Effect of cabinet tray dryer on Tomato (*Lycopersicon Esculentum)* slices during drying process and storage study of dehydrated tomato powder

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Abstract: The effected dehydrated tomato (*Lycopersicon Esculentum)* samples determining by acidity, pH, ascorbic acid, lycopene content and microbial growth. The highest acidity value 7.42 of untreated samples (4mm) in LDPE packaging material and 8.12 of untreated samples (8 mm) in aluminum foil packaging and the lowest pH value 2.05 of untreated samples (6mm) in LDPE packaging material and 2.07 of untreated samples (8 mm) in aluminum foil package under cabinet tray dryer (65 ^{0}C) after 120 days. The lowest lycopene content value 50.71 of untreated samples (6 mm) in LDPE packaging material and 60.24 of untreated samples (4 mm) in aluminum foil packaging under cabinet tray dryer at 65 ^{0}C after 120 days. The lowest vitamin C value 8.54 of untreated samples (4mm) in LDPE packaging and 9.50 of untreated samples (6 mm) in aluminum foil packaging under cabinet tray dryer after 120 days. We can see that microbial growth not detect in the starting 30 days but after one month we can easily see microbial growth. When considering growth rates of microbial pathogens, in addition to temperature, time is a critical consideration. Food producers or manufacturers address the concept of time as it relates to microbial growth when a product's shelf life is determined. The highest microbial growth 4.55×10^2 of untreated samples (6mm) in LDPE packaging and 4.49×10^2 of untreated samples (8 mm) in aluminum foil packaging under cabinet tray dryer after 120 days.

Keywords: Aluminum foil pouch, Cabinet tray dryer, Low density poly ethylene pouch, Preservatives

INTRODUCTION

The tomato is the fruit of th eplant *Lycopersicon esculentum*. (Botanically speaking, tomato is not only a fruit, but also a berry since it is formed from a single ovary.). Worldwide, tomatoes are considered an important agricultural crop and an integral part of the human diet. Although tomatoes are commonly consumed fresh, over 80% of the tomato consumption comes from processed products such as tomato juice, ketchup etc. Recent studies have indicated the potential health benefits of a diet that is rich in tomatoes. Lycopene, a major carotenoid without provitamin an activity, present in red tomatoes, is considered responsible for their beneficial effects (Shi *et al.*, 1997; Rao *et al.,* 1998). Vegetables and their products are of great nutritional importance since they make a significant contribution in supplying wealth of essential vitamins, minerals, antioxidants, fibers and carbohydrates that improve the quality of the diet. Many vegetables are highly seasonal in nature. They are available in plenty at a particular period of time in specific regions that many times result in market glut. Due to perishable nature, huge quantity of vegetables is spoiled within a short period. The post harvest loss in vegetables has been estimated to be about 30-40% due to inadequate post harvest handling, lack of infrastructure, process-

ing, and marketing and storage facilities. The size of the fruit is influenced by the availability water to the plant. A series of quantitative and qualitative changes of the chemical composition take place during tomato fruit ripening. Organic acids, soluble sugars, amino acids, pigments and over 400 aroma compounds contribute to the taste, flavour and aroma volatile profiles of the tomatoes (Petro- Turza, 1987).

