determined by moisture content, ash, ascorbic acid, rehydration ratio and pH content. The highest moisture value was found 84.97% for 60^{o}Brix sample dried at 50^{o}C and lowest 4.91% for untreated sample dried at 70^{o}C under cabinet tray dryer after 90 days of storage packed in HDPE bags. The highest ash content value was found 3.65% for untreated sample dried at 70^{0}C and lowest 0.79% for 60^{o}Brix treated sample dried at 50^{0}C under cabinet tray dryer after 90 days of storage packed in HDPE bags. The highest ascorbic acid value was found 169.1 mg/100gm for 50^{o}Brix treated sample dried at 50^{0}C and lowest 78.5 mg/100gm for untreated sample dried at 70^{0}C under cabinet tray dryer after 90 days of storage packed in HDPE bags. The highest rehydration ratio value was found 4.69 % for untreated sample dried at 50^{0}C and lowest 2.65% for 60^{o}Brix treated sample that was dried at 70^{0}C under cabinet tray dryer after 90 days of storage packed in HDPE bags. The highest pH value was found 5.3 for 50^{o}Brix sample that was dried at 50^{0}C and lowest 4.8 for untreated sample dried at 70^{0}C under cabinet tray dryer after 90 days of storage in HDPE bags. In most of the quality characteristics cabinet tray drying at 50^0 C for 60^0Brix sugar solution treated sample presented better values in comparison to 50^0 Brix and control samples.

Keywords: Cabinet tray dryer, Osmotic dehydration, Storage, Temperature and Pineapple

INTRODUCTION

Pineapple is a tropical fruit grown in the tropical and sub-tropical regions. It's grown on large scale in India and now India is the second largest producer of fruits after Brazil. Pineapple is largely consumed around the world as canned pineapple slices, chunk and dice, pineapple juice, fruit salads, sugar syrup, alcohol, citric acid, pineapple chips and pineapple puree. It mainly contains water, carbohydrates, sugars, vitamins A, C and carotene and refreshing sugar-acid balance and a very rich source of vitamin C and organic acids **(Bartolomew, *et al.*, 1995).** Pineapple is one of the most important fruit crops of north eastern India especially in Arunachal Pradesh in India. Thailand, Philippines, Brazil and China are the main pineapple producers in the world supplying nearly 50 % of the total output. Other important producers include India, Nigeria, Kenya, Indonesia, Mexico, Costa Rica and these countries provide most of the remaining fruit.

Many processing techniques can be employed to preserve fruits and vegetables such as drying and dehydration it is one of the most important operations that are widely practiced because of considerable saving in packaging, storage etc. Osmotic dehydration has received greater attention in recent years as an effective method for preservation of fruits (**Chaudhari, *et al.*, 2015**). Being a simple process, it facilitates processing of tropical fruits such as banana, sapota, pineapple, mango etc., with retention of initial fruit characteristics viz., colour, aroma and nutritional compounds **(Pokharkar and Prasad, 1998).** It is less energy intensive than air or vacuum drying processes because it can be conducted at low or ambient temperature. It has potential advantages in processing industry that maintain the food quality and also preserve the wholesomeness of the food (**Bongirwar and Sreenivasan, 1977).** It involves dehydration of fruit slices in two stages, removal of water using as an osmotic agent (osmotic concentration) and subsequent dehydration in a dryer where moisture content is further reduced to make the product shelf stable **(Ponting, 1973).**

Drying is the most common form of food preservation and extends the shelf life of the food. The major objective in drying agricultural products is the reduction of the moisture content to a level, which allows safe storage over an extended period. Also, it brings about substantial reduction in weight and volume, minimizing packaging, storage and transportation costs **(Ashish, *et al.*, 2012).** In the Mediterranean countries the traditional technique of fruit and vegetable drying is by using the sun. This technique has the advantages of simplicity and the small capital investments, but it requires long drying times that may have adverse consequences to the product quality, the final product may be contaminated from dust and insects, suffer from enzyme and microbial activity. In order to improve the quality, the traditional sun drying technique should be replaced with industrial drying methods. By keeping the view to avoid disadvantages it is necessary to use the other mechanical drying methods like cabinet tray dryer, hot air oven etc. **(Singh, *et al.*,. 2012)**

MATERIALS AND METHODS

Studies were carried out to evaluate the physico chemical characteristics of the dried pineapple slices. The experiments were conducted in the Process and Food Engineering Laboratory of the Department of Agriculture Engineering, S.V.P.U.A & T, Meerut.

