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Effect of Pretreatments on Dehydration of Ivy Gourd

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ABSTRACT

The present investigation was carried out to study the effect of different pretreatments on dehydration characteristics of ivy gourd. Fresh and uniformly sliced ivy gourds were subjected for eight different pretreatments, prior to drying and were subjected to two different drying temperatures (55°C and 60°C) in a tray drier. The moisture content, dehydration and rehydration ratio varied significantly among the pretreatments with a mean of 4.66 g, 15.19 w/w and 2.99 w/w at 55°C, respectively, whereas, at 60°C it was recorded 4.69 g, 16.34 and 3.05 w/w per 100 g of sample, respectively. Between the two different drying temperatures and among eight different pre-treatments, dehydration ratio was found higher in 0.1 per cent citric acid pretreated sample and rehydration ratio was found highest in 3 min water blanched sample which were dried at 60°C, respectively.

Keywords: Ivy gourd, Pretreatments, Dehydration, Rehydration, Pretreatments, Blanching, Temperature.

IVY GOURD [*Coccina indica* Wight and Arn, (synonym *C. cordifolia*)] is also known as little gourd or tindora. It is a climbing perennial herb, grown throughout India especially in warmer and humid climatic conditions, and is widely distributed in tropical Asia and Africa (Sastri, 1950). It is a storehouse of several health promoting nutrients, vitamins and minerals. It belongs to the family *Cucurbitaceae,* cultivated for its edible young shoots and edible fruit which is grown abundantly in India and has been widely used in the traditional treatment of diabetes mellitus (Shyamrao and Pasupuleti, 2012).

Ivy gourd is a good source of nutrients, *i.e.,* vitamins and minerals. Consuming 100 grams of ivy gourd supplies, 1.4 mg of Iron, 1.6 g of total dietary fiber, 40 mg of calcium and 30 mg of potassium (Rubatzky *et al.,* 1997). Hence it should be consumed within 10-12 days after harvest as it is perishable in nature. The availability of ivy gourd could be extended by dehydration process.

Drying is one of the oldest and simplest methods of preservation, requiring little outlay of special equipment which preserves foods by removing enough moisture to prevent decay and spoilage. Dehydration is also one of the cost-effective and practicable methods of preservation of surplus produce for use in season of short fall, thereby minimizing the fluctuation in the market price. The demand for dehydrated vegetables is increasing rapidly both in domestic and international markets, due to condensed losses and cost of bulk shipment. Dried and processed vegetables constitute total export of processed product between 40-42 per cent both by volume and by value (Chadha, 1995).

However, very little information is available on ivy gourd regarding dehydration and its impact on quality characteristics. Hence an effort was made to understand the influence of different pretreatment on dehydration of ivy gourd on processing qualities.

MATERIAL AND METHODS

Materials and sample preparation: Ivy gourd was purchased from a local vegetable market and used for dehydration studies. Ivy gourd with uniform size, free from spoilage were sorted and washed with running tap water to remove adhering dirt and soil. They were slit into uniform slices manually, and were used for pretreatments and dehydration.

Physico-chemical characteristics: Ten fruits of ivy gourd were randomly selected and examined for average fruit length and average weight. Number of

ivy gourd/ kg was counted manually. pH in the fresh fruit was measured using digital pH meter. The Total soluble solids (TSS) in fresh ivy gourd were measured by using a hand refractometer and expressed as per cent after necessary corrections. Titratable acidity (TA) and Total sugars (%) were estimated using standard (Anon., 2000) method.

Pretreatment and dehydration of Ivy Gourd Slices: Sliced ivy gourds were subjected to different pretreatments and these pretreated samples were tray dried at two different temperatures *i.e.,* at 55°C for 7 hrs and 60°C for 6 hrs until the attainment of constant moisture content in the dehydrated sample.

The pretreatments were as follows:

T1: Slices were pretreated with 2 per cent (20gm NaCl 1000ml water 1:2 w/w) sodium chloride solution for 15 minutes at room temperature.

T2: Slices were pretreated with 0.25% per cent potassium meta bisulphate (2.5gm of KMS 1000ml water 1:2 w/w) for 15 minutes at room temperature.

T3: Slices were pretreated with 0.1% citric acid (1gm of citric acid in 1000ml of water 1:2 w/w) for 15 minutes at room temperature.

T4: Slices were subjected for steam blanching for 5 minutes.

T5: Slices were subjected for water blanching for 2 minutes.

T6: Slices were subjected for water blanching for 3 minutes.

