HortFlora Research Spectrum
Vol. 5, Issue 1; 53-56 (March 2016)
www.hortflorajournal.com
ISSN: 2250-2823

INFLUENCE OF DIFFERENT DRYING METHODS AND PRE-TREATMENTS ON QUALITY PARAMETERS OF DEHYDRATED POLE TYPE FRENCH BEAN

Santosh Chavan*, Abbas Hussain, Shekharagouda Patil and R. V. Beladhadi

Department of Horticulture, College of Agriculture, UAS Raichur - 586 104 Raichur (Karnataka)
**Corresponding Author's E-mail: santoshchavan4852@gmail.com*

ABSTRACT : The experiment was conducted to study the effect of different drying methods and pre-treatments for maximum retention of quality parameters of pole type French bean (*Phaseolus vulgaris* L.). The results revealed that tray dryer was found superior for dehydration of pole type French bean samples pre-treated with 1 per cent KMS without blanching which recorded higher total soluble solids (TSS), low titrable acidity (TA) and marginally low crude protein content compared with other drying methods.

Key words : *French bean, blanching, pre-treatments, drying methods, quality parameters.*

India is the largest producer of vegetables in the world after China, accounting about 10 per cent of the world production. Among vegetables, pole type French bean (*Phaseolus vulgaris* L.) occupies an important place among legumes in the world including India and it belongs to family Leguminoceae where, it is locally called as *Rajma* (Sharma *et al.*, 12) and also known as string bean or snap bean. Pole type French bean is grown for its green tender pods as vegetable and is generally marketed in fresh form. It has high medicinal value as it prevents diabetes, diarrhea, carminative and diuretic. It is also rich in source of carbohydrates (6.97 g), dietary fibre (2.7 g), protein (1.83 g), fat (1.7 g), calcium (37 mg), thiamin (132 mg), and vitamin-C (12.2 mg), along with minerals like iron, magnesium, potassium, vitamin-A and vitamin-B (Angadi *et al.,* 2). Pole type French bean has tremendous export potential, on an average 25,000 tonnes of dry beans are exported annually to the neighbouring African countries mainly Angola, Mozambique, Mauritius and Zimbabwe (Anon., 3).

The important pole type French bean growing states are Maharashtra, Jammu and Kashmir, Himachal Pradesh and Uttar Pradesh, Nilgiri (Tamil Nadu), Palni hills (Kerala) Chikkamagalur (Karnataka) and Darjeeling hills (West Bengal). In Karnataka, it is grown an area of 11986 hectare with production of about 138137 tonnes and the productivity is 11.53 tonnes per hectare (Anon., 4). Pole type French bean is a highly perishable and rapidly deteriorates after harvest. One of the major problems in the pole type French bean production is the high post harvest loss *i.e.,* 5 - 20 per cent in developed country and 20 - 50 per in developing countries. This might be due to lack of organized market facilities such as transportation and temporary storage and the seasonality of the crop (Prasad *et al.,* 10).

Article's History:
Received : 24-02-2016 ***Accepted : 18-03-2016***

Dehydration is the best method of preservation of vegetables because it reduces the cost of storage and transportation due to reduction in weight and volume of the final product. Dehydration of vegetable have the potential with respect to value addition because of relatively inexpensive, quickly cookable and rich in several nutrient which are essential for human health. Beside, dehydrated vegetable have great potential to use throughout the year. However, different drying methods and pre-treatments significantly influence the quality of dehydrated pole type French bean. Therefore, the present investigation was conducted to study the suitable drying methods and pre-treatments for preserving maximum quality traits of pole type French bean.

MATERIALS AND METHODS

The experiment was carried out in Department of Horticulture, UAS, Raichur, to study the effect of drying methods and pre-treatment on quality parameters of pole type French bean (*Phaseolus vulgaris*). Blanching was done by dipping of French bean pods in hot water for 30 seconds at 60 ºC. The whole pods of French bean were pre-treated with KMS solution at different concentrations levels *i.e.,* 1, 1.5 and 2 per cent by dipping in the KMS solution for 15 minutes. There were three main treatments *viz.,* M_1 : Tray dryer (60 ºC) and M_2: Solar dryer and M_3: Sun drying, and eight subtreatments, *viz.,* T_1 : Control : T_2: Only blanching, T_3: KMS 1 % without blanching, T_4: KMS 1.5 % without blanching, T_5 : KMS 2 % without blanching, T_6 : KMS 1 % with blanching, T_7 : KMS 1.5 % with blanching and T_8: KMS 2 % with blanching.

The data collected from the experiment were analyzed statistically by factorial complete randomized design as per procedure given by Panse and Sukhatme (8).

RESULTS AND DISCUSSION

Total soluble solids (TSS)

Total soluble solids of dehydrated pole type French bean was observed higher in pods pre-treated with 1 per cent KMS without blanching in tray dryer (4.63 brix) followed by 1.5 per cent without blanching (3.97 ºbrix). The lowest total soluble solids (2.71 ºbrix) were recorded in sun drying without any pre-treatments (Table 1). Due to leaching losses of soluble substances and high temperature and also increased TSS due to changes in carbohydrate biosynthetic enzymes activity and increased transpiration. However, use of chemical pre-treatments improved the amount of total sugars of dried bean. This might be due to the fact that blanching and additives like KMS might have checked the non-enzymatic browning during drying as observed by Take *et al.* (13) in red bell peppers. These observations are in line with that reported by Ajaykumar *et al.* (1) in green chilli powder and Rathod (11) in onion.