Samples preparation with treatments:

Fresh, good quality pineapple was taken from the local market of Meerut. The pineapple were washed to remove soil particles attached to the surface. Then sorted cleaned pineapple was cut into 4.5 mm thickness. The sliced pineapple was subjected to pre-treatment. In this, the pineapple slices were dipped in osmotic solution having sugar concentration ranging from 50 to 60 °Brix at 45^0C temperature for 180 minute. Then slices were removed from the solution and the surface moisture was removed by blotting paper than after slices were subjected to drying in cabinet tray dryer at 50^0C, 60^0C and 70^0C. After drying slices are packaged in HDPE bags and stored at room temperature. **(Chaudhary, *et al.*, 2018)**

EXPERIMENTAL SET-UP

Cabinet tray dryer method: The osmotic treated and untreated pineapple slices were dried in the cabinet tray dryer. A cabinet tray dryer was used for dehydrated pineapple experiments. The pineapple slices were placed uniformly on stainless steel tray (80 cm length x 40 cm width and

1.37 kg weight) and experiments were conducted at 50^0C, 60^0C and 70^0C temperature. Weight losses (moisture content) of sample during drying process was determined, every 30 minutes interval and continued until no further weight changes were observed**. (Kumar, *et al.*, 2017)**

Fresh pineapple

↓

Washing

↓

Peeling

↓

Cut into slices (4.5mm)

↓

Osmotic treatment

↓

Dip in Sugar solution

(50 and 60^0Brix at 45^oC)

↓

Immersion time (3 hr.)

↓

Osmotically dehydrated pineapple slices

↓

Tray drying at 50^0,60^0 and 70^0C

↓

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Quality evaluation

Figure 3.1: Flow chart of osmotic dehydration process **(Vikrant *et al*., 2019).**

RESULTS AND DISCUSSION

Effect on moisture content: The moisture of the samples having dehydrated pineapple slices with untreated and treated pineapple slices with 50^{o}Brix and 60^{o}Brix. During room temperature storage, it was observed that the moisture content of all samples was found in increasing trend at 0, 30, 60 and 90 days of storage. The highest moisture value was found 84.97% for 60^{o}Brix sample dried at 50^{o}C after 90 days of storage while lowest 4.91% for untreated sample dried at 70^{o}C after 90 days of storage packed in HDPE bags. The higher moisture content causing the grow of micro-organisms and lowering protein and other nutritional parameters. It is observed that the moisture content gradually increased due to water vapor transmission through HDPE bags.

Effect on pH: The pH of osmotic treated with sugar 50^{o}Brix and 60^{o}Brix and control pineapple samples were studied. The highest pH value was found 5.3for 50^{o}Brix sample dried at 50^{0}C after 90 days of storage while lowest was found 4.8 for untreated sample dried at 70^{0}C after 90 days of storage packed in HDPE bags. The slightly increase in pH of pineapple slices may be due to reduction of acidity with the increase of storage period. The acidity affects the pH value increasing in all untreated (control) samples. The 50^{o}Brix and 60^{o}Brix samples are decreasing the pH level due to increasing the storage period, preservatives are lower the pH value.

Effect on ash content: The ash content of the samples having dehydrated pineapple slices with untreated and treated pineapple slices with 50^{o}Brix and 60^{o}Brix. During room temperature storage, it was observed that ash content of all samples was found in decreasing trend at 0, 30, 60 and 90 days of storage. The highest ash value was found 3.65% for untreated sample dried at 70^{0}C after 90 days of storage while lowest 0.79% for 60^{o}Brix treated sample dried at 50^{0}C after 90 days of storage packed in HDPE bags. While lower the ash content as more pure.