Drying is very important process applicable for agricultural and industrial products. Drying is the moisture removing process from the products. Drying reduces the bacterial growth in the products. It will helpful for preserving the products for long time. Solar drying is the oldest method of products drying. Open air solar drying method is used frequently to dry the agricultural products. But this method has some disadvantages. Therefore to avoid disadvantages it is necessary to use the other solar drying methods. Different solar drying methods are direct solar drying, indirect solar drying, and mixed mode solar drying. The device used for drying process with application of solar energy called the Solar dryer. Solar dryer are also classified with mode of air circulation (Ashish *et. al.,* 2012).
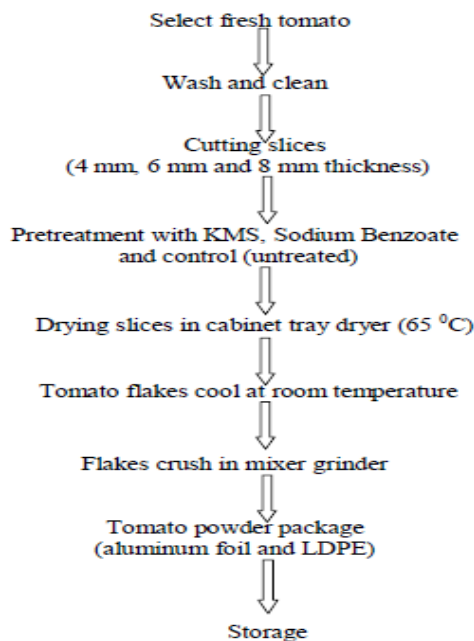
MATERIALS AND METHODS

Studies were also carried out to evaluate the physi-

chemical characteristics of the dried tomato slice and products. The experiments were conducted in the Process and Food Engineering Laboratory of the Department of Agricultural Engineering and Food Technology, Sardar Vallabhbhai Patel University of Agriculture and Technology, Modipuram, Meerut. Geographically, Modipuram is located in semi-arid and subtropical region at $29^0 \ 05' \ 19"$ North latitude, $77^0 \ 41' \ 50"$ East longitudes and at an altitude of 237 meters above the mean sea level.

Samples preparation with treatments: Fresh tomato was purchased from the local market Meerut. The tomatoes were cleaned to remove any dust particles attached to the surface. Then the sorted cleaned tomato was cut into the uniform thickness of 4.0mm, 6.0mm and 8.0mm. For the treated samples after cutting in to different sizes and slices were dipped into a solution (ml) 1:4 ratio of preservative (sodium benzoate and potassium metabisulphite). The slices were then taken out from the solution and the surface moisture was removed by blotting paper than after slices drying in cabinet tray dryer at 65 ^{0}C.

Experimental set-up

Cabinet tray dryer method : The pre-treated and untreated tomato slices were dried in the cabinet tray dryer. A cabinet dryer was used for the dehydrated tomato experiments. The tomatoes slices were placed uniformly on stainless steel trays (80 cm length × 40 cm width and 1.37 kg weight) and experiments were conducted at 65 ^{0}C temperature. Weight losses (moisture content) of sample during drying process was determined, after each 1 hour interval and continued until no further weight changes were observed.

Select fresh tomato
↓
Wash and clean
↓
Cutting slices
(4 mm, 6 mm and 8 mm thickness)
↓
Pretreatment with KMS, Sodium Benzoate
and control (untreated)
↓
Drying slices in cabinet tray dryer (65 ^{0}C)
↓
Tomato flakes cool at room temperature
↓
Flakes crush in mixer grinder
↓
Tomato powder package
(aluminium foil and LDPE)
↓
Storage

Fig 1. *Process flow chart for dehydrated tomato by cabinet tray dryer.*

Statistical analysis: The analysis was carried out in four replicates for all determinations. The mean and standard deviation of means were calculated. The data were analyzed by one-way analysis of variance (ANOVA). A multiple comparison procedure of the treatment means was performed by Duncan's new multiple range tests. Significance of difference of the difference was defined as (P<0.05).

RESULTS AND DISCUSSION

Effect on acidity: The acidity of the samples having dehydrated tomato powder with untreated and treated of tomato slices with KMS, sodium benzoate. During room temperature storage, it was observed from the Tables 1 to 2 and that acidity of all the samples was increased at 0, 30, 60, 90 and 120 days of storage at room temperature conditions. The highest acidity value 7.42 of untreated samples (4mm) in LDPE packaging material and 8.12 of untreated samples (8 mm) in aluminum foil packaging under cabinet tray dryer after 120 days at room temperature conditions. We are found that superior sample of the aluminum foil pouch because this are highly protective than compression to low density polyethylene pouch. The higher acidity content prevents the growth of spoilage causing microorganisms by lowering the protein food or by the action on carbohydrate to from lactic acid. All means scores, bearing different superscripts in columns differ significantly ($p \leq 0.05$).

