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Evaluation of quality attributes of dehydrated mint leaves under different packaging materials

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Abstract
Mint leaves are very popular in Mediterranean regions and represent a dominant part of the vegetation and they are mainly found only in summer. Drying is one of the traditional methods of preservation, which converts the vegetables into light weight, easily transportable and storable product. Advantage of this method is that the vegetable can be used throughout the year as it can be easily converted into fresh like form by rehydrating it. Blanching of Mint was done and it was checked by catalase test. Mint leaves (*Mentha spicata* L.) are a common name for members of the Labiatae Family. It is very difficult to preserve for other weather because they become spoil and its colour and flavour decreases. We want that Mint leaves are stored for whole year so dehydration were done. Dehydrated mint sample are packed in different packaging material such as LDPE, HDPE and Aluminum foil. Drying was completed under four different temperature, 40ºC, 50ºC, 60ºC and Sundry. In Aluminum foil Moisture content and Ash content show best result under Sundry condition. The amount of β-carotene show best result in Aluminum foil under 40ºC temperature and lower in Sundry condition. Chlorophyll a, Chlorophyll b and Total Chlorophyll were found best in Aluminum foil packaging bag under Sundry condition. For Mint sample Aluminum foil packaging material are the best packaging material for long time preservation. 40ºC and Sundry condition are the best for the drying of Mint because at this temperature the colour, flavor and nutritional quality of mint was maintained.

Keywords: mint, dehydration, β-carotene, chlorophyll

1. Introduction

Green leafy vegetables (GLVs) are highly perishable but can be preserved by various methods including dehydration which is eco-friendly and easily adoptable. An investigation was undertaken to study the dehydration of mint and its effect on quality. Dehydration is simple and economical method of preservation. Dehydration makes the green leafy vegetables light in weight, easily transportable and storable product. Dehydrated vegetables can be easily converted into fresh like form by rehydration and can be used throughout the year**.** Quality characteristics of dehydrated curry leaves and drumstick leaves were influenced by packaging materials and storage temperature (Singh and Sagar, 2010) [36]. During the drying process there is lot of losses takes place like nutritional, physical and chemical composition of leaves. When fenugreek leaves were dried by using solar, infra-red and tray drier there was a loss of color pigments (Satwase *et al.* 2011) [25]. Fenugreek leaves pretreated with 0.1% Sodium bicarbonate gave better results in chlorophyll-a, chlorophyll-b and carotene retention. So, to minimize drying losses various pretreatments are used. Probably drying was the first continually food preserving method used by mankind even before cooking. It involves removal of moisture from vegetables to preserve it for longer time.

Blanching which is an important pre-processing heat treatment of vegetable for freezing, canning or dehydration inevitably causes separation and loss of water soluble nutrients such as minerals, water soluble vitamins. Blanching (scalding vegetables in boiling water or steam for a short time to inactivate the enzymes) is a must for almost all vegetables to be frozen. It inactivate the enzyme actions which can cause loss of flavor, color and texture. In blanching process removal the surface of dirt and organisms, brightens the color and helps retard loss of vitamins. It also effective for softens vegetables and makes them easier to pack. Leafy vegetables are important in the diet as they provide variety and are a good source of ascorbic acid, carotene and fibre. vegetables in particular dehydration processes affect, the, the quality attributes of colour, texture, and nutrient retention. Such variations in nutrient retention and other quality attributes may be due to the type of vegetables, differences in the stage of maturity, harvesting method, cultural practices, type of pretreatment and the drying method. Washing, trimming and blanching have been reported to affect the yield and nutrient retention of the vegetables as well as the subsequent processing method such as drying or freezing. Although there is consensus that blanching prior to drying or freezing (especially) improves nutrient retention and sensory attributes of mint leaves.