Effect on ascorbic acid: The ascorbic acid were examined from pineapple samples controlled, 50^{o}Brix and 60^{o}Brix treated during 0, 30, 60 and 90days storage period respectively. The ascorbic acid was observed that of all samples was decreasing trend during storage. The highest ascorbic acid value was found 169.1 mg/100gm for 50^{o}Brix treated sample dried at 50^{0}C after 90 days of storage while lowest 78.5 mg/100gm for untreated sample dried at 70^{0}C after 90 days of storage.

Effect on Rehydration ratio: Rehydration ratio of all samples was in decreasing trend at 0, 30, 60 and 90 days of storage at room temperature conditions. The highest fat value was found 4.69 % for untreated sample dried at 50^{0}C after 90 days of storage while lowest 2.65% for 60^{o}Brix treated sample dried at 70^{0}C after 90 days of storage.

Table 1. Effect of solution and temperature on moisture content of pineapple slices during storage dried at 50°C, 60°C and 70°C.

Quality parameter	Temperatures	50°C			60°C			70°C		
	Storage period (Days)	T_0	T_1	T_2	T_0	T_1	T_2	T_0	T_1	T_2
Moisture	0	11.11	66.66	84.44	6.66	64.44	82.22	4.44	55.55	66.66
	30	11.41	66.73	84.62	6.77	64.56	82.33	4.56	55.66	66.78
	60	11.67	66.88	84.75	6.89	64.77	82.54	4.78	55.87	66.89
	90	11.67	66.99	84.97	6.98	64.89	82.86	4.91	55.99	66.98

T_0 = Control T_1 = 50^{0}Brix T_2 = 60^{0}Brix

Table 2. Effect of solution and temperature on pH content of pineapple slices during storage dried at 50°C, 60°C and 70°C.

Quality parameter	Temperatures	50°C			60°C			70°C		
	Storage period (Days)	T_0	T_1	T_2	T_0	T_1	T_2	T_0	T_1	T_2
pH	0	5.1	5.7	5.6	5.2	5.5	5.3	5.3	5.4	5.2
	30	5.0	5.6	5.4	5.1	5.4	5.2	5.2	5.3	5.1
	60	4.9	5.4	5.3	5.0	5.3	5.1	5.1	5.2	5.1
	90	4.8	5.3	5.2	4.9	5.1	5.0	4.8	5.1	5.0

Table 3. Effect of solution and temperature on ash content of pineapple slices during storage dried at 50°C, 60°C and 70°C.

Quality parameter	Temperatures	50°C			60°C			70°C		
	Storage period (Days)	T_0	T_1	T_2	T_0	T_1	T_2	T_0	T_1	T_2
Ash	0	3.50	1.12	0.82	3.60	1.15	0.83	3.70	1.20	0.94
	30	3.48	1.11	0.81	3.58	1.13	0.82	3.69	1.19	0.93
	60	3.45	1.10	0.80	3.55	1.11	0.81	3.68	1.17	0.92

	90	3.43	1.08	0.79	3.52	1.09	0.80	3.65	1.15	0.90

Table 4. Effect of solution and temperature on ascorbic acid of pineapple slices during storage dried at 50°C, 60°C and 70°C.

Quality parameter	Temperatures	50°C			60°C			70°C		
	Storage period (Days)	T_0	T_1	T_2	T_0	T_1	T_2	T_0	T_1	T_2
Ascorbic acid	0	91.1	170.2	128.6	86.1	166.5	119.1	80.1	164.2	112.5
	30	90.8	170.0	128.1	85.8	166.0	118.8	79.7	164.0	112.1
	60	90.5	169.5	127.6	85.3	165.7	118.5	79.2	163.8	111.8
	90	90.1	169.1	127.1	84.9	165.3	118.1	78.5	163.2	111.7

Table 5. Effect of solution and temperature on rehydration ratio of pineapple slices during storage dried at 50°C, 60°C and 70°C.