The higher acidity content prevent the growth of spoilage causing microorganisms by lowering the protein content of certain food or by action on carbohydrates to from lactic acid (srivastav and kumar, 2002).

Effect on Ph: The pH value of a food is a direct function of the free hydrogen ions present in that food. Acids present in foods release these hydrogen ions, which give acid foods their distinct sour flavor. pH is defined as the negative log of the hydrogen ion concentration. The *pH,* or potential of hydrogen, is the measure of acidity or alkalinity in food. The values range from 1 to 14. Neutral is 7. Lower values are more acidic, while higher values are more alkaline. The lower the pH value in your food, the more acidic it is. The pH of various chemically pre-treated tomato samples were studied and drying rate curves as a function of drying time at constant temperature for dehydrated tomato pre-treated with KMS, sodium benzoate and control samples were plotted based on their higher dehydration efficiency. All means scores, bearing different superscripts in columns differ significantly ($p \leq 0.05$). it was observed from the Table 3 to 4.

The lowest pH value 2.05 of untreated samples (6mm) in LDPE packaging material and 2.07 of untreated samples (8 mm) in aluminum foil package under cabinet tray dryer after 120 days. This observation agrees with the work of who attributed that the decrease in

Table 1. Change in Acidity (g/100g) of the samples of dehydrated tomato powder at cabinet tray dryer and storage in LDPE pouch.

Storage	Untreated			Treated (KMS)			Treated (Sodium Benzoate)		
					LDPE packaging				
					cabinet tray dryer				
Periods	4mm	6mm	8mm	4mm	6mm	8mm	4mm	6mm	8mm
0	5.80	5.80	5.80	5.82	5.82	5.82	5.81	5.81	5.81
30	5.95	5.87	5.75	5.80	5.93	5.90	5.88	5.89	5.97
60	6.39	6.26	6.60	6.12	6.21	6.35	6.09	6.15	6.29
90	6.72	6.77	6.95	6.69	6.78	6.99	6.79	6.75	6.90
120	7.42	7.37	7.45	7.01	7.12	7.05	6.99	7.09	7.12

ANOVA for the effect of acidity (g/100g) during storage

Source	D.F.	S.S	M.S.	F-Cal	Significance	CD	SE(d)	SE(m)	CV
Replications	04	0.19				0.231	0.113	0.080	2.792
Treatment	0 8	12.10	1.51	47.46	0.000000				
Error	32	1.02	0.03						
Total	44	13.31							

Table 2. Change in Acidity (g/100g) of the samples of dehydrated tomato powder at cabinet tray dryer and store in aluminum foil pouches

Storage	Untreated			Treated (KMS)			Treated (Sodium Benzoate)		
					Aluminium foil packaging				
					Cabinet tray dryer				
Periods	4mm	6mm	8mm	4mm	6mm	8mm	4mm	6mm	8mm
0	5.80	5.80	5.80	5.82	5.82	5.82	5.81	5.81	5.81
30	5.91	5.83	5.75	6.00	6.11	5.94	5.97	5.99	6.01
60	6.47	6.77	6.93	6.66	6.87	6.48	6.19	6.45	6.67
90	7.01	7.10	7.15	7.25	7.33	7.07	6.97	6.94	7.00
120	7.89	7.88	7.93	7.41	7.52	7.22	7.15	7.21	7.11

ANOVA for the effect of acidity(g/100g) during storage

Source	D.F.	S.S	M.S.	F-Cal	Significance	CD	SE(d)	SE(m)	CV
Replications	04	00.11				0.333	0.163	0.115	3.904
Treatment	08	17.97	2.25	33.96	0.000000				
Error	32	02.12	0.07						
Total	44	20.20							

ascorbic acid content was correlated to the lowering of the pH. The later increase in pH and decrease in acidity is probably due to the effect of organisms responsible for the spoilage, some of which can release basic substances into the samples. Processing of tomatoes using sun drying with cut pieces, drying of whole tomatoes, spray drying and convection drying using solar or mechanical systems has been used for many years (Baloch *et al.,* 1997; Collins *et al.,* 1997; Hawlader *et al.,* 1991; Olorunda, *et al.,* 1990; Shi *et al.,* 1999 and Zanoni *et al.,* 1999).