Sun drying is the traditional method of drying which involves simply exposing the vegetables in the solar radiation on mats or roofs. This conventional method have a number of disadvantages since the agriculture produce are laid in open sun and there is danger of spoilage due to adverse climatic conditions like rain, wind, moist, dust, loss of produce due to birds, insects, and rodents. In addition to this drying rate is lower and quality of dried material is not proper**.** The most common drying method used for preserving vegetables is sun drying. Despite the facility to be used, sun drying method has been known to reduce some nutrients and this affects the nutritional value of leafy vegetables. Thus, the objective of this research was to evaluate the effect of postharvest preservation method such as sun drying on the nutritive quality and antioxidant properties of leafy vegetables.

2. Materials and Methods
2.1 Material
2.1.1 Raw Materials
Fresh and mature mint leaf were selected and procured from local market of Allahabad for daily experiment Other Materials: Muslin cloth

2.1.2 Glassware required
Beaker**,** Flask Petriplates, Crucible.

2.1.3 Chemicals
Potassium metabisulphite (KMS), Acetone, Hydrogen Peroxide and distilled water

2.1.4 Equipment requirement
Tray dryer**,** Blancher machine**,** Hot air oven**,** Spectrophotometer, pH meter, Sealing machine

2.1.5 Other requirements
High density polyethylene (HDPE), Knife, Funnel, Glass tube, Wooden trays, Muslin cloth

2.1.6 Experimental setup
Electronic weighing balance, Desiccators, Spectrophotometer, Centrifuge, Thermometer Muffle furnace, Dehydrator, pH meter, sealing machine were used in course of experiment.

2.2 Methods
2.2.1 Preparation of product

Fresh mint leaves taken

↓

Blanching (90ºC±2ºC for 60 sec.)

↓

Drying of the leaves (40ºC, 50º, 60º and Sun Dry)

↓

Packaging and storage (using Aluminum foil, LDPE.HDPE)

↓

Chlorophyll determination

↓

Nutritional testing

↓

Collection of data

↓

Statistical analysis

Fig 3.1: Flow chart for preparation of mint leaf powder

2.2.2 Physico-Chemical analysis of dehydrated Mint leaves
2.2.2.1 Moisture content (%)
Moisture was determined according to the hot air oven method described by AOAC 2000.

Apparatus required: Hot air oven, lab grinder, Aluminum dishes, balance and desiccator.

Procedure: 5g of sample was weighed in Petri dish and was kept in the hot air oven at 60ºC till constant weight achieved. Moisture divided by initial weight taken gave the moisture content of the mint sample. Moisture content will be determined using the following equation:

$$\text{Moisture Content (\%)} = \frac{W_1 - W_2}{W_1 - W} \times 100$$

Where

W = weight of empty petriplates, g

W_1 = weight of petri plate + shreds before drying, g

W_2 = weight of petri plate + shreds after drying, g

2.2.2.2 Total Ash Content (%)
The ash was estimated according to the method described by AOAC 1995.

Apparatus Required: Muffle furnace, desiccators, weighing balance, crucibles.

Procedure: Ten grams of sample was weighed in a tarred pre-weighed silica dish and was first charred on a burner and then placed in a muffle furnace maintained at 550 - 600°C until light grey ash results and was cooled in the desiccator and weighed. Amount of the ash, expressed as percentage is calculated by the following formula:

$$\text{Ash Content} = \frac{W_2 - W \times 100}{W_1 - W} \quad \ldots\ldots\ldots\ldots\ldots \quad (3.2)$$

Where

W = weight of crucible, g,

W_1 = weight of crucible + mint shreds before drying, g

W_2 = weight of crucible + mint shreds after drying, g

2.2.3 Determination of Beta Carotene Content (µg/100g) process from Spectrophotometer
Reagents: Acetone, anhydrous sodium sulphate, petroleum ether

Procedure: 5g of fresh sample was taken and crushed in 10-15 ml acetone, adding few crystals of anhydrous sodium sulphate, with the help of pestle and mortar. The supernatant was decanted into the beaker. The process was reported twice and transferred the combined supernatant to a separator funnel, adding 10-15 ml petroleum ether and mix thoroughly. Two layers were separated and the lower layer was discarded and upper layer was collected in a 100 ml with petroleum ether and optical density was recorded using petroleum ether as blank.

