

Studies on drying and dehydration of fenugreek leaves

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SUMMARY : An experiment was carried out to evaluate the drying and dehydration behavior of fenugreek leaves. The fenugreek leaves were dried by cabinet and sun drying using different pre-treatments. Out of these different pre-treatments and drying methods, blanched fenugreek leaves for 2 min. in water containing MgO 0.1 per cent +KMS 0.5 per cent + NaHCO₃ 0.1 per cent solution and dried in cabinet drying was found superior in maintaining minimum moisture and dehydration ratio, while maximum rehydration ratio, chlorophyll and ascorbic acid throughout the storage period as compared to sun drying.

Key Words : Fenugreek leaves, Cabinet drying, Sun drying, Pre-treatments

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Fenugreek is member of Leguminosae family having botanical name *Trigonella foenum graecum* L. It is popular green leafy vegetable in India. Fenugreek is highly seasonal and usually available in plenty at a particular part of the year.

Green leafy vegetables are extensively used in various cooked and processed form. It is gaining importance, mainly because of being good source of vitamins, minerals and dietary.

The art of drying food stuff especially of fruits and vegetable is very old and in modern times it is being done on improved scientific lines. There are various method of preservation of vegetables but dehydration is highly acceptable process for preservation and reduction in weight of raw materials and their product. Dehydration process should be done in such a way that the food value, natural flavour and characteristics cooking quality of the raw material may be retained after dehydration.

Dehydrated vegetables are good source of energy,

minerals and vitamins. Some provide moderate amount of protein to diet and they are concentrated nutrients(Thomas and Calloway, 1961). In the process of drying or dehydration, sufficient moisture is removed and thus the product is ensured against spoilage.

EXPERIMENTAL METHODS

The study was conducted in post harvest technology Laboratory at University Department of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during 2010-2011.

Fresh matured, diseased free fenugreek leaves were washed in clean tap water and destalking was done with the help of sharp stainless steel knife and pieces of 3 to 5 cm length were made. Then subjected to various treatments *viz.*, steeping solution of NaCl (2%), KMS (0.5%), NaHCO₃ (0.1%), MgO(0.1%) and MgO(0.1%)+KMS (0.5%) + NaHCO₃ (0.1%). Blanching was carried out in boiling water for 2 minute(Tandon and Virmani, 1980). Then allowed to dry in cabinet dryer (D₂) for 4 to 4½ hours hrs at 60°C (Bajaj *et al.*, 1993). and in open sun drying (D₁).

Dried fenugreek sample were immediately cooled to room temperature and packed in 200 gauge polyethylene bags, sealed and stored at ambient storage. During the storage observations

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of the dried sample were recorded for its change in chemical properties at every 30 days interval up to 90 days.

The physical and chemical parameters like dehydration ratio, rehydration ratio, moisture, chlorophyll and ascorbic acid of dried fenugreek were determined according to methods of Ranganna (1979)

EXPERIMENTAL FINDINGS AND ANALYSIS

An investigation was carried out to find out suitable drying methods, for drying fenugreek leaves. General physical

Table 1 : Effect of pre-treatments and drying methods on dehydration ratio of fenugreek leaves

Treatments	Dehydration ratio		Mean
	D ₁	D ₂	
T ₁	8.61	7.91	8.26
T ₂	8.15	7.56	7.86
T ₃	8.94	8.37	8.66
T ₄	9.82	8.72	9.27
T ₅	8.89	8.31	8.60
T ₆	9.43	8.50	8.99
T ₇	8.13	7.52	7.83
Mean	8.85	8.12	
	T	D	T x D
'F' test	Sig.	Sig.	Sig.
S.E. (m)±	0.04	0.08	0.12
C.D. (P=0.05)	0.12	0.24	0.36

Sig.=Significant

and chemical properties of dried fenugreek leaves are presented in Table 1 and 2.

The dehydration ratio was found lowest in T₇ (Blanching in water containing MgO 0.1 % + KMS 0.5% + NaHCO₃ 0.1% solution) dried in cabinet drying, while highest in T₄ (Blanching in water containing 0.1% NaHCO₃ solution) dried in sun drying. The similar result reported by Patil *et al.* (1978). The T₁ (control) treatment had registered the maximum moisture but found lowest in T₇ (MgO 0.1%+KMS 0.5% + NaHCO₃ 0.1%). The maximum rehydration ratio, chlorophyll and ascorbic acid recorded in the dehydrated fenugreek leaves treated with MgO 0.1 per cent + KMS 0.5 per cent + NaHCO₃ 0.1 per cent solution and dried in cabinet drier throughout the storage period of 90 days. These result are in good agreement with the result reported by Patil *et al.* (1978), Gupta *et al.* (2008) and Singh *et al.* (1997). where as minimum rehydration ratio was recorded in pre-treatment T₆, Pre-treatments T₂ and T₃ recorded minimum chlorophyll and ascorbic acid, respectively.

