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Effect of Solar and Sun Drying on Vitamin A, and Vitamin C Content of Fenugreek Leaves

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ABSTRACT

The use of conventional energy sources for the dehydration of vegetables is not feasible now days since there is scarcity of conventional energy sources. Therefore suitable technology should be adapted for the drying of vegetables. In present research, a cabinet solar dryer has been fabricated. The comparative study of solar dryer and open sun was studied for the drying of fenugreek leaves. The sample of 1kg fenugreek leaves was dried in cabinet solar dryer and open sun. After complete drying, powdered samples were prepared and vitamin A and vitamin C content was determined. The result obtained revealed that, the vitamin A was increased 134 % in cabinet solar dried sample compared to open sun dried sample where as vitamin C shows 12.67 % reduction in cabinet solar dried sample in comparison with open sun.

Keywords: Cabinet solar drying, Open sun drying, Fenugreek, Nutrient.

INTRODUCTION

Dehydration is a straightforward course of removing surplus water from leafy vegetables or fruity vegetables. It is the traditional method of food preservation. Generally many agricultural products contain higher moisture i.e. in the range of 25 % to 85 % [1]. But for long preservation, the value of moisture content is much higher than required one [2].

The higher moisture content resulted into fungal and bacterial growth rapidly. The bacteria and enzymes sometimes spoil the foodstuffs and responsible for the reduction in nutrient content. The reduction of moisture content in the vegetables to a certain level slows down the bacterial, enzymes and yeasts effects [3, 4]. Hence it is very important to reduce the moisture content in the vegetables for its long preservation.

The application of solar drying technologies are very much useful than using fossil fuels and other energy sources. The advantages of solar dryings are, it is pollution free, faster drying nutrients retains properly and reduces the emission of carbon particles in atmosphere [2, 4, 5 and 6]. Solar drying technologies are basically classified as direct solar drying, indirect solar drying and mixed mode solar drying. In present work a low cost direct solar dryer was fabricated and comparative study of fenugreek leaves for vitamin A and vitamin C was carried out.

METHODOLOGY

The sample of 1kg fenugreek leaves sample was collected from the one farm only to ensure the uniformity and to avoid the effect of soil variation on the nutrient content of the sample. The fresh and green fenugreek leaves were selected and discoloured, as well as wilted leaves removed to avoid bad odour and loss of nutrients after dehydration. The fenugreek leaves were cut from the stem in order to make them free of soil and dirt. The leaves were washed with ample of fresh and clean water number of times. After washing, the leaves were air dried at room temperature to eliminate the residual moisture in the sample. Any non leafy part present in the sample was then removed to get a homogenous collection of fenugreek leaves which was then separated in two equi-weighted quanta for open sun drying (OSD) and cabinet solar drying (CSD). The sample weight was recorded before the actual experimental drying was started. Both the drying systems i.e. CSD & OSD have the same surface area of the mesh used to spread the sample [4, 6]. The fenugreek leaves dried by OSD & CSD, were powdered using a grinder and were sifted by a fine mesh. Powdered samples were then analysed by nutritive tests (Vitamin A and Vitamin C). The tests were carried out at National Food and Agricultural Research Institute, Tilak Road, Pune (Certified by the Government of India).

Vitamin 'A' Content: The retinal acetate of 4 gm (Purity 98.50%) was taken and the volume was made 10 ml with ethanol. About 20 ml ethanol, 1 ml 50% KOH, 5ml ascorbic acid was then added to 1.3 ml of the above solution and was refluxed for 1 hr on boiling water bath. The content was then transferred in to separating funnel. The flask was washed with 10 ml each ethanol and water. 150 ml pet ether was then extracted in three portions and pet ether layer was then collected, washed till it is alkali free. The pet ether layer was passed through sodium sulphate and was kept on water bath to dry and reconstituted in IPA to10 ml. About 20 micro liters solution were injected on HPLC.The 50.0 gm of homogenized sample in a 500 ml flask was taken and adding it 200 ml ethanol, 2 ml ascorbic acid, 50 ml 50% KOH and well mixed the content. The solution was reflux on water bath for one hour with frequent swirling. The content was then transferred in to separating funnel. 180 ml pet ether was extracted in three portions and pet ether layer was then collected, washed till it is alkali free. The pet ether layer was passed through sodium sulphate and was kept on water bath to dry and reconstituted in IPA to10 ml. About 20 micro liters solution was injected on HPLC.

Vitamin A content (%) = A × C × E × F × G × 100 / B × D ×100

Where, A = Area of sample, B = Area of Vitamin A Acetate Standard

C = Concentration of retinal acetate standard in gram,
D = Weight of sample taken.
E = Sample diluted volume, F = Purity of Vitamin A Acetate Standard.

G = 1000 mg of retinol Acetate corresponds to 2906976.7 IU of Vitamin A.

Vitamin 'C' Content: About 5 gm to 10 gm of the sample was ground in a mortar using meta phosphoric acid and was transferred it into a 100 ml-graduated flask. The 100 ml volume was made up using meta phosphoric acid. It was then filtered

through a fluted filter paper No. 1. 10 ml of the filtrate was titrated rapidly with the indophenol solution. The end point was faint pink colour. Readings were noted and the vitamin content was calculated using following formula

Vitamin C = A × B × 1000 / W
Where, A = Volume in ml of the indophenol solution used for titration,
B = Weight in mg of the ascorbic equivalent to one millilitre of the indophenol solution,
W = Weight in gm of the sample taken for the test.