Calculation

$$\beta\text{- Carotene (u/g)} = \frac{\text{O.D} \times 13.9 \times 104 \times 100}{\text{Wt. of sample} \times 560 \times 1000} \quad \ldots\ldots \quad (3.3)$$

2.2.4 Chlorophyll Determination
Estimation of chlorophyll in fresh and dehydrated mint leaves was carried out according to the procedure of (Rangana, 2010). The sample (0.5-1.0 gm) was macerated with acetone in a pestle and mortar. The supernatant layer was decanted and the extraction was repeated until the residue was colorless. The extracts were then pooled, filtered and made up to 100 ml in a volumetric flask. About 25-50 ml aliquot of the acetone extract was taken into

separating funnel and mixed with 50 ml diethyl ether and water was added until the water layer was free of all the fat-soluble pigment. The water layer was drained off and the ether layer washed with 25 ml portions of distilled water until the layer was free of acetone. The ether layer was taken into a 50 ml volumetric flask 3-4 gm of anhydrous sodium sulphate was added to remove the moisture. The absorbance was taken at wavelengths of 662 nm and 645 nm. The parameters are given in Table 3.3

Table 3.3: Parameters with equations

Parameter, units	Equations*
Chlorophyll a, mg/ml	Ccha = 12.25 A662-279 A645
Chlorophyll b, mg/ml	Cchb = 21.5 A645-5.1 A662
Total Chlorophyll, mg/ml	Ccht = Ccha + Cchb

In column equation following abbreviations are used: Ccha - concentration of chlorophyll a in extract; Cchb - concentration of chlorophyll b in extract; Ccht - concentration of total chlorophyll in extract; A662 - absorbance of the extract at wavelength 662nm; A645 - absorbance of extract at 645nm.

2.2.5 Statistical Analysis

The experiment was conducted by adopting completely randomized design the data recorded during the course of investigation were statistically analyzed by the 'Analysis of variance- Three way classification 'ANOVA'(Fisher 2000) [4]

3. Results and discussion.

3.1 Preparation of sample

The sample were blanched and dried at 40ºC, 50ºC, 60ºC and sundry. The dried sample were packed into different packaging material (LDPE, HDPE, Aluminum foil). The packaging material were sealed by the sealing machine and the packed sample are put at the room temperature and they tested after 10 days, 20 days, 30 days, and 40 days. The changes in moisture content, ash content, β- carotene, chlorophyll (chl a, chl b, total chl.) of the dried mint leaves during storage period.

3.2 Physico-Chemical analysis of fresh Mint

On the basis of physical-chemical analysis of mint, we determined the Moisture content, Ash content, β- carotene and chlorophyll (Chl.a, Chl.b, Total chl.) of fresh mint.

Table 4.1: Quality analysis of fresh Mint leaves.

Quality analysis	Reading
Moisture content	79.6%
Ash content	3.78%
β-carotene	6.92 mg/100gm
Chlorophyll a	0.614 mg/gm
Chlorophyll b	0.182 mg/gm
Total Chl.	0.796 mg/gm

Fresh samples of the green Mint leaves were then analysed with regard to their Qualitative analysis as Moisture content (79.6%), Ash content (3.78%), β-carotene (6.92 mg/100gm), Chl.a (0.614 mg/gm), Chl.b (0.182 mg/gm) and Total Chl. (0.796 mg/gm). The result of quality analysis of fresh Mint show the standard result and after blanching, drying, packaging and storage the quality of dried Mint decrease but Mint powder are stored for a long time.