The progressive decrease in rehydration ratio and increase in moisture were notified in all the samples dried by cabinet and sun drying method. It might be possibly due to hygroscopic nature of the leaves, which absorbed the atmospheric moisture during storage. The gain of moisture was highest and lowest rehydration ratio observed in sun dried sample as compared to sample dried by cabinet drying. Loss of ascorbic acid and chlorophyll content was primarily due to its oxidation during drying. Sulphur dioxide inhibited the oxidative changes of ascorbic acid and hence, ascorbic acid

Table 2 : Effect of pre-treatments and drying methods on physical and chemical parameters of dried fenugreek leaves

Treatments	Physio-chemical parameters							
	Moisture (%)		Rehydration ratio		Ascorbic acid (mg/100g)		Chlorophyll (mg/100g)	
	1 Day	90 Day	1 Day	90 Day	1Day	90 Day	1Day	90 Day
Pre-treatments								
T ₁	6.12	9.50	9.50	6.12	25.51	21.90	155.15	145.75
T ₂	6.23	9.15	9.15	6.23	24.01	20.61	142.53	134.51
T ₃	5.05	8.45	8.45	5.05	23.75	17.21	148.04	141.03
T ₄	5.01	8.64	8.64	5.01	24.54	20.72	141.15	134.11
T ₅	5.32	8.65	8.65	5.32	26.08	22.63	147.54	140.52
T ₆	4.74	7.31	7.31	4.74	23.02	19.30	150.54	145.03
T ₇	6.63	7.85	7.85	6.63	27.03	24.01	157.03	154.51
'F' test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
S.E. (m)±	0.20	0.41	0.39	0.20	0.35	1.15	0.41	0.33
C.D. (P=0.05)	0.60	1.19	1.14	0.60	1.03	3.37	1.21	0.97
Drying methods								
D ₁	5.38	9.01	8.27	5.28	24.45	19.93	145.78	138.95
D ₂	5.74	8.30	9.04	5.84	25.21	21.81	151.85	145.42
'F' test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
S.E. (m)±	0.11	0.21	0.21	0.11	0.18	0.61	0.22	0.17
C.D. (P=0.05)		0.63	0.61	0.32	0.55	1.80	0.64	0.52

Sig.=Significant

retention was better in combination with KMS treated samples.

Some of antioxidants are reducing agents and essential equipment for higher retention of ascorbic acid and chlorophyll content during drying and subsequent storage and thereby help to extent the keeping quality of dried product. The decreased trend of ascorbic acid and chlorophyll content were found mostly due to its oxidation during the storage period and also ascorbic acid is very sensitive to heat. It might be lost due to application of heat during drying Sivakumar *et al.* (1991).

During storage, the physico-chemical parameters like moisture showed the increasing trend while, rehydration ratio, ascorbic acid and chlorophyll content noticed the decreasing trend with the advancement of storage period and drying methods i.e qualitative product were obtained in cabinet drying as compared to sun drying.

The merits of any product depend upon the consumer acceptability, organoleptic evaluation.

Good quality of dried fenugreek leaves with respect to physico-chemical and organoleptic characters were obtained by treatment combination T₇D₂ (Blanching in water containing MgO 0.1 per cent +KMS 0.5 per cent +NaHCO₃ 0.1 per cent solution+ cabinet drying) stood superior and scored maximum points colour, texture, flavour and overall acceptability. It was found to be best as gave a dark green product of soft texture, good flavour after cooking. The overall acceptability was also good.

Conclusion:

At the end of storage period maximum ascorbic acid, chlorophyll and rehydration ratio were recorded in the fenugreek treated with T₇ pre-treatment (Blanching in water containing MgO 0.1 % +KMS 0.5% +NaHCO₃ 0.1% solution) dried in cabinet drier and minimum in sun drying. Sun drying showed

maximum loss of physical as well as chemical parameters. Regarding sensory scores, the cooked fenugreek leaves prepared from the T₇ pre-treatment dried in cabinet drier secured the maximum score upto 90 days.

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