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RESEARCH PAPER

Drying of Bitter Gourd by Using Tray Dryer

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ABSTRACT

India is the second largest producer of fruits and vegetables in the world, after China. Vegetables and fruit play a vital role in human nutrition, as vitamin sources (A, B6, C, E, thiamine, and niacin), minerals, dietary fiber and other phytonutrients. Keeping the above facts in mind the present investigation was conducted to investigate the effect of effect of drying on chemical quality of bitter gourd. Mature bitter gourds of uniform medium size and dark green colour were procured and washed in water to remove dust dirt from its surface. It sliced into 1, 2 and 3 cm thick rings with stainless steel knife. After preparation slices were blanched in boiling water at 90 °C for 2 minutes. Sulphitation by dipping the blanched bitter gourd slices in 0.2% KMS solution for 10 min at room temperature. Pretreated bitter gourd slices were spread on a stainless steel tray and dried in tray oven dryer at different temperatures 50, 60, 70, 80 °C till bitter gourd crisp. It was founded that high thickness and lower temperature takes more time to dry of bitter gourd. Rehydration ration of sample was inversely proportional to drying temperature. DPPH inhibition activity was found lower in all dried samples than fresh.

Keywords: Bitter Gourd, Phenolic content, Moisture analysis, Tray Drying, Rehydration Ratio

India is the second largest producer of fruits and vegetables in the world, after China. Vegetables and fruit play a vital role in human nutrition, as vitamin sources (A, B6, C, E, thiamine, and niacin), minerals, dietary fiber and other phytonutrients (Quebedeaux and Eisa 1990; Wargovich 2000). These component reduced the incidence of cancer, cardiovascular disease, and other chronic diseases (Quebedeaux and Eisa 1990; Wargovich 2000). A vegetable have several health promoting properties is bitter gourd. Bitter gourd is widely grown in Asia for its medicinal attributes, especially in China, India and Southeast Asia. Bitter gourd has twice the calcium and potassium of spinach and banana respectably. It is rich in iron, zinc and good in phosphorus, sodium, magnesium. It is a fair source of vit. C contributes about 55% of total vitamins. The bitterness in bitter gourd is due to the cucurbitacin like alkaloid momordicine and triterpene glycoside. The extract of bitter gourd used in the traditional medical system and most often as hypoglycemic and anti-diabetic agents (Semiz and Sen, 2007). Fruit juice or dried fruit bits have been used worldwide particularly for blood sugar lowering effect (Welihinda *et al.* 1986; Raman and Lau, 1996). The major compounds that

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have been isolated from bitter gourd reported to have hypoglycemic actions of potential benefits in diabetes mellitus (Yibchok-Anun *et al.* 2006). Bitter gourd has been shown to possess powerful activities against viruses such as simplex virus 1 and human immunodeficiency virus 1 (HIV 1) (Raman and Lau, 1996) through stimulating the immune system and activating the body's natural killer cells. It has also shown anti- carcinogenic properties and can be used as cytotoxic agent against different types of cancer (Grover and Yadav, 2004). In addition, extract of bitter gourd can be used as an antibacterial agent to fight off infections caused by *E. coli, Salmonella, S. aureus, Staphylococcus* and *Pseudomonas* (Saeed and Tariq, 2005). Bitter gourd also possesses anti-helmintic properties, which are effective in the treatment of malaria (Grover and Yadav, 2004). The most extensively used synthetic antioxidants such as butylated hydroxyl toluene (BHT) and butylated hydroxyl anisole (BHA) have been suspected of being responsible for liver damage and carcinogenesis (Suja *et al.* 2005; Senevirathne *et al.* 2006). Bitter gourd has been reported to contain antioxidant including phytochemicals. Phytochemicals such as phenolic compounds have been considered beneficial for human health through inhibition of macromolecule oxidation and reduction of oxidative stress to help in decreasing the risk of degenerative disease (Silva *et al.* 2004; Pereira *et al.* 2007). Keeping the above facts in mind the present investigation was conducted to investigate the effect of effect of drying on chemical quality of bitter gourd and the results are reported here.

MATERIALS AND METHODS

Drying of Bitter gourd: Mature bitter gourds of uniform medium size and dark green colour were procured and washed in water to remove dust dirt from its surface. It sliced into 1, 2 and 3 cm thick rings with stainless steel knife. After preparation slices were blanched in boiling water at 90 °C for 2 minutes. Sulphitation by dipping the blanched bitter gourd slices in 0.2% KMS solution for 10 min at room temperature. Pretreated bitter gourd slices were spread on a stainless steel tray and dried in tray oven dryer at different temperatures 50, 60, 70, 80 °C till bitter gourd crisp (Fig. 1).

Fig. 1: Dehydrated Bitter gourd Slices

Packaging of dried bitter gourd: Dehydrated products were vacuum packed in low density polythene bags having 5 layers, dimension; 26×15 cm of 0.1 mm and Oxygen transmission rate 480 cc/0.001inch/100 inch^2/24h/atm O_2 by using vacuum packaging machine (Induac Saurabh Engineers, INDIA). Packed biter gourd slices were stored at ambient temperature.

Moisture analysis: Moisture content of sample was calculated as per the method of AOAC (2000).

Rehydration ratio: The rehydration ratio of dried bitter gourd slices was determined as the ratio of rehydrated mass to the initial dehydrated mass, which gives a measure of the ability of dried bitter gourd slices to reabsorb water mass (Prakash *et al.* 2004).