3.3 Physico-Chemical analysis of dried Mint

The dried green Mint leaves samples were ground to fine powder by using a mixer grinder and sieved through a 100 mesh size sieve and packed separately in 300 gauge low density polyethylene, high density polyethylene and aluminum foil and kept at ambient conditions, for a period of 10 days, 20 days, 30 days and 40 days. The changes in Moisture content, Ash content, β-carotene, Chl. a, Chl. b and Total Chl. of the dried Mint leaves and the result are show.

3.3.1 Determination of Moisture Content

The effect of different temperatures and storage period on percent moisture content at 10 days interval during storage is shown in fig.4.2. On evaluation of result it was found that there was an increase in moisture content in the samples. The moisture content varied from sample to sample. It was found that as the temperature were increasing, moisture content was also increasing as shown in the table. It might be noted that the moisture content of product on storage is an important determinant of their keeping quality. There is some amount of water ingress in samples especially during storage and it increases as the duration of storage increases. The present study was conducted to determine the Moisture content of Mint at different temperature 40ºC, 50ºC, 60ºC and Sun dry under different packaging material such as LDPE, HDPE and aluminum foil. The data of Moisture content was received at different interval of time (10 days, 20 days, 30 days and 40 days). The Moisture content of Mint in different packaging material like LDPE, HDPE and Aluminum foil was found increasing. In LDPE packaging material the variation in moisture content was found 6.51 % at zero day and 7.78 % at 40 days in Sun dry condition. In HDPE packaging material, the variation in Moisture content was found 6.51 % at zero day and 7.64 % at 40 days in Sun dry condition. In Aluminum foil the variation in moisture content was found 6.51 % at zero days and 7.61 % at 40 days in sun dry condition. At 60ºC moisture content was found 6.51 % in LDPE packaging material at zero days and 7.94 % at 40 days. At 60ºC moisture content found 6.51 % in HDPE packaging material at zero days and 7.91 % moisture content found at 40 days. In Aluminum foil 6.51 % moisture content found at zero days at 60ºC temperature and 7.91 % moisture content found at 40 day. The data so obtained analysed by using three way ANOVA and found significant at 5% level.

Table 4.2: Variation of moisture content under different packaging material with respect to time and temperature.

Temperature	Packaging materials	No. of days				
		0	10	20	30	40
40ºC	LDPE	6.51	6.61	6.79	7.52	7.79
	HPDE	6.51	6.59	6.72	7.47	7.68
	Aluminum	6.51	6.55	6.68	7.41	7.62
50ºC	LDPE	6.51	6.64	6.82	7.72	7.88
	HPDE	6.51	6.6	6.78	7.69	7.78

	Aluminum	6.51	6.56	6.73	7.63	7.72
60ºC	LDPE	6.51	6.69	6.8	7.74	7.94
	HPDE	6.51	6.63	6.79	7.7	7.91
	Aluminum	6.51	6.59	6.73	7.61	7.91
SUN DRY	LDPE	6.51	6.6	6.72	7.52	7.78
	HPDE	6.51	6.59	6.69	7.49	7.64
	Aluminum	6.51	6.54	6.63	7.42	7.61
		Result	S. Ed. (±)	C.D. at 5%		
Due to days		S	0.01	0.02		
Due to Temp		NS	0.05	0.03		
Due to Packing		S	0.01	0.02		

Due to day's: F_{cal} (1474.877)>F_{tab} (2.55); (S) at 5% level.
Due to temp: F_{cal} (2.78) <F_{tab} (7.743); (NS) at 5% level.
Due to packaging material: F_{cal} (26.9818) > F_{tab} (3.17); (S) at % level.

