Asian Journal of Chemistry; Vol. 24, No. 12 (2012), 5882-5884

ASIAN JOURNAL OF CHEMISTRY

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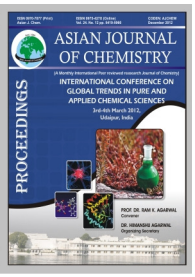

Effect of Blanching and Drying Under Different Conditions on Retention of β-Carotene in Drumstick Leaves†

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AJC-11784

Drumstick leaves are abundant and cheap food source and contain high amount of β-carotene. The present study was undertaken to investigate the effect on β-carotene retention on blanching in plain and sulphited water and drying in different conditions *i.e.*, in shade, solar drier and solar drier with forced convention. Results revealed that unblanched leaves took longer for drying but there was no significant difference on drying time of samples blanched in plain and sulphited water. However, there was significant difference between the different techniques used for drying. The β-carotene content of drumstick leaves was found to be highest for unblanched samples (11645 µg per 100 g) and lowest for samples blanched in plain water (8739 µg per 100 g). β-Carotene retention was maximum when dried in solar drier with forced convention (80 %) and least when dried in shade (50 %). The interaction of the blanching and drying treatments on β-carotene retention ranged between 85 to 50 percentage.

Key Words: Drumstick leaves, β-Carotene, Blanching, Solar drying, Shade drying.

INTRODUCTION

β-Carotene has received a great deal of attention from early researchers since it is a precursor of vitamin A. In recent years, role of β-carotene as an antioxidant and serving as quencher of highly reactive singlet oxygen and acting as a protective agent against cancer have been postulated[1]. Drumstick leaves (*Moringa Oleifera*) are considered as one of the richest source of β-carotene. Green leafy vegetables are seasonal and highly perishable and their availability is also limited. Drying is one of the most common methods for preserving these food substances. Drying is defined as a process of removal of moisture due to simultaneous heat and mass transfer[2]. The drying kinetics of food is a complex phenomenon and requires dependable models to predict drying behaviour[3].

Drying results in concentration of essential nutrients like β-carotene. However the problem with the natural source of carotene is its rapid loss during drying and storage. The content of vitamin A precursor in raw plants and in stored or processed products is not static in the so called food chain. In fact the final value for β-carotene in food at the time of consumption is often significantly modified than existed. This is why in many cases, real biological activity of vitamin A dietary rations or diets obtained only by calculations from food consumption tables is often misleading[4]. There is need for maximum use of carotene rich foods like drumstick leaves with highest retention of vitamin A activity even after processing. So far no systematic methodology has been reported for getting the products from drumstick leaves. Proper pre-treatment under suitable conditions can prevent the loss of β-carotene. It is thus essential for proper processing and drying technology to be developed which minimises the loss of β-carotene and at the same time is cost effective too. The present study was therefore planned to find out the effect of blanching and drying under different conditions and to explore best method for maximum retention of β-carotene in drumstick leaves.

EXPERIMENTAL

Drumstick leaves were freshly plucked from the plants grown in four different geographical areas of Udaipur city during winter season. The leaves were sorted out for the maturity and freshness. Only fresh leaves with soft stem having green colour and free from blemishes were selected (Plate 1). These leaves were washed in a colander with running water and drained off. The leaves were then divided into three equal parts (600 g each). One part (B1) was kept as control without any treatment prior to drying whereas second and third parts were blanched in boiling water (B_2) and water containing 0.1

†Presented at International Conference on Global Trends in Pure and Applied Chemical Sciences, 3-4 March, 2012; Udaipur, India

per cent potassium meta bisulphate (B_3) respectively. Water was drained off by keeping the samples in sieve for 10 min.

Each part was again subdivided into three equal portions (200 g each) and spread evenly on a muslin cloth and kept for dying under different conditions *viz*. sun drying under shade (D_1), solar drying with natural convention (D_2, Plate 2) and solar drying with forced convention (D_3, Plate 3). The leaves were kept for drying in solar driers after three hours (± 20 min) of sunshine for maximum efficiency. Leaves were dried in shade on cemented floor until a constant weight was obtained. Shade drying was done at room temperature ranging between 6.5 ºC to 27.3 ºC. The solar drier with natural convention and forced convention used in the present study were developed at renewable energy scheme, college of technology and agricultural engineering, Maharana Pratap University of Agriculture & Technology, Udaipur. The temperature of the solar drier with natural convection was between the range of 30-58 ºC and the temperature of solar drier with forced convection ranged from 68-70 ºC.

The moisture and β-carotene content of the fresh and dried leaves were estimated by standard procedures[5].

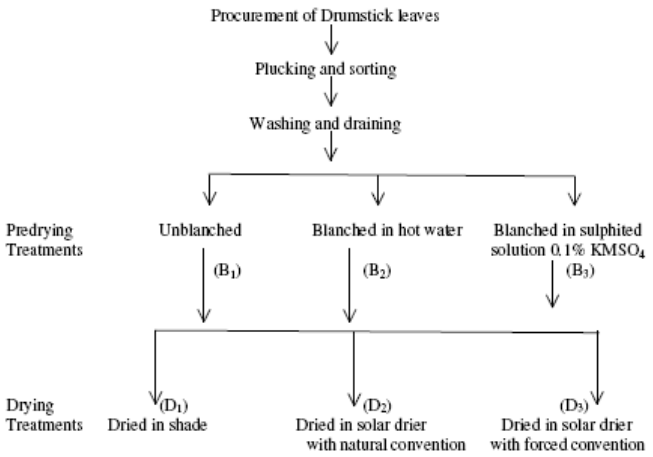

Fig. 1. Flowchart of the research study

RESULTS AND DISCUSSION

Results reveal that the moisture content in the drumstick leaves was approximately 75 % at one per cent significance level. Similar results have been obtained by Joshi and Mehta[6] and Nambiar[7]. The leaves were blanched and dried under different conditions. Basic variation between the different techniques was in the methods of supplying heat and exposure of samples to direct heat and light. This phenomenon would affect the drying pattern and nutrient content of the samples. Time required for drying under different drying conditions has been given in Table-1.