T7: Slices were subjected for water blanching for 5 minutes.

T8: Untreated (control)

Dehydration ratio: Dehydration ratio (DR) of ivy gourd slices was calculated by the ratio of weight of the material kept for dehydration to the weight of dehydrated material and expressed as (w/w)

$$\text{Dehydration ratio (w/w)} = \frac{W_f}{W_d}$$

where, W_f is the weight of the fresh ivy gourd slice (g) and W_d is the dried ivy gourd slices (g).

Rehydration ratio (Ranganna, 1986): Rehydration ratio (RR) was determined by rehydrating the dehydrated slices in water at 98°C for 10 min. The ratio of weight of rehydrated material to the dehydrated material was expressed as (w/w).

$$\text{Rehydration ratio (w/w)} = \frac{W_r}{W_d}$$

where, W_r is the weight of the rehydrated ivy gourd slices (g) and W_d weight of the dehydrated ivy gourd slices (g)

Coefficient of rehydration (Ranganna, 2000): The coefficient of rehydration of the samples was calculated by using the following formula

$$\text{Coefficient of rehydration} = \frac{W_d \times (100 - M_f)}{W_r - M_d} \times 100$$

where, W_d is the weight of the dehydrated sample, M_f moisture content of fresh sample (*i.e.* before drying), W_r is the weight of the sample taken for rehydration and M_d is the moisture present in dried sample taken for rehydration

Recovery percentage :The weight of fresh ivy gourd slices and dried ivy gourd slices at the end of drying obtained from each treatment were noted down and the percentage recovery of dried ivy gourd slices were calculated by using the following formula.

$$\text{Recovery percentage } \% = \frac{W_d}{W_f} \times 100$$

where, W_d is the weight of dried ivy gourd slices and W_f is the weight of fresh ivy gourd slices

Moisture (%): Fresh and dehydrated ivy gourds were taken and dried in an oven at 60 p C. After ensuring that the weight of the dry samples remained constant, the dried samples were weighed and final values were subtracted from the fresh weight of the sample to obtain the weight of the moisture (Anon., 1980).

$$\text{Moisture (\%)} = \frac{W_f - W_d}{W_f} \times 100$$

where, W_f is the weight of the fresh sample (g), W_d is weight of the dried sample (g)

Statistical analysis: Three samples for each parameter were prepared, each sample was analyzed in triplicate, and data obtained in experiments was analyzed by completely randomized design to test statistical significance at $p \leq 0.05$, with three replications, by adopting the standard statistical procedures.

Results and Discussion

The physico-chemical properties of fresh ivy gourd are presented in Table 1**.** The mean length of ivy gourd was found to be 4.68 cm, while the weight was 12.05 gm. The mean moisture and pH in fresh sample were found to be 93.07 per cent and 5.57, respectively which were slightly higher than that of the value recorded by Shyamrao and Pasupuleti (2012).The difference might due to location and time of harvest or maturity stage. pH is most variable factor as it depends on fruit

Table 1

Physico-chemical properties of fresh ivy gourd

Length(cm)	4.68 ± 1.00
Weight (g)	12.05 ± 2.00
No. of ivy gourd /kg	88 - 89
Moisture (g/100g)	93.07 ± 0.05
pH	5.57 ± 0.03
Total sugars (g/100g)	1.22
Total Soluble Solids (%)	3.84 ± 0.02
Titrable acidity (g/100g)	0.32 ± 0.01

maturity and storage temperature and hence may be one of reasons for higher pH in the fruit. Similarly, the mean total sugars, total soluble solids and titrable acidity were found to be 1.22g, 3.84 per cent and 0.32 g per 100g of fresh sample. As maturity level increases there is a decrease in titrable acidity due to reduction in acid content of the fruit as in processed tomato juice. This may be the reason for the variation in the values of the present study as compared to the one reported by Shyamrao and Pasupuleti (2012).