3.3.2 Determination of Ash Content (%)

The effect of different temperatures and storage periods on ash content of samples at different interval during storage is shown in table 4.3. This study was conducted to determine the Ash content of Mint at different temperature 40ºC, 50ºC, 60ºC and Sun dry under different packaging material such as LDPE, HDPE and aluminum foil. The data of Ash content was received at different interval of time (10 days, 20 days, 30 days and 40 days). The Ash content of Mint in different packaging material like LDPE, HDPE and Aluminum, these value are decreases. In LDPE packaging material, the variation in Ash content was found 3.16 % in Sun dry condition at 10 days and 2.80 % at 40 days. In HDPE packaging material, the variation in Ash content was found 3.24 % at 10 days and 2.94 % at 40 days in sun dry condition. In Aluminum foil, the variation in Ash content was found 3.27 % at 10 days and 2.96 % at 40 days in sun dry condition. At 60ºC Ash content was found 3.11 %, 3.16 % and 3.20 % in LDPE, HDPE and Aluminum foil at 10 days. At 40 days the Ash content was found 2.87 %, 2.91 % and 2.90 % in LDPE, HDPE and Aluminum foil at 60ºC. The data so obtained were analysed by using three way ANOVA and found significant at 5% level

Table 4.3: Determination of Ash content of dehydrated Mint sample at different interval of time under different packaging material

Temperature	Packaging materials	No. of days			
		10	**20**	**30**	**40**
40ºC	LDPE	3.16	3.11	3.06	2.8
	HPDE	3.22	3.2	3.11	2.93
	Aluminum	3.27	3.21	3.13	2.96
50ºC	LDPE	3.12	3.01	3.02	2.87
	HPDE	3.18	3.14	3.1	2.9
	Aluminum	3.2	3.17	3.11	2.9
60ºC	LDPE	3.11	3.01	3.02	2.87
	HPDE	3.16	3.12	3.1	2.91
	Aluminum	3.2	3.17	3.1	2.9
SUN DRY	LDPE	3.16	3.12	3.06	2.8
	HPDE	3.24	3.2	3.11	2.94
	Aluminum	3.27	3.2	3.13	2.96
		Result	S. Ed. (±)	C.D. at 5%	
Due to days		S	0.00	0.01	
Due to Temp		S	0.01	0.02	
Due to Packing		S	0.00	0.01	

Due to day's: F_{cal} (335.39) > F_{tab} (2.83); (S) at 5 % level
Due to temperature: F_{cal} (48.801) > F_{tab} (2.83); (S) at 5% level
Due to packaging material: F_{cal} (16.2335) > F_{tab} (3.23); (S) at 5% level

3.3.3 Determination of Beta carotene (mg/100gm)

The Beta carotene of dried Mint powder was assessed by crushing 5 gm of the product in 80:20 ratio of acetone. The amount of beta carotene is presented in fig. 4.4. The present study was conducted to determine the Beta carotene of Mint at different temperature 40ºC, 50ºC, 60ºC and Sun dry under different packaging material such as LDPE, HDPE and aluminum foil. The data of Beta carotene was received at different interval of time (10 days, 20 days, 30 days and 40 days). The Beta carotene of Mint in different packaging material like LDPE, HDPE and Aluminum foil was found decreases. At 40ºC the amount of β-carotene is 5.74 mg/100gm, 5.80 mg/100gm and 5.84 mg/100gm in LDPE, HDPE and Aluminum foil at 10 days and 5.30 mg/100gm, 5.42 mg/100gm and 5.47 mg/100gm in LDPE, HDPE and Aluminum foil at 40 days.
The data so obtained analysed by using three way ANOVA and found significant at 5% level.

Table 4.4: Determination of β- carotene of dehydrated Mint sample at different interval of time under different packaging materials.

Temperature	Packaging materials	No. of days			
		10	**20**	**30**	**40**
40ºC	LDPE	5.74	5.42	5.3	5.3
	HPDE	5.8	5.57	5.48	5.42
	Aluminum	5.84	5.6	5.51	5.47
50ºC	LDPE	5.7	5.31	5.1	5.02
	HPDE	5.76	5.4	5.24	5.12
	Aluminum	5.79	5.43	5.28	5.17
60ºC	LDPE	4.16	3.82	3.67	3.4
	HPDE	4.2	4	3.8	3.57
	Aluminum	4.22	4	3.82	3.6
SUN DRY	LDPE	2.62	2.5	2.36	2.17
	HPDE	2.68	2.58	2.45	2.24
	Aluminum	2.73	2.6	2.48	2.27
		Result	S. Ed. (±)	C.D. at 5%	
Due to days		NS	0.027	0.013	
Due to Temp		S	0.031	0.062	
Due to Packing		S	0.013	0.027	