Quality parameter	Temperatures	50°C			60°C			70°C		
	Storage period (Days)	T_0	T_1	T_2	T_0	T_1	T_2	T_0	T_1	T_2
Rehydration ratio	0	4.74	3.10	2.86	4.60	3.06	2.78	4.22	3.02	2.70
	30	4.72	3.08	2.85	4.59	3.07	2.76	4.21	3.01	2.69
	60	4.71	3.05	2.83	4.57	3.05	2.74	4.19	2.98	2.67
	90	4.69	3.04	2.81	4.55	3.03	2.72	4.17	2.96	2.65

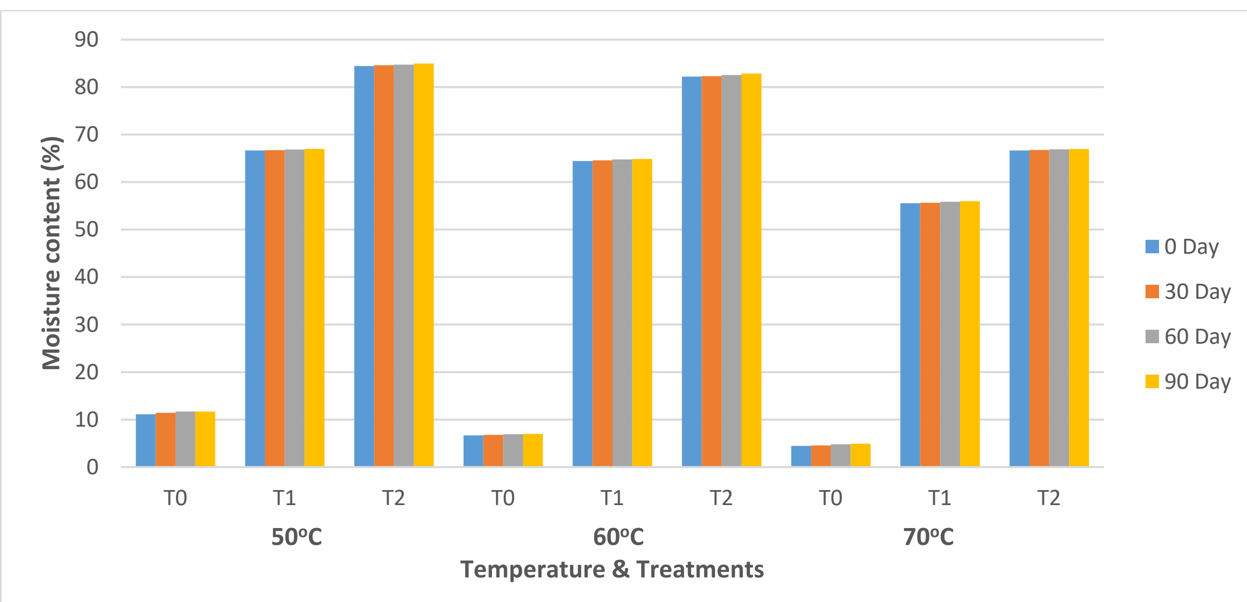

Fig 1. Effect of solution and temperature on moisture content of pineapple slices during storage dried at 50°C, 60°C and 70°C.

