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STANDARDIZATION OF DRYING TECHNIQUES FOR DIFFERENT FRUIT PEEL FOR MAKING POTPOURRIS

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Abstract

The present study entitled Standardization of drying techniques for different fruit peel for making potpourris was conducted at Postharvest Technology Laboratory, College of Horticulture, Anantharajupeta, Andhra Pradesh during the year 2017 under Dr. YSR Horticultural University. In the present investigation, five different fruit peel were tried *viz.,* $\mathbf{T_1}$ (acid lime peel), $\mathbf{T_2}$ (sweet orange peel), $\mathbf{T_3}$ (Mandarin peel), $\mathbf{T_4}$ (Pomegranate rind), $\mathbf{T_5}$ (custared apple skin) and these materials were subjected to five drying methods like D_1 (Air drying), D_2 (Sun drying), D_3 (Silica gel drying), D_4 (Hot air oven drying), D_5 (Microwave oven). Data recorded on different parameters were subjected to statistical analysis with factorial CRD. Among the fruit peel lowest dry weight (19.00 g) was received in D_4T_3 (hot air oven + mandarin peel), whereas highest dry weight (34.67 g) was recorded D_5T_4 (microwave oven + pomegranate). Highest moisture loss was recorded in D_4T_3 (hot air oven + mandarin peel) (81.00%) whereas minimum moisture loss in D_5T_4 (Microwave oven + pomegranate) (65.33%). With regards to the time taken for peels under air drying process acid lime and sweet orange peel took least number of days (3 days) to dry. Under sun drying mandarin peel dried in a minimum of 2 days. In silica gel drying method, less number of (3 days) recorded to dry mandarin peel. Custard apple skin took less number of (16 hours) 40°C to dry completely in hot air oven drying. The time taken to dry acid lime peel in microwave oven drying was recorded 5 minutes.

Key words : Fruit peels, drying, air drying, sun drying, silica gel drying, hot air oven, microwave drying, potpourri.

Introduction

Drying is a method to remove moisture from the peels and other plant parts. Dried and preserved ornamental products offer a wide range of qualities like novelty, longevity, aesthetic properties, flexibility and year round availability (Joyce, 1998). The range of dried flowers and other attractive plant parts is quite extensive, namely, roots, shoots, stems, buds, flowers, inflorescences, fruiting shoots, fruit peel, fruits, cones, seeds, foliage, bracts, thorns, barks, lichens, fleshy fungi, mosses and selaginella (Deshraj, 2001). Dried flowers and foliage are used for making decorative floral segments like wall hangings, landscape calenders, potpourris *etc.,* for various purposes with potpourris being the major segment of drying flower industry valuing at Rs. 55 crores in India alone (Nirmala *et al*., 2008). In India, industry provides direct employment to around 15,000 persons and indirect employment to around 60,000 persons. Nearly 60% of the raw materials sourced from natural forests and plains, only 40% of the flowers are cultivated for drying, bleaching. Easy availability of products from forests, possibility of manpower available for labour intensive craft making and availability of wide range of products throughout the year are the reasons for development of dry flower industry in India. Potpourris are used for income generation through drying different plant parts will be helpful to self help groups, young entrepreneur, and unemployees etc., even for empowering women in rural households by income generation. In present modern days people preference towards aesthetic products like floral segments, wall hangings, landscapes, calendars, potpourris, dry landscapes etc., is increasing day by day.

Materials and Methods

The present study entitled standardization of drying technique for different fruit peel for making potpourris was conducted at Postharvest Technology Laboratory, College of Horticulture, Anantharajupeta during 2016-

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17. For the present experiment different fruit peels used *viz*., acid lime peel, sweet orange peel, mandarin peel, pomegranate rind and custard apple skin. Dehydration of fruit peels were dried under various drying methods used *viz.,* air drying, sun drying, hot air oven and microwave oven drying and silica gel drying to carry out present experiment. 100 g of fruit peels was taken to carried out the experiment and replicated thrice. The experiment was laid out in Factorial Completely Randomised Design with factorial concept with 5 plant materials (F_1) and 5 drying methods (F_2) and their combinations (25) (F_1 X F_2). These combinations were replicated thrice. Observations were recorded for dry weight, moisture loss (%), time taken for drying. The data collected were analyzed statistically using factorial completely randomized design as per the procedure outlined by Panse and Sukhatme (1985) and valid conclusions were drawn only on significant differences between treatments mean at 0.05 per cent level of significance.