Due to day's: F_{cal} (2.83) < F_{tab} (146.915); (NS) at 5 % level
Due to temperature: F_{cal} (13.007) > F_{tab} (2.83); (S) at 5 % level
Due to packaging material: F_{cal} (8548.45) > F_{tab} (3.23); (S) at 5 % level

3.3.4 Determination of Chlorophyll a (mg/gm)

The effect of different temperatures and storage period in Chlorophyll a on 40°C, 50°C, 60°C and Sun dry at 10 days interval during storage is shown in fig 4.5. On the 10^{th} day of storage, Chlorophyll A value was found to be higher in LDPE, HDPE, Aluminum foil 0.406 mg/gm, 0.459 mg/gm, 0.487 mg/gm at Sun dry condition and 0.284 mg/gm, 0286 mg/gm and 0.301 mg/gm found in LDPE, HDPE and Aluminum foil at 40 days on same temperature. On the 10 day Chlorophyll a value found lower in LDPE, HDPE and Aluminum foil, 0.372 mg/gm, 0.391 mg/gm and 0.40 mg/gm at 60℃ at 60℃ and 0.184 mg/gm, 0.20 mg/gm and 0.201 mg/gm found in LDPE, HDPE and Aluminum foil at 40 days on same temperature. The data so obtained analysed by using three way ANOVA and found significant at 5% level.

Table 4.5: Determination of Chl.a of dehydrated Mint sample at different interval of time under different packaging materials.

Temperature	Packaging materials	No. of days			
		10	20	30	40
40ºC	LDPE	0.389	0.4	0.316	0.201
	HPDE	0.434	0.416	0.337	0.26
	Aluminum	0.468	0.42	0.34	0.3
50ºC	LDPE	0.312	0.291	0.271	0.206
	HPDE	0.376	0.306	0.286	0.222
	Aluminum	0.41	0.32	0.3	0.261
60ºC	LDPE	0.372	0.3	0.28	0.184
	HPDE	0.391	0.321	0.286	0.2
	Aluminum	0.4	0.371	0.301	0.201
SUN DRY	LDPE	0.406	0.36	0.307	0.284
	HPDE	0.459	0.382	0.326	0.286
	Aluminum	0.487	0.417	0.361	0.301
		Result	S. Ed. (±)	C.D. at 5%	
Due to days		NS	0.008	0.004	
Due to Temp		S	0.009	0.018	
Due to Packing		S	0.004	0.008	

Due to day's: F_{cal} (2.83) < F_{tab} (155.365); (NS) at 5 % level
Due to temperature: F_{cal} (16.214) > F_{tab} (2.83); (S) at 5 % level
Due to packaging material: F_{cal} (59.7855) > F_{tab} (3.23); (S) at 5 % level

On critical evaluation of the result during storage it was found that the Chlorophyll a content decreased with increase in storage period and temperature as in Fig 4.5. The similar result were obtained by Straumite *et al.* (2015) [33] whose work was on pigment is mint leaves and stems and Rudra *et al.* (2007) [22] whose work was on enthalpy entropy compensation during thermal degradation of chlorophyll in mint and coriander puree.

3.3.5 Determination of Chlorophyll b (mg/gm)

The present study was conducted to determine the Chlorophyll b content of Mint at different temperature 40ºC, 50ºC, 60ºC and Sun dry under different packaging material such as LDPE, HDPE and aluminum foil. The data of Chlorophyll b content was received at different interval of time (10 days, 20 days, 30 days and 40 days). The Chlorophyll b content of Mint in different packaging material like LDPE, HDPE and Aluminum foil was found decreasing. On the 10th day of storage, Chlorophyll b value was found to be higher in LDPE, HDPE, Aluminum foil 0.038 mg/gm, 0.062 mg/gm, 0.094 mg/gm at Sun dry condition. During the 40th days of storage the value of Chl. b was lower in LDPE, HDPE, Aluminum foil 0.011 mg/gm, 0.01 mg/gm, 0.015 mg/gm at 60℃. The data so obtained analysed by using three way ANOVA and found significant at 5% level.