Effect on lycopene: The data for lycopene content is given in Table 5 to 6. In the fresh tomatoes the lycopene is present in the form of all-trans isomers, which have lower bioavailability than its cis-configuration. The stability of colorants in dehydrated tomato prod-

ucts during storage is affected by temperature, presence of oxygen, water activity and texture of the product. The lowest lycopene content value 50.71 of untreated samples (6 mm) in LDPE packaging material and 60.24 of untreated samples (4 mm) in aluminum foil packaging under cabinet tray dryer at 65 [0]C after 120 days. All means scores, bearing different superscripts in columns differ significantly ($p \leq 0.05$). (Sharma and Maguer, 1996) revealed that in the event that freeze drying and oven drying (at 25-75 [0]C) were applied for tomato pulp solids, a loss in lycopene content was not significantly caused by the increase in temperature. However, freeze drying is generally seen as a very expensive preservation method; for example, freeze drying costs are 4 to 8 times higher than those of air drying (Ratti, 2001).

Table 3. Change in pH of the samples of dehydrated tomato powder at cabinet tray dryer and store in LDPE pouches

Storage Periods	LDPE packaging Cabinet tray dryer								
	Untreated			Treated (KMS)			Treated (Sodium Benzoate)		
	4mm	6mm	8mm	4mm	6mm	8mm	4mm	6mm	8mm
0	4.21	4.20	4.21	4.10	4.02	4.04	4.05	4.08	4.01
30	3.81	3.77	3.71	3.65	3.82	3.85	3.80	3.79	3.81
60	3.42	3.40	3.33	3.23	3.57	3.52	3.57	3.47	3.52
90	2.94	2.92	2.81	2.99	3.00	2.99	3.00	3.08	3.11
120	2.31	2.39	2.52	2.74	2.77	2.55	2.82	2.75	2.90

ANOVA for the effect of pH during storage

Source	D.F.	S.S	M.S.	F-Cal	Significance	CD	SE(d)	SE (m)	CV
Replications	04	0.14				0.248	0.121	0.086	5.651
Treatment	08	11.80	1.47	40.19	0.000000				
Error	32	1.17	0.04						
Total	44	13.12							

Table 4. Change in pH of the samples of dehydrated tomato powder at cabinet tray dryer and store in aluminum foil pouches

Storage Periods	Aluminium foil packaging Cabinet tray dryer								
	Untreated			Treated (KMS)			Treated (Sodium Benzoate)		
	4mm	6mm	8mm	4mm	6mm	8mm	4mm	6mm	8mm
0	4.21	4.20	4.21	4.10	4.02	4.04	4.05	4.08	4.01
30	3.82	3.72	3.69	3.67	3.80	3.81	3.83	3.81	3.79
60	3.44	3.45	3.37	3.32	3.72	3.58	3.54	3.50	3.57
90	3.04	2.88	2.87	2.82	3.00	2.94	3.10	3.07	3.17
120	2.40	2.44	2.55	2.79	2.77	2.74	2.87	2.89	2.84

ANOVA for the effect of pH during storage

Source	D.F.	S.S	M.S.	F-Cal	Significance	CD	SE(d)	SE(m)	CV
Replications	04	0.10				0.249	0.122	0.086	5.641
Treatment	08	11.02	1.38	37.19	0.000000				
Error	32	1.19	0.04						
Total	44	12.30							

Table 5. Change in Lycopene (mg/100gm) of the samples of dehydrated tomato powder at cabinet tray dryer and store in LDPE pouches