Influence of pretreatment]s on dehydration characteristics of ivy gourd at 55°C is presented in Table 2. Among different pretreatments, the moisture content of dehydrated samples were found to be in the range of 3.92-4.70 g per 100g. Higher moisture was observed in untreated sample while, lower (3.92g) was recorded in sample pretreated with 0.1 citric acid solution. The difference in moisture content among the pretreatments was statistically significant at five per cent level. This is on par with results as recorded by Shyamrao and Pasupuleti (2012). The dehydration ratio was found in the range of 12.43-16.89 (w/w) with highest (16.89 w/w) being in sample pretreated with 0.25 per cent KMS solution followed by sample blanched for 3 min (15.79), and lowest (12.43) was observed in untreated sample. The results are in agreement with Ahsan *et al*. (2008) where maximum dehydration ratio was observed with pretreatment of KMS (1.5%) in dehydrated apple. This may be due to oozing out of some soluble solids during drying. Rehydration ratio plays a very important role in deciding the quality of the product. The rehydration ratio of the dehydrated ivy gourd as influenced by pre-treatments varied significantly when compared to control, and was found in the range of 2.27-3.63 (w/w). Higher value was observed in sample treated with 0.1 per cent citric acid followed by, 5 min water blanched sample. The re-absorption capacity is closely related to the tissue integrity and structure, *i.e.,* lower the disturbance in the tissue structure of the ivy gourd during drying, higher will be the capacity of dried tissue to reabsorb moisture during rehydration. Similar trend was observed in the study reported by Dev-raj *et al*. (2006), where increase in rehydration ratio of dehydrated onion rings was observed with pretreatment of KMS (0.25%) + citric acid (0.05g/kg) as compared to KMS (0.25%) alone. However, increased rehydration ratio with KMS (0.2%) alone was also observed in dehydrated ivy gourd (Shyamrao and Pasupuleti, 2012). The coefficient of rehydration varied significantly among the pretreatments and

TABLE 2

Influence of pretreatments on dehydration characteristics of Ivy gourd at 55°C

Treatments#	Moisture Content in Dehydrated sample (g/100g)	Dehydration ratio(w/w)	Rehydration ratio(w/w)	Coefficient of rehydration	Recovery percentage
T1	4.65	14.28	2.44	1.45	7.00
T2	4.67	16.89	3.28	1.36	5.58
T3	3.92	15.22	3.63	1.53	6.57
T4	4.66	15.19	2.86	1.21	6.76
T5	4.68	15.65	2.89	2.03	6.35
T6	4.63	15.79	3.18	2.38	7.08
T7	4.64	14.12	3.42	3.00	5.92
T8	4.70	12.43	2.27	1.78	6.93
GM	4.66	15.19	2.99	1.84	6.52
F Value	*	*	*	*	*
Range	3.92 - 4.70	12.43 - 16.89	2.27 - 3.63	1.21 - 3.00	5.58 - 7.08
SEm± (0.05)	0.01	0.35	0.01	0.01	0.04
CD (Pd"0.05)	0.03	1.07	0.02	0.02	0.12
CV (%)	0.35	4.05	0.49	0.73	1.07

*Significant at 5%

T1= Pretreated with 2% Sodium chloride (NaCl), T2= Pretreated with 0.25% Potassium Meta Bisulphate (KMS), T3= Pretreated with 0.1% citric acid, T4=Steam blanched for 5 min, T5=Water blanched for 2 min, T6= Water blanched for 3 min, T7= Water blanched for 5min, T8=Untreated (control

maximum coefficient of rehydration was observed in 5 min water blanched sample followed by 3 min water blanched sample. Findings of Bhattacharjee *et al.,* 2016 revealed similar results wherein dehydrated bitter gourd water blanched for 2 minutes and dried at 60,°C had higher coefficient of rehydration. Recovery percentage varied significantly among the treatments with a mean range of 5.58 - 7.08. Sample pretreated with 3 min water blanching had higher recovery per cent followed by 2 per cent NaCl pretreated sample.

Table 3 depicts the influence of pretreatments on dehydration characteristics of ivy gourd at 60 °C. The average moisture content of samples dehydrated at 60 °C varied with mean range of 4.61-4.77g per 100g, highest being in untreated sample (*i.e.,* 4.77g) and least being in sample pretreated with 0.1 per cent citric acid. The moisture content recorded in the present study was less compared to the results of Shyamrao and Pasupuleti (2012), which might be due to the temperature and method of drying used. Results for dehydration ratio varied significantly, among the treatments and when compared to dehydration ratio at 55°C with a mean range of 13-19.60 (w/w) higher dehydration ratio was observed in 0.1 per cent citric acid treated sample (19.60 w/w) followed by 3 min water blanched sample (17.51w/w) while lower dehydration ratio was observed in untreated sample (13 w/w). Rehydration ratio varied significantly among the pretreatments when compared to untreated sample with a mean range of 2.19 to 3.58 (w/w). Higher rehydration ratio was found in the sample water blanched for 3 min while, lower rehydration ratio was found in the untreated sample. Results for rehydration