Table 4.6: Determination of Chl.b of dehydrated Mint sample at different interval of time under different packaging materials.

Temperature	Packaging materials	No. of days			
		10	20	30	40
40ºC	LDPE	0.014	0.021	0.016	0.02
	HPDE	0.047	0.041	0.02	0.06
	Aluminum	0.081	0.061	0.032	0.018
50ºC	LDPE	0.044	0.02	0.014	0.011
	HPDE	0.06	0.031	0.021	0.012
	Aluminum	0.067	0.042	0.026	0.015
60ºC	LDPE	0.021	0.02	0.09	0.011
	HPDE	0.047	0.026	0.016	0.01
	Aluminum	0.051	0.031	0.02	0.015
SUN DRY	LDPE	0.038	0.041	0.019	0.02
	HPDE	0.062	0.062	0.027	0.06
	Aluminum	0.094	0.071	0.046	0.029
		Result	S. Ed. (±)	C.D. at 5%	
Due to days		S	0.004	0.007	
Due to Temp		NS	0.008	0.016	
Due to Packing		S	0.004	0.007	

Due to day's: F_{cal} (6.213) > F_{tab} (2.83); (S) at 5 % level
Due to temperature: F_{cal} (2.715) < F_{tab} (2.83); (NS) at 5 % level
Due to packaging material: F_{cal} (3.9236) > F_{tab} (3.23); (S) at 5 % level

On critical evaluation of the result during storage it was found that the Chlorophyll b content decreased with increase in storage period and temperature as in Fig 4.6. The variation in the Chl. b may be due to the separately opening of the packaging material. The similar study show by Grzeszczuk and Jadczak (2009) [7] whose work was on estimation of biological value of some species of mint and Kizhedath and Suneetha (2011) [9] whose work was on estimation of chlorophyll content in common household medicinal leaves and their utilization to avail health benefits of chlorophyll.

3.3.6 Determination of total Chlorophyll (mg/gm)

The effect of different temperatures and storage period in Chlorophyll a on 40°C, 50°C, 60°C and Sun dry at 10 days interval during storage is shown in fig 4.5. On the 10th day of storage, Total chl. value was found to be higher in LDPE, HDPE, Aluminum foil 0.444 mg/gm, 0.521 mg/gm and 0.581 mg/gm at Sun dry condition. During the 40th days of storage the value of Total Chl. was found lower in LDPE, HDPE, Aluminum foil 0.195 mg/gm, 0.210 mg/gm, 0.216 mg/gm at 60℃. The data so obtained analysed by using three way ANOVA and found significant at 5% level.

Table 4.7: Determination of total chl. of dehydrated Mint sample at different interval of time under different packaging materials.

Temperature	Packaging materials	No. of days			
		10	20	30	40
40ºC	LDPE	0.403	0.421	0.332	0.221
	HPDE	0.481	0.457	0.366	0.32
	Aluminum	0.549	0.481	0.372	0.318
50ºC	LDPE	0.356	0.311	0.285	0.217

	HPDE	0.436	0.337	0.307	0.234
	Aluminum	0.477	0.362	0.326	0.276
60ºC	LDPE	0.393	0.32	0.37	0.195
	HPDE	0.438	0.347	0.302	0.21
	Aluminum	0.451	0.402	0.321	0.216
SUN DRY	LDPE	0.444	0.401	0.326	0.304
	HPDE	0.521	0.444	0.353	0.346
	Aluminum	0.581	0.488	0.407	0.33
		Result	S. Ed. (±)	C.D. at 5%	
Due to days		S	0.006	0.012	
Due to Temp		S	0.014	0.027	
Due to Packing		S	0.006	0.012	