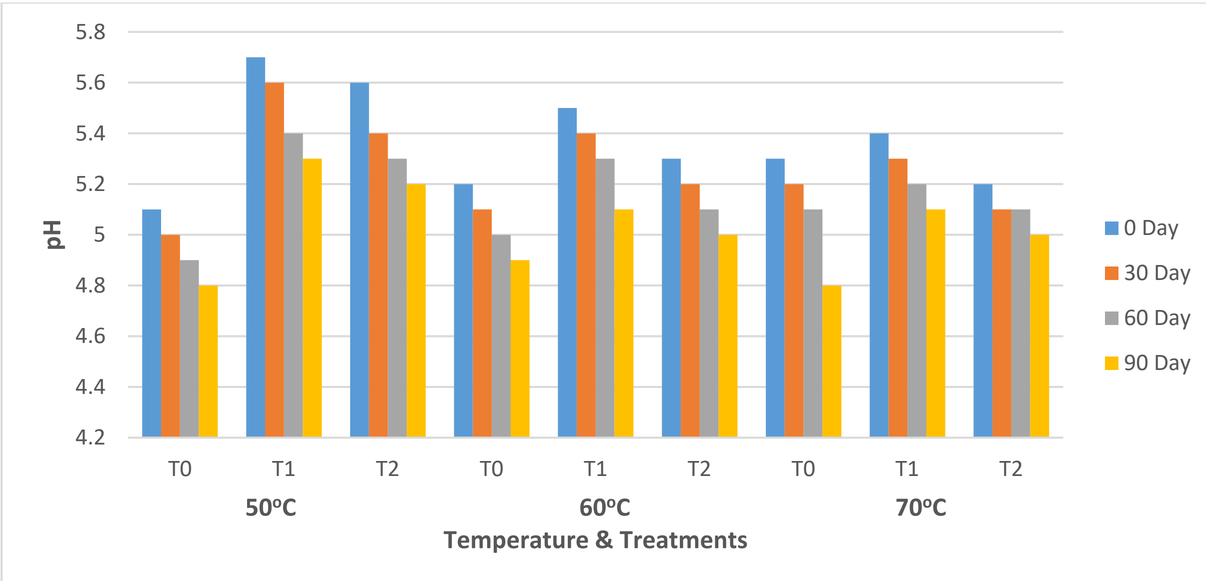

Fig 2. Effect of solution and temperature on pH content of pineapple slices during storage dried at 50°C, 60°C and 70°C.

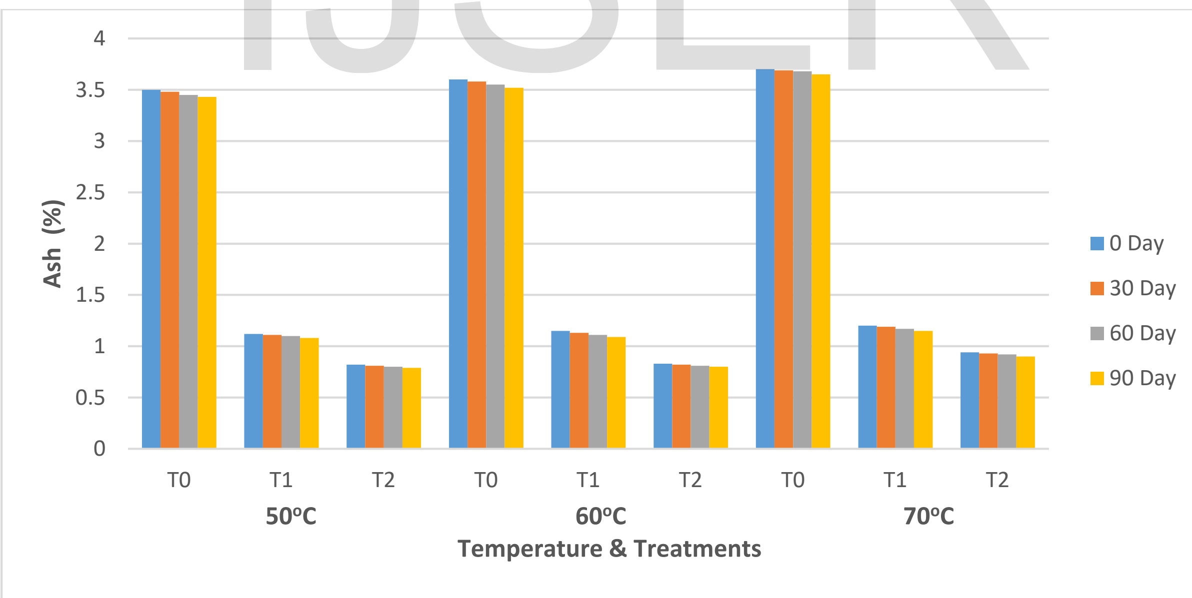

Fig 3. Effect of solution and temperature on ash content of pineapple slices during storage dried at 50°C, 60°C and 70°C.