Storage Periods	LDPE packaging Cabinet tray dryer								
	Untreated			Treated (KMS)			Treated (Sodium Benzoate)		
	4mm	6mm	8mm	4mm	6mm	8mm	4mm	6mm	8mm
0	86.62	87.70	85.05	87.71	88.28	89.91	87.23	89.19	88.00
30	80.21	81.44	83.24	82.88	84.47	83.67	80.55	85.76	81.49
60	72.84	73.01	74.91	75.81	77.55	78.87	75.11	77.65	73.54
90	65.44	66.59	68.59	69.26	68.46	71.87	68.77	69.11	68.95
120	52.24	50.71	51.00	53.65	61.49	64.48	62.29	59.55	60.22

ANOVA for the effect of lycopene (mg/100g) during storage

Source	D.F.	S.S	M.S.	F-Cal	Significance	CD	SE(d)	SE(m)	CV
Replications	04	109.98				4.941	2.415	1.707	5.136
Treatment	08	4924.13	615.52	42.22	0.000000				
Error	32	466.48	14.58						
Total	44	5500.59							

Table 6. Change in Lycopene (mg/100gm) of the samples of dehydrated tomato powder at cabinet tray dryer and store in aluminum foil pouches

	Aluminium foil packaging								
	Cabinet tray dryer								
Storage Periods	**Untreated**			**Treated (KMS)**			**Treated (Sodium Benzoate)**		
	4mm	**6mm**	**8mm**	**4mm**	**6mm**	**8mm**	**4mm**	**6mm**	**8mm**
0	86.62	87.70	85.05	87.71	88.28	89.91	87.23	89.19	90.00
30	83.21	82.41	82.14	85.18	86.97	87.47	86.75	85.66	87.19
60	77.74	80.11	78.81	78.89	79.22	80.47	78.31	80.15	85.74
90	73.47	78.39	74.51	73.86	72.44	77.17	72.77	75.71	80.15
120	60.24	62.71	65.04	67.75	68.47	70.88	69.25	71.55	73.99

ANOVA for the effect of lycopene (mg/100g) during storage

Source	D.F.	S.S	M.S.	F-Cal	Significance	CD	SE(d)	SE(m)	CV
Replications	04	27.05				5.040	2.463	1.742	4.914
Treatment	08	2131.17	266.40	17.56	0.000000				
Error	32	485.36	15.17						
Total	44	2643.58							

Table7. Change in ascorbic acid (mg/100g) of the samples of dehydrated tomato powder at cabinet tray dryer and store in LDPE pouches

	LDPE packaging								
	Cabinet tray dryer								
Storage Periods	**Untreated**			**Treated (KMS)**			**Treated (Sodium Benzoate)**		
	4mm	**6mm**	**8mm**	**4mm**	**6mm**	**8mm**	**4mm**	**6mm**	**8mm**
0	35.12	34.00	35.10	34.12	34.14	34.13	35.00	35.10	35.15
30	27.44	30.87	31.11	29.56	30.02	30.33	31.25	30.54	29.90
60	21.49	24.51	26.66	23.38	25.25	26.69	26.00	27.54	25.52
90	16.47	19.01	19.46	18.71	17.62	18.54	19.87	17.36	18.59
120	08.54	09.01	10.25	13.00	14.54	14.01	15.09	14.99	14.00

ANOVA for the effect of ascorbic acid (mg/100g) during storage

Source	D.F.	S.S	M.S.	F-Cal	Significance	CD	SE(d)	SE(m)	CV
Replications	04	63.86				3.445	1.684	1.191	11.001
Treatment	08	2634.16	329.27	46.46	0.000000				
Error	32	226.81	7.09						
Total	44	2924.83							