Due to day's: F_{cal} (101.466) > F_{tab} (2.83); (S) at 5 % level
Due to temperature: F_{cal} (14.300) > F_{tab} (2.83); (S) at 5 % level
Due to packaging material: F_{cal} (41.4167) > F_{tab} (3.23); (S) at 5 % level

3.4 Sensory properties of dehydrated mint leaves

Colour, taste, texture, appearance and overall acceptability, on the basis of sensory evaluation was done. The samples dried at different temperatures were prepared. Sensory evaluation was done on 9-point hedonic scale. The evaluation of dried leaves was done on the basis of color, taste, flavour, appearance, overall acceptability. The value of different parameters was written on average score and shown below in tabular form.

The sensory analysis of the samples at different temperatures were done on 9-point hedonic scale with colour, aroma, flavour, appearance as these are the quality parameters. The sensory evaluation scores obtained for the various treatments i.e., 40°C, 50°C, 60°C and Sun dry were subjected to determine the most acceptable treatment.

Table 4.8: Effect of temperature and ambient storage on overall acceptability of dried mint leaves

Temperature	LDPE (NO. of days)				HDPE (No. of days)				Aluminum (NO. of days)			
	10	20	30	40	10	20	30	40	10	20	30	40
40ºC	8.5	7.9	7.4	7.6	8.5	8.0	7.8	7.8	9.0	8.2	8.0	8.0
50ºC	8.0	7.8	7.6	7.4	8.2	8.0	8.0	7.6	8.6	8.3	8.1	8.0
60ºC	7.6	7.2	7.0	7.0	7.8	7.6	7.2	7.3	8.0	7.6	7.5	7.3
Sun dry	9.0	8.5	8.3	7.9	9.0	8.8	8.4	8.4	9.0	9.0	8.6	8.4

The effect of storage period and different temperatures on Overall Acceptability of dried mint leaves. The overall acceptability is an important attribute for product. There was slight decrease in overall acceptability score during storage of the product due to decrease in all the attributes of sensory criteria. The highest score for overall acceptability was observed for 40°C, Sundry followed by 50°C and 60°C at different temperatures and ambient storage in LDPE, HDPE and Aluminum foil. Overall acceptability depends on the score of colour, flavour, appearance. The highest overall acceptability score was for the samples treated at 40°C and Sundry condition under Aluminum foil packaging bag.

4. Summary and conclusion

Mint leaves are very popular in Mediterranean regions and represent a dominant part of the vegetation. Mint leaves are known for refreshing, antiseptic, antiasthmatic, simulative, diaphoretic, stomachic, and antispasmodic features. Mint leaves are used in both fresh and dried forms in different cuisines. Mint leaves are not available in market over whole year. In the present study the mint leaves were dehydrated at different temperature and stored for a long time and these dehydrated mint samples were packed under different packaging material. Mint leaves were dried at 40ºC, 50ºC, 60ºC and Sun dry and after that they packed into different packaging material and stored for a long time. After 10 days interval, the physico-chemical properties of dehydrated mint were tested and also checked the sensory attributes of the sample

The result are as follows

- 40ºC temperature and aluminum foil was found as best for dehydrated of mint leaves.
- Aluminum foil was found best among different packaging materials.
- Ash content was found best at 40ºC and sun dried.
- Beta carotene was found as best under sun dry condition and aluminum foil packaging material.
- The amount of chlorophyll also observed best in aluminum foil at 40ºC.

On the basis of results, it can be concluded that

- 40ºC dehydrating temperature and aluminum foil were found optimum for sensory attributes of mint.

5. Recommendation

From the present study it can be recommended that-

Mint can be dehydrated at 40ºC in aluminum foil in which nutritional and sensory attributes are maintained up to 40 days of storage.

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