Titratable acidity

The titratable acidity of dehydrated pole type French bean were recorded lowest in pods pre-treated with 1 per cent potassium metabisulphite without blanching in the tray drying (0.030 %) followed by 1.5 per cent without blanching (0.038 %). The acidity in dehydrated pole type French bean without any pre-treatment under sun drying was highest (0.052 %) (Table 2). The decline in acidity might be attributed to hydrolysis of polysaccharides and non-reducing sugars, where acid is utilized for converting them to hexose sugars. The sun dried sample was higher in titratable acidity values than the tray and solar dried

Table 1 : Effect of different drying methods and pre-treatments on total soluble solids (°Brix) of dehydrated pole type French bean.

Main treatments	Sub-treatments								
	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	Mean
Tray dryer (M_1)	2.83	3.10	4.63	3.97	3.77	3.37	3.29	3.27	**3.53**
Solar dryer (M_2)	2.77	3.30	4.23	3.73	3.33	3.07	3.47	3.60	**3.44**
Sun drying (M_3)	2.71	3.13	3.94	3.57	3.57	3.40	3.17	3.23	**3.34**
Mean	**2.77**	**3.18**	**4.27**	**3.76**	**3.56**	**3.28**	**3.31**	**3.37**	**3.43**
C.D. (P=0.01)	Main treatments 0.076					Sub-treatments 0.123		Interaction 0.214	

**Initial value of total soluble solids (2.5 °brix)*

Treatments: T_1: Control; T_2: Blanching; T_3: 1% KMS without blanching; T_4: 1.5% KMS without blanching; T_5: 2% KMS without blanching; T_6: 1% KMS with blanching; T_7: 1.5% KMS with blanching; T_8: 2% KMS with blanching.

Table 2: Effect of different drying methods and pre-treatments on titrable acidity (%) of dehydrated pole type French bean.

Main treatments	Sub-treatments								
	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	Mean
Tray dryer (M_1)	0.045	0.043	0.030	0.038	0.041	0.043	0.044	0.046	**0.041**
Solar dryer (M_2)	0.047	0.044	0.035	0.036	0.043	0.046	0.045	0.048	**0.043**
Sun dryer (M_3)	0.052	0.048	0.041	0.043	0.045	0.045	0.051	0.045	**0.046**
Mean	**0.048**	**0.045**	**0.035**	**0.039**	**0.043**	**0.045**	**0.047**	**0.046**	**0.044**
C.D. (P=0.01)	Main treatments 0.0011					Sub-treatments 0.0020		Interaction 0.0031	

* Initial value of titratable acidity (0.057 %)

Treatments : T_1: Control; T_2: Blanching; T_3: 1% KMS without blanching; T_4: 1.5% KMS without blanching; T_5: 2% KMS without blanching; T_6: 1% KMS with blanching; T_7: 1.5% KMS with blanching; T_8: 2% KMS with blanching

Table 3: Effect of different drying methods and pre-treatments on crude protein content (%) of dehydrated pole type French bean.

Main treatments	Sub-treatments								
	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	Mean
Tray dryer	9.65	9.96	11.34	10.25	9.79	9.39	10.89	11.05	**10.29**
Solar dryer	10.37	10.03	12.98	11.12	11.59	10.45	10.50	11.52	**11.07**
Sun dryer	9.01	9.51	9.87	9.59	9.54	9.14	9.25	9.37	**9.41**
Mean	**9.68**	**9.83**	**11.40**	**10.32**	**10.31**	**9.66**	**10.21**	**10.65**	**10.26**
C.D. (P=0.01)	Main treatments					Sub-treatments		Interaction	
	0.31					0.51		0.88	

**Initial value of protein content (1.5 %)*

Treatments: T_1: Control; T_2: Blanching; T_3: 1% KMS without blanching; T_4: 1.5% KMS without blanching; T_5: 2% KMS without blanching; T_6: 1% KMS with blanching; T_7: 1.5% KMS with blanching; T_8: 2% KMS with blanching

samples because it may be due to variations caused by contamination from microorganisms. Microorganisms, mainly lactic acid bacteria, produce organic acids, which then increases acid content as observed by Toontom *et al.* (14) in dried chilli. Similar finding was also reported by Mangaraj *et al.* (6) in sun dried chilli.

Crude protein

The crude protein content of dehydrated pole type French bean were recorded higher in pods pre-treated with 1 per cent potassium metabisulphite (KMS) without blanching in solar dryer (12.98 %) followed by 1.5 per cent potassium metabisulphite (KMS) without blanching (11.12 %). The untreated control recorded lowest protein content (9.01 %) in sun dried pods (Table 3). Loss of protein in sun drying was due to the denaturation or changes in solubility during drying. Another possible cause is the release of amino acids from the proteins following denaturation, which could react with other compounds such as sugars to produce dark brown coloured polymers (Lee and Shibamoto, 5; Perera, 9). The loss in protein could be attributed to the mild heating effect associated with all the drying conditions which could result in the unzipping of hydrophobic forces leading to a partial distribution of the primary, secondary, tertiary and quartenary structure of the protein molecule (Ngoddy and Ihekoronye 7).

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Citation: Chavan S., Hussain A., Patil S. and Beladhadi R.V. (2016). Influence of different drying methods and pre-treatments on quality parameters of dehydrated pole type French bean. *HortFlora Res. Spectrum,* **5**(1) : 53-56.