Phenolic content: The total phenolic content of the bitter gourd was determined according to the Folin-Ciocalteau method as described by Cliffe *et al*. (1994).

DPPH radical scavenging activity: The DPPH radical scavenging activity of bitter gourd was calculated according to the methods of Brand-William *et al.*

(1995).

ABTS inhibition activity: The ABTS inhibition activity of bitter gourd was calculated according to the methods of (Miller *et al*. 1996).

RESULTS AND DISCUSSION

Drying of bitter gourd slices: The initial moisture content of the bitter gourd slices was about 91% (w.b). The drying of bitter gourd slices was kept in oven at different temperatures (50, 60, 70 and 70°C) and time required to dry the KMS (0.2%) pretreated bitter gourd slices of 1, 2 and 3 cm thickness upto 7% in oven is shown in the table 1.

Table 1: Dying time (min) to reduce the moisture content of bitter gourd slices in tray drying from 91% (weight basis) to 7% (weight basis)

Temperature (°C)	Slices Thickness (cm)		
	1	2	3
50	1410	1555	1730
60	1260	1405	1575
70	1185	1340	1505
80	990	1140	1320

From table 1 it is clear that maximum time of drying of 3 cm thickness at 50°C was 1730 min while lowest was found in 990 min for 1cm slice.

Rehydration Ratio: The rehydration ratio of bitter gourd slices (1, 2 and 3 cm thickness) is given in Table 2. The higher rehydration ratio of samples indicated that the samples retained good texture and absorbed more water.

Table 2: Rehydration ratio of dehydrated bitter gourd slices

Temperature (°C)	Slices Thickness (cm)		
	1	2	3
50	5.0	5.1	5.2
60	4.8	5.1	5.1
70	4.6	4.9	5.0
80	4.6	4.8	4.9

From table 2 it is clear that 1 cm and 3 cm treated sample were 4.6-5.0 and 4.9-5.2 rehydration ratio, respectively. There was a significant difference in the rehydration ratios among the dried bitter gourd slices. KMS pre-treated 3 cm sample dried at 50˚C hold maximum water. Madamba and Liboon (2001) reported that the rehydration ratio of vacuum dried celery was influenced by the temperature, vacuum pressure and slice thickness. The rehydration ratio could be improved by maintaining lower pressure (higher vacuum) and higher microwave power (Giri and Prasad (2005). The variation in the rehydration ratio values might be influenced by the drying temperature, soaking time, air displacement, pH and ionic strength (Salunkhe, 1991).

DPPH Inhibition Activity: The DPPH inhibition activity of pretreated bitter gourd slices (1, 2 and 3 cm) was presented in Table 3.

Table 3: DPPH Inhibition activity (%) of dehydrated bitter gourd slices

Temperature (°C)	Slices Thickness (cm)		
	1	2	3
50	73.8	75.3	74.3
60	74.6	75.1	74.2
70	72.4	72.6	71.8
80	68.7	69.6	69.4

50°C treated sample was higher DPPH inhibition activity in comparison to 60, 70 and 80°C. Maximum DPPH inhibition activity was observed in 2 cm dried sample at 50°C. The higher antioxidant activity of samples indicated that the samples may retain good medicinal properties. Raw broccoli florets had total antioxidant activity measured by DPPH with 60.5% but after cooking for 5 min by boiled florets retained 35% and microwaving boiled florets retained 34.7% of total antioxidant activity (Zhang and Hamauzu, 2004). Chu *et al.* (2000) reported that scavenging activities against DPPH of green leaves of potatoes blanched for 2 min at 100 °C remained the same as for fresh ones.

ABTS Inhibition Activity: The ABTS inhibition activity of pretreated bitter gourd slices (1, 2 and 3 cm) is presented in Table 4.

Table 4: ABTS Inhibition activity (%) of dehydrated bitter gourd slices

Temperature (°C)	Slices Thickness (cm)		
	1	2	3
50	71.1	71.4	71.6
60	71.4	71.7	71.8
70	69.4	70.6	69.8
80	67.6	67.8	68.3

Maximum ABTS inhibition activity was observed in 50°C dried sample. The ABTS inhibition activity was found to be lower than DPPH inhibition activity at same conditions. The analysis indicated that there was a significant difference in the ABTS inhibition activity among the dried bitter gourd slices.

Total Phenolic Content: Total phenolic content (mg/g) of dehydrated bitter gourd slices is presented in Table 5. KMS (0.2%) pretreated bitter gourd slices of 2 and 3cm at lower temperature of 60 °C was found to retain higher total phenolic content than other pretreatment, thickness and temperature combination conditions. Roy *et al.* (2007) reported that decreasing temperature of processing was also found to preserve 80-100% of phenolic content in some vegetables. Semi drying of tomatoes was found to lower the phenolic content by 30%, but drying of pepper gave contradicting results (Toor and Savage, 2006).

Table 5: Total phenolic content (mg/g) of dehydrated bitter gourd slices

Temperature (°C)	Slices Thickness (cm)		
	1	2	3
50	5.2	5.3	6.0
60	5.2	6.0	6.1
70	5.1	5.1	5.6
80	5.1	5.3	5.2

CONCLUSION

It was concluded that high thickness and lower temperature takes more time to dry of bitter gourd. Rehydration ration of sample was inversely proportional to drying temperature. DPPH inhibition activity was found lower in all dried samples than fresh.

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