Air drying

The clean, fresh fruit peels collected in cloth bags were carried to the laboratory and weighed on electronic balance for fresh weight purpose. These materials were transferred to plastic trays containing open ventilation on both sides. Every day readings were taken at regular intervals to record the dry weight and moisture content of the fruit peel.

Sun drying

Fruit peels were exposed to the sun daily from 9 am - 4 pm by keeping them in plastic trays. The trays are shifted to laboratory during evening hours and again the next morning they were kept under the sun. This practice was followed till the material dried up completely. The readings were taken at regular intervals to record the moisture content till the moisture % is same, indicating that the drying process is completed.

Silica gel drying

The plastic trays which were selected for drying to dry the materials was filled evenly with the silica gel media up to two inches of height. Depressions were made to insert the selected peels into the silica gel medium. After inserting the peels, it was covered with silica gel again the media was evenly distributed so as to equalize the pressure on all sides of the plant parts. After drying, the embedded peels were taken out carefully by tilting the containers. plant parts were also gently brushed with soft camel hair brush to remove the desiccant completely so that the original colour of the dried fruit peel could be seen. Standard setting time of 3 hours was maintained.

Hot air oven drying

The fruit peel were kept in the ir on trays and placed in an electrically operated hot air oven at two specified temperatures and duration no of hours for drying at (40°C) respectively.

Microwave oven drying

Beakers selected for drying were filled evenly with the media up to 2 inches of height. Depressions were made to insert the fruit peel into the silica gel medium. After inserting it was covered with silica gel. The media was evenly distributed so as to equalize the pressure on plant parts.The plant parts were kept in beaker in upright position and they were dried in microwave oven at different time levels (*viz*., 30 Sec, 1 minute, 2 minutes, 2.5 minutes and 3 minutes). After drying, the embedded peels were taken out carefully by tilting the containers. The peels were rolled down and were collected, plant parts were also gently brushed with soft camel hair brush to remove the desiccant completely so that the original colour of the dried fruit peel could be seen.

Results and Discussion

Dry weight (g)

Dry weight of the flowers and other plant parts was recorded during course of study till the moisture completed and expressed in grams. These materials are used for the potpourri preparation.

Moisture loss (%)

The difference between the fresh weight and dry weight gives the actual moisture content of the flowers and other plant parts or loss of moisture. Moisture/weight loss was calculated as per the given formula (Gupta, 1999; Marousky, 1973 and Parups and Chan, 1973).

$$\text{Per cent moisture loss} \frac{FW - DW}{FW} \times 100$$

Where,

FW = Fresh weight of plant materials

DW = Dry weight of plant materials

Significant differences were observed among the fruit peel and drying methods under the study for dry weight of fruit peel (table 1). With respect to fruit peel, significantly minimum dry weight of fruit peel was observed in treatment $\mathbf{T_3}$ (Mandarin peel) (22.20 g) followed by $\mathbf{T_1}$ (Acid lime peel) (28.67 g), while maximum was noticed in treatment $\mathbf{T_4}$ (Pomegranate rind) (31.20 g) followed by $\mathbf{T_5}$ (Custard apple peel) (30.33 g). Among the drying methods, significant differences were observed and air drying (D_1) had lowest dry weight noticed in (26.73

Table 1 : Dry weight (g) of fruit peels / skins as influenced by different methods of drying.