Effect on ascorbic acid: The data for ascorbic acid (Vitamin- C) is given in Table 7 to 8, which shows that for all experiments. The lowest vitamin C value 8.54 of untreated samples (4mm) in LDPE packaging and 9.50 of untreated samples (6 mm) in aluminum foil packaging under cabinet tray dryer after 120 days. The vitamin-C basically include in the dehydrated tomato powder but vitamin-C decrease in drying process because in cabinet tray dryer directly hot air to tomato slices and second main region of ascorbic acid degradation, during storage periods might be due to oxidation or irreversible conversion of L-ascorbic acid in to dehydration process ascorbic acid in the presence of enzyme ascorbic acid oxidase (ascorbinase) caused by trapped or residual oxygen in the storage conditions. All means scores, bearing different superscripts in col-

umns differ significantly ($p \leq 0.05$). The observed that the ascorbic acid was very sensitive to oxidative heat damages as the reduction was significant in cabinet tray dryer, green house type solar dryer, foam mat drying and freeze drying methods. This is confirmed with the result reported by (Giovanelli *et al.,* 2002) that the reduction in ascorbic acid content was mainly due to the temperature, exposure to direct heat on tomato slices by cabinet tray dryer and directly sun light effect on the samples of tomato slices in absence of air.

Effect on microbial growth: The microbial load of the tomato powder during storage of 120 days are shown in Table 9 to 10 it were analyzed to see the effect of microbial growth of the samples of different tomato slices thickness (4mm, 6mm and 8mm) powder packed and storage at room temperature. We can see

Table 8. Change in ascorbic acid (mg/100g) of the samples of dehydrated tomato powder at cabinet tray dryer and store in aluminum foil pouches

Storage Periods	Aluminium foil packaging								
	Cabinet tray dryer								
	Untreated			Treated (KMS)			Treated (Sodium Benzoate)		
	4mm	6mm	8mm	4mm	6mm	8mm	4mm	6mm	8mm
0	35.12	34.00	35.10	34.12	34.14	34.13	35.00	35.10	35.15
30	27.40	31.89	31.87	29.00	30.02	29.39	31.89	28.54	30.90
60	22.99	23.01	27.68	25.19	24.22	27.99	26.86	25.55	26.20
90	16.40	18.11	19.00	17.70	18.52	17.00	17.02	18.96	18.50
120	09.55	09.50	10.75	13.55	15.54	14.58	15.72	13.00	14.45

ANOVA for the effect of ascorbic acid (mg/100g) during storage

Source	D.F.	S.S	M.S.	F-Cal	Significance	CD	SE(d)	SE(m)	CV
Replications	04	73.33				3.318	1.621	1.47	10.581
Treatment	08	2627.54	328.44	49.97	0.000000				
Error	32	210.32	6.57						
Total	44	2911.19							

Table 9. Change in microbial growth (cfu/ml) of the samples of dehydrated tomato powder at cabinet tray dryer and store in LDPE pouches

Storage Periods	LDPE packaging								
	Cabinet tray dryer								
	Untreated			Treated (KMS)			Treated (Sodium Benzoate)		
	4mm	6mm	8mm	4mm	6mm	8mm	4mm	6mm	8mm
0	ND	ND	ND	ND	ND	ND	ND	ND	ND
30	ND	ND	ND	ND	ND	ND	ND	ND	ND
60	2.26×10^2	2.38×10^2	2.50×10^2	1.78×10^2	1.82×10^2	1.85×10^2	1.80×10^2	1.82×10^2	1.90×10^2
90	3.55×10^2	3.68×10^2	3.72×10^2	2.12×10^2	2.35×10^2	2.30×10^2	2.29×10^2	2.66×10^2	2.70×10^2
120	4.00×10^2	4.55×10^2	4.50×10^2	3.45×10^2	3.39×10^2	3.30×10^2	3.49×10^2	3.67×10^2	3.65×10^2

ANOVA for the effect of microbial growth (cfu/ml) during storage

Source	D.F.	S.S	M.S.	F-Cal	Significance	CD	SE(d)	SE(m)	CV
Replications	02	0.20				0.196	0.092	0.065	3.922
Treatment	08	19.46	2.43	192.04	0.000000				
Error	16	0.20	0.01						
Total	26	19.86							