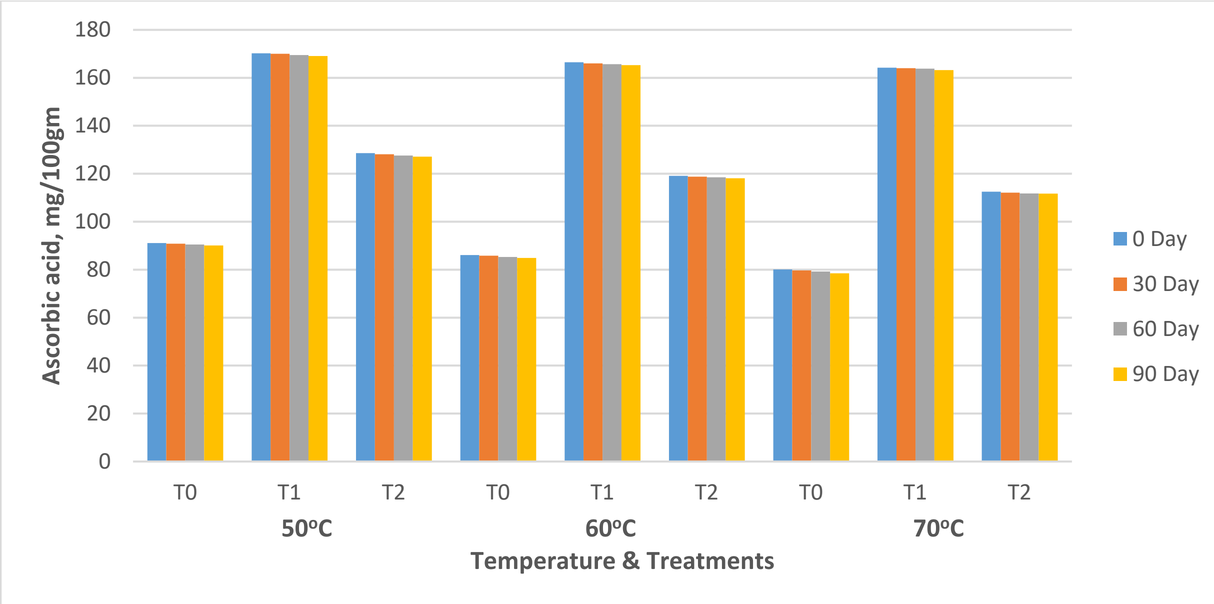

Fig 4. Effect of solution and temperature on ascorbic acid of pineapple slices during storage dried at 50°C, 60°C and 70°C