TABLE 3

Influence of pretreatments on dehydration characteristics of Ivy gourd at 60°C

Treatments#	Moisture Content in Dehydrated sample (g/100g)	Dehydration ratio(w/w)	Rehydration ratio(w/w)	Coefficient of rehydration	Recovery percentage
T1	4.67	15.43	2.86	1.09	6.50
T2	4.71	14.20	2.82	2.86	5.72
T3	4.61	19.60	3.08	1.28	7.04
T4	4.70	16.83	3.45	2.05	5.94
T5	4.70	16.66	2.93	1.75	6.00
T6	4.75	17.51	3.58	2.85	7.69
T7	4.64	17.48	3.51	1.60	5.08
T8	4.77	13.00	2.19	1.85	5.70
GM	4.69	16.34	3.05	1.92	6.21
F Value	*	*	*	*	*
Range	4.61 - 4.77	13 - 19.60	2.19 - 3.58	1.09 - 2.86	5.08 - 7.69
SEm± (0.05)	0.01	0.005	0.01	0.01	0.02
CD (Pd"0.05)	0.02	0.02	0.03	0.02	0.06
CV (%)	0.25	0.06	0.50	0.61	0.58

*Significant at 5%

T1= Pretreated with 2% Sodium chloride (NaCl), T2= Pretreated with 0.25% Potassium Meta Bisulphate (KMS), T3= Pretreated with 0.1% citric acid, T4=Steam blanched for 5 min, T5=Water blanched for 2 min, T6= Water blanched for 3 min, T7= Water blanched for 5min, T8=Untreated (control

ratio were slightly different when compared to 55 °C dried sample. The variation in rehydration may be due to difference in temperature of dehydration as high temperature may decline the tissue integrity and structure. The mean coefficient of rehydration and recovery percentage were found to be 1.92 and 6.21 per cent respectively. Higher mean value for coefficient of rehydration was observed at 60 °C when compared to 55 °C, whereas recovery percentage was observed little low for samples dried at 60 °C in comparison to samples dried at 55 °C. The differences may be attributed to influence of high temperature on tissue integrity and structure.

Fig.1 shows the mean moisture content of dehydrated sample dried at 55 and 60 °C. It was observed that in both drying temperature untreated sample had higher moisture content and least was observed in citric acid treated sample.

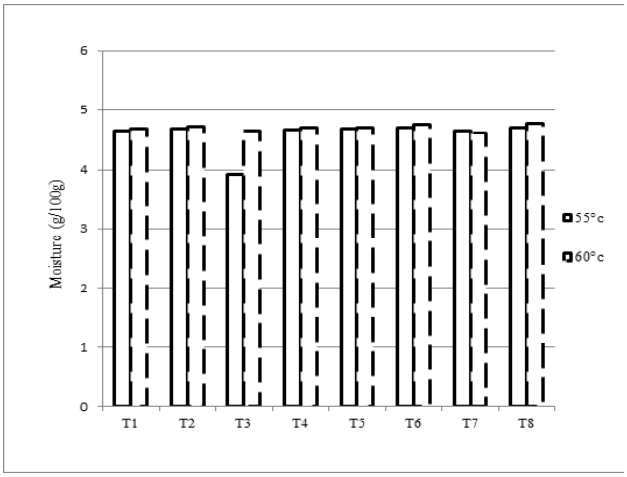

Fig.1: Effect of pretreatments on moisture (g/100g) content of the dehydrated ivy gourd

T1= Pretreated with 2% Sodium chloride (NaCl), T2= Pretreated with 0.25% Potassium Meta Bisulphate (KMS), T3= Pretreated with 0.1% citric acid, T4=Steam blanched for 5 min, T5=Water blanched for 2 min, T6= Water blanched for 3 min, T7= Water blanched for 5min, T8=Untreated (control)

It is evident that pretreatments had significant effect on dehydration characteristics of the ivy gourd. Two different drying temperatures (55 and 60 °C) did not vary much in terms of moisture and recovery percentage but had greater impact on dehydration ratio and rehydration ratio. The mean dehydration ratio, rehydration ratio and coefficient of rehydration were higher at 60°C. Among the eight different pretreatments and between two different drying temperatures the dehydration ratio was found to be highest in 0.1 per cent citric acid pretreated sample dried at 60 °C. Similarly, rehydration ratio was observed higher in 2 min water blanched sample dried at 60 °C. Between two different drying temperatures drying at 60 °C gave better results due to lower duration of drying. Hence, it is concluded that among all pretreatments drying at 60 °C was considered best for dehydration of ivy gourd.

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