RESULTS AND DISCUSSION

The vitamin A (β carotene) and vitamin C measurements were carried out on the powder of fenugreek leaves dried in open sun and in cabinet solar dryer. The vitamin contents are as shown in following Table 1.

The dried fenugreek leaves showed higher vitamin A content as compared to the fresh leaves [7, 8]. The leaves dried in cabinet solar dryer exhibited maximum retention of β carotene (31265.70 µg/100gm) than in open sun (13565.41µg/100gm) and the fresh leaves (2340 µg/100gm). In comparison with other researchers [7, 8, 9] the retention of β carotene dried in cabinet solar dryer shows higher retention. Vitamin 'C' contained in the dried samples is observed to be much reduced than that in the fresh sample since it is highly water soluble. Furthermore, the vitamin C content in cabinet solar dryer shows more reduction compared to open sun drying as temperature in cabinet solar dryer is higher than the open sun. The level of vitamin C in vegetables is temperature dependent [8, 9].

The details of HPLC analysis for fenugreek leaves dried in open sun are as:
Column: Zorbaxr ODS
Mobile phase: Actronitrile, Dichloromethane and Methanol (70:20:10)
Detector variable wavelength: U. V-453 nm
Flow rate: 1.0 ml/min
Retention time: about 3.094 min
Area under the pick = 3872.99

The area under above blue pick of HPLC pattern shows the content of β carotene in the fenugreek leaves dried in open sun. The brown small picks in above HPLC pattern show the other ingredients (showing negligible percentage).

Table 1: Vitamin composition of dehydrated fenugreek leaves.

Nutrient	Fresh leaves	Open sun drying	Cabinet Solar dryer	Unit
Vitamin A(β Carotene)	2340	13565.41	31265.70	µg / 100gm
Vitamin C	52	13.97	12.2	mg / 100gm

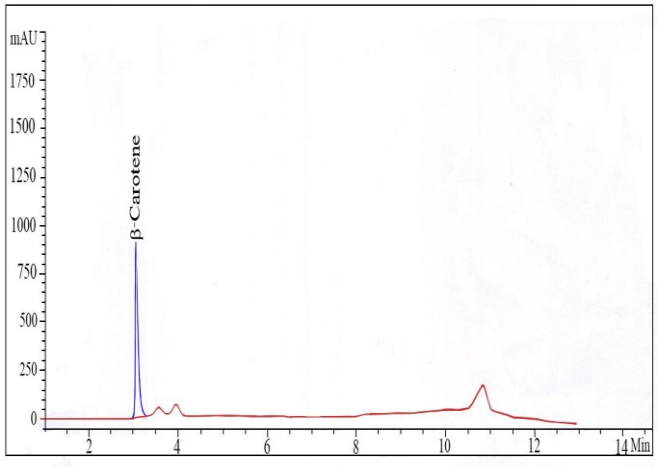

Fig.1: HPLC curve for fenugreek leaves dried in open

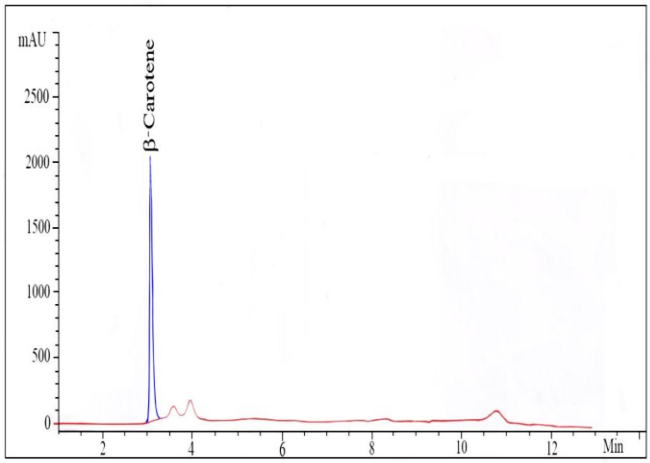

Fig. 2: HPLC curve for fenugreek leaves dried in

sun

The details of HPLC analysis for fenugreek leaves dried in cabinet solar dryer are as:

Column: Zorbaxr ODS

Mobile phase: Actronitrile, Dichloromethane and Methanol (70:20:10)

Detector variable wavelength: U. V-453 nm

Flow rate: 1.0 ml/min

Retention time: about 3.099 min

Area under the pick = 8936.64

The area under above blue pick of HPLC pattern shows the content of β carotene in the fenugreek leaves dried in cabinet solar dryer. The brown small picks in above HPLC pattern show the other ingredients (showing inferior percentage).

CONCLUSION

Dried Fenugreek leaves shows higher retention of vitamin A content. The retention of vitamin A content is higher in solar dried sample as compared to open sun. Dehydration reduces the vitamin C content as it is temperature dependent.

Conflicts of interest: The authors stated that no conflicts of interest.

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cabined solar dryer

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