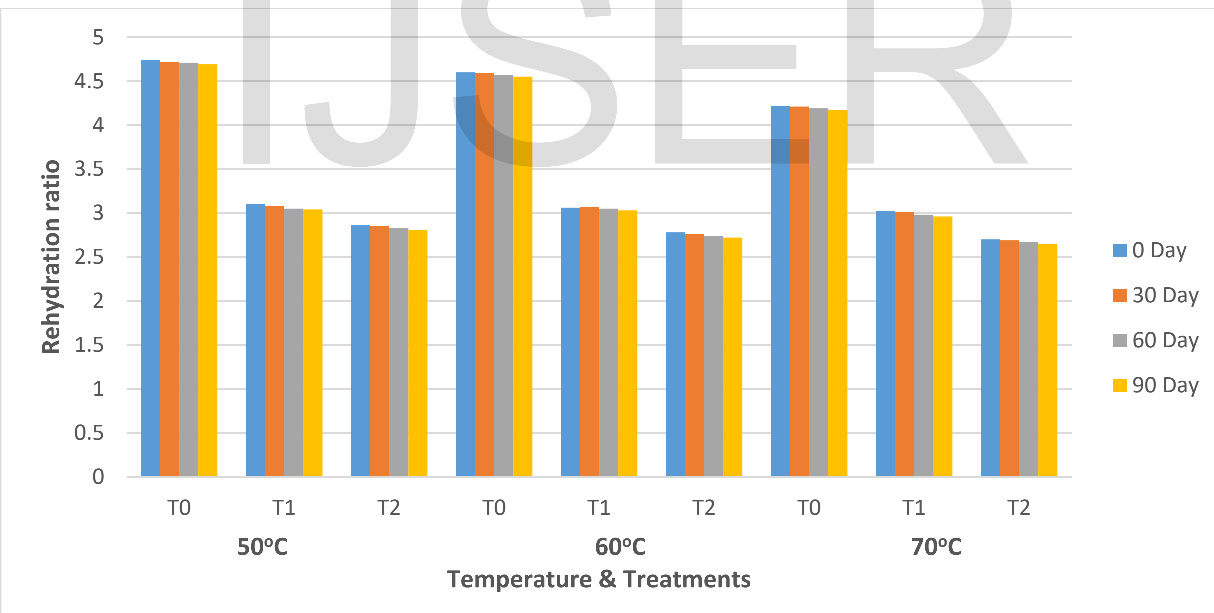

Fig 5. Effect of solution and temperature on rehydration ratio of pineapple slices during storage dried at 50°C, 60°C and 70°C.

CONCLUSION

The osmo-dried pineapple slices were stored and the study was carried out for at 0, 30, 60 and 90 days at room temperature conditions using HDPE packaging material. Among the three different temperatures are used in this experiment, tray dried 50^0C samples attained better quality characteristic as compared to 60^0C and 70^0C dried samples. 50^oBrix sugar treated at 50^0C samples were found to have most protective effect on quality process during storage period. Storage studies carried out for period of almost 3 months showed highly effectiveness of treatments during storage. Pineapple slices was safe for consumption up to 3 months at ambient storage temperature, and it was packed in HDPE bags.

REFERENCES

Ashish, D. Chaudhari and Sanjay, P. Salve (2012). A review of solar dryer technologies. *International Journal of Research in Advnat Technology, 02 (02):* 218-232.

Bartolomew, A.P.; Pilar, R. and Foster, C. 1995. Pineapple fruit: morphological characteristics chemical composition and sensory analysis of Red Spanish and Smooth cayenne cultivars. *Food Chemistry*, 53: 75 –79.

Bongirwar, D. R. and Sreenivasan, A. 1977. Osmotic dehydration of banana. *Journal. Food Science. Technology*, 14 (3), 104-112.

Chaudhari, A. P., Dhake, K. P. and Manisha, M. 2015. Osmotic dehydration of pineapple. *International journal in it and engg*.vol.03 issue-04, issn: 2321-1776.

Chaudhary, V., Kumar, V., Singh, G.R., Singh, J., Chauhan, N. and Kumar. K. 2018. Tom study the osmotic dehydration characteristics of pineapple (Ananas comosus) slices. *International Journal of Chemical Studies*, 6(5): 1081-1083,

Kumar, A. A., Singh, S., Singh, B. R., Chauhan, N., Singh, G. R. and Mishra, D.K. 2017. Effect of temperature and treatments on quality of stored ginger powder dried under cabinet tray dryer. *Annals of Horticulture*, 10 (1): 31-34

Pointing, J. D. 1973. Osmotic dehydration of fruits, recent modifications and applications. *Journal of Process Bio Technology*, *12*(8), 8-20.

Pokharkar, S. M. and Prasad, S. 1998. Mass transfer during osmotic dehydration of banana slices. *Journal Food Science. Technology, 35* (4), 336-338.

Sweta Singh; Singh Papu and Singh B. R. 2012. Effect of Pretreatments, Loading Density and Drying Methods on Garlic Leaves. *International Journal of Science and Research*, 2319-7064: 3, 358.

Vikrant, K., Singh, J., Chauhan, N., Chandra, S., Ratnesh, K., and Sunil (2019). Osmo-convective dehydration of papaya slices and quality evaluation: A review, *International Journal of Chemical Studies*; **7**(1): 635-640.