Table 10. Change in microbial growth (cfu/ml) of the samples of dehydrated tomato powder at cabinet tray dryer and store in aluminum foil pouches

Storage Periods	Aluminium foil packaging								
	Cabinet tray dryer								
	Untreated			Treated (KMS)			Treated (Sodium Benzoate)		
	4mm	6mm	8mm	4mm	6mm	8mm	4mm	6mm	8mm
0	ND	ND	ND	ND	ND	ND	ND	ND	ND
30	ND	ND	ND	ND	ND	ND	ND	ND	ND
60	2.36×10^2	2.40×10^2	2.52×10^2	1.88×10^2	1.98×10^2	1.80×10^2	1.80×10^2	1.86×10^2	1.91×10^2
90	3.70×10^2	3.60×10^2	3.66×10^2	2.42×10^2	2.59×10^2	2.52×10^2	2.49×10^2	2.57×10^2	2.76×10^2
120	4.12×10^2	4.35×10^2	4.49×10^2	3.59×10^2	3.72×10^2	3.80×10^2	3.69×10^2	3.71×10^2	3.79×10^2

ANOVA for the effect of microbial growth (cfu/ml) during storage

Source	D.F.	S.S	M.S.	F-Cal	Significance	CD	SE(d)	SE(m)	CV
Replications	02	0.08				0.145	0.068	0.048	2.808
Treatment	08	19.37	2.42	349.17	0.000000				
Error	16	0.11	0.01						
Total	26	19.56							

that microbial growth not detect in the starting 30 days but after one month we can easily see microbial growth. When considering growth rates of microbial pathogens, in addition to temperature, time is a critical consideration. Food producers or manufacturers address the concept of time as it relates to microbial growth when a product's shelf life is determined. Shelf life is the time period from when the product is produced until the time it is intended to be consumed or used. Several factors are used to determine a product's shelf life, ranging from organoleptic qualities to microbiological safety. The highest microbial growth 4.55×10^2 of untreated samples (6mm) in LDPE packaging and 4.49×10^2 of untreated samples (8 mm) in aluminum foil packaging under cabinet tray dryer after 120 days. All microorganisms have a defined temperature range in which they grow, with a minimum, maximum, and optimum. An understanding of the interplay between time, temperature, and other intrinsic and extrinsic factors is crucial to selecting the proper storage conditions for a food product. Temperature has dramatic impact on both the generation time of an organism and its lag period. Over a defined temperature range, the growth rate of an organism is classically defined as an Arrhenius relationship (Mossel *et al.,* 1995).

Conclusion

Storage studies carried out for periods of 4 months showed highly effectiveness of treatments during storage. While control samples were slightly dark brown color with degradation and loss of lycopene was observed in storage tomato powder at room temperature conditions. The main causes of tomato lycopene degradation during heat processing and storage are isomerisation and oxidation. All microorganisms have a defined temperature range in which they grow, with a minimum, maximum, and optimum. Over a defined temperature range, the growth rate of an organism is classically defined as an Arrhenius relationship. The main region of ascorbic acid degradation, during storage periods might be due to oxidation or irreversible conversion of L-ascorbic acid in to dehydration process ascorbic acid in the presence of enzyme ascorbic acid oxidase (ascorbinase) caused by trapped or residual oxygen in the storage conditions but cabinet dryer sample better under aluminum foil package and same conditions foam mat drying samples are not good because egg albumen effect on the quality and vitamin-C but freeze drying samples are than compare to other samples. The later increase in pH and decrease in acidity is probably due to the effect of organisms responsible for the spoilage, some of which can release basic substances into the samples. The higher acidity content

prevents the growth of spoilage causing microorganisms by lowering the protein food or by the action on carbohydrate to from lactic acid. The aluminum foil was found to be a good packaging material to maintain the quality and tomato powder was safe for consumption up to 4 months at room temperature conditions, LDPE package was not good because these packages absorb of moisture fast than compare to aluminum foil package.

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