Unblanched samples took more time for drying. It is evident from the Table-1 that there was not much variation between the drying time of samples blanched in plain water or sulphited solution. On an average forced flow type solar drier took minimum time (approximately 4-6 h) whereas, other two methods *i.e.*, solar drier with natural convention and shade drying took 8-11 h and 18-24 h respectively. The reduction in the drying time in forced convection type drier was due to the maintenance of high inner temperature which facilitated the removal of moisture at a faster rate. In case of shade drying and solar drying with natural convention the low temperature and slower rate of circulation of air resulted in prolonged drying time. Similar results have been reported by Anwar[8].

TABLE-1
EFFECT OF PREDRYING TREATMENTS AND DRYING METHODS ON DRYING TIME OF THE DRUMSTICK LEAVES

Samples	Total drying time (h)		
	Shade drying	Solar drying with natural convention	Solar drying with forced convention
Unblanched leaves	22	10	6
Blanched in plain water	20	9	5
Blanched in sulphited solution	20	9	5

Values are mean of three replications

On comparing different predrying treatments (Table-2), it was found that there was a reduction in the β-carotene content during blanching treatments in comparison to their unblanched counterparts.

TABLE-2
EFFECTS OF PRE-DRYING TREATMENT ON THE BETA CAROTENE CONTENT OF DRUMSTICK LEAVES

Treatments	β-carotene (µg/100 g)
Unblanched leaves (B_1)	11645
Blanched in plain water (B_2)	8739
Blanched in sulphited solution (B_3)	8838

Values are mean of three replications

Plate. 1. Fresh Drumstick leaves; Plate. 2. Solar drier with natural convection

Plate. 3. Solar drier with forced convection

The β-carotene content of drumstick leaves was found to be highest for unblanched samples (11645 µg per 100 g) followed by samples blanched in sulphited water (8838 µg per 100 g) and lowest for samples blanched in plain water (8739 µg per 100 g). Similar results have been reported by Goindi[9] and Yadav and Sehgal[10]. While Subadra *et al.*[11] reported sulphating at the rate of 0.2 per cent to be more effective over blanching. The loss in β-carotene content may be due to heat oxidation of the vitamin on blanching.

The interaction of the pre-drying and drying treatments on β-carotene retention was also studied. Among the different pre-drying and drying treatments (Table-3), unblanched samples with forced convection showed maximum values (436 µg per g) and minimum values were obtained for the samples blanched in sulphited solution and dried in shade (250 µg per g). This shows that blanching treatment caused greater loss of the vitamin as compared to the unblanched samples. Comparisons of drying methods showed best results for samples dried in solar drier with forced type convection ranging from 393-436 µg per g.

TABLE-3
EFFECTS OF PREDRYING AND DRYING METHODS ON THE BETA CAROTENE CONTENT (µg/g dm*) OF DRUMSTICK LEAVES

Treatments	Shade drying (D_1)	Solar drying with natural conv. ention (D_2)	Solar drying with forced convention (D_3)
Unblanched leaves (B_1)	260	323	436
Blanched in plain water (B_2)	255	311	398
Blanched in sulphited solution (B_3)	250	301	393

*dm-Dry matter; values are mean of three replications

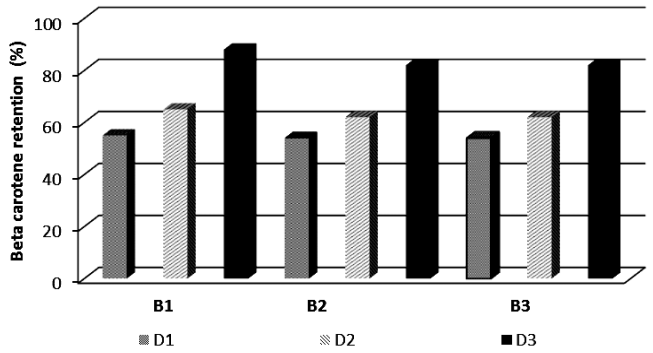

Fig. 2. Effect of blanching and drying methods on per cent retention of β-carotene in drumstick leaves

Fig. 2 shows that β-carotene retention percentage varied according to the type of treatment given and method of drying. Sample dried in solar drier with forced convection retained the maximum amount of β-carotene (76-85 %) samples dried in shade retained least amount of β-carotene (50 %), this may be due to prolonged duration of drying and destruction of vitamin through photo oxidation. Anon[12] also reported 50 % retention of β-carotene when drumstick leaves were shade dried.

Conclusion

The interaction of drying conditions and blanching treatment resulted in the loss of β-carotene. It was observed that samples dried in forced flow type solar drier retained higher amount of β-carotene. Much greater loss occurred in case of shade dried samples. It was also noted that unblanched samples retained greater amount of β-carotene. Thus, it can be concluded that for maximum retention of β-carotene, drumstick leaves should not be blanched and should be dried in forced flow type solar convection.

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