Method of drying	T_1	T_2	T_3	T_4	T_5	Mean
D1 (Air drying)	28.67	26.67	21.00	25.33	32.00	**26.73**
D2 (Sun drying)	26.67	26.33	21.33	30.33	32.67	**27.47**
D3 (Silica gel drying)	32.67	30.67	23.00	32.33	29.00	**29.53**
D4 (Hot air oven)	25.67	32.67	19.00	33.33	27.67	**27.67**
D5 (Microwave oven)	29.67	29.67	26.67	34.67	30.33	**30.20**
Mean	**28.67**	**29.20**	**22.20**	**31.20**	**30.33**	
	SED		**SE m±**		**CD at 5%**	
Treatments	0.39		0.55		1.10	
Drying methods	0.39		0.55		1.10	
Interaction	0.87		1.23		2.47	
CV (%)	5.32					

T_1 : Acid lime peel
T_2 : Sweet orange peel
T_3 : Mandarin peel
T_4 : Pomegranate rind
T_5 : Custard apple skin

g) followed by D_2 (Sun drying) (27.47 g), while highest dry weight was noticed in D_5 (Microwave oven drying) (30.20 g) followed by D_3 (Silica gel drying) (29.53 g). Significantly combinations D_4T_3 (19.00 g) produced lowest dry weight fruit peel. Whereas, highest dry weight (34.67 g) was recorded in treatment combination D_5T_4, which was statistically at par with D_4T_4 (33.33 g) with regards interaction effect of peel and drying methods. Highest dry weight was recorded in Pomegranate rind dried by microwave oven because of drying was completed only in minutes electronically produced microwaves liberate moisture from organic substances by agitating the water molecules is the principle lying behind the quickest microwave oven drying (Bhutani, 1990). Lowest was recorded in mandarin peel dried by hot air oven drying because of peels are easily dried in oven at 40°C and uniform temperature in the oven removed the moisture and due to small size of the peels are used.

Moisture loss (%)

The fresh and dry weights of different fruit peel taken for calculating the percentage moisture loss. Per cent loss in weight was analysed with completely randomised design and the data were subjected to arc sine transformation. Data indicate the influence of fruit peel, drying methods and their interactions on per cent loss of moisture (table 2). Out of the fruit peels tested to remove moisture the loss was highest for mandarin peel (77.67%) followed by T_1 (Acid lime peel) (71.00%), while minimum moisture loss was observed in T_4 (Pomogranate rind) (68.87%) followed by T_5 (Custard apple skin) (69.67%). Among the drying methods, significantly highest moisture loss was noticed in D_1 (Air drying) (73.07%) followed by D_2 (Sun drying) (72.60%), while microwave oven drying (T_5) (69.80%) had minimum moisture loss followed by T_3 (Silica gel drying) (70.47%). The percent moisture loss was significantly influenced by fruit peel and drying methods presented the table 2 highest moisture loss was recorded in combination of D_4T_3 (81.00%), which was statistically on par with combination D_2T_3 (79.00%), whereas minimum moisture loss was recorded in D_5T_4 (65.33%) followed by D_5T_4 (67.00%).

Table 2 : Influence of drying methods on moisture loss (%) of different fruit peels and skins.

Method of drying	T_1	T_2	T_3	T_4	T_5	Mean
D1 (Air drying)	*71.33(57.61)	73.33(58.90)	78.00(62.01)	74.67(59.78)	68.00(55.55)	**73.07**(58.77)
D2 (Sun drying)	73.33(58.89)	73.67(59.10)	79.00(62.74)	69.67(52.56)	67.33(55.12)	**72.60**(58.77)
D3 (Silica gel drying)	67.33(55.12)	69.33(56.35)	77.00(61.32)	67.67(55.33)	71.00(57.40)	**70.47**(57.10)
D4 (Hot air oven)	72.67(58.46)	67.33(55.12)	81.00(64.14)	67.00(54.92)	72.33(58.24)	**72.07**(58.18)
D5 (Microwave oven)	70.33(56.98)	70.33(56.98)	73.33(58.89)	65.33(53.91)	69.67(56.56)	**69.80**(56.66)
Mean	**71.00**(57.41)	**70.80**(57.29)	**77.67**(61.82)	**68.87**(56.10)	**69.67**(56.58)	
	SED		**SEm±**		**CD at 5%**	
Treatments	0.27		0.38		0.76	
Drying methods	0.27		0.38		0.76	
Interaction	0.60		0.85		1.70	
CV (%)	1.80					

T_1 : Acid lime peel
T_2 : Sweet orange peel
T_3 : Mandarin peel
T_4 : Pomegranate rind
T_5 : Custard apple skin
*Figures in parenthesis are the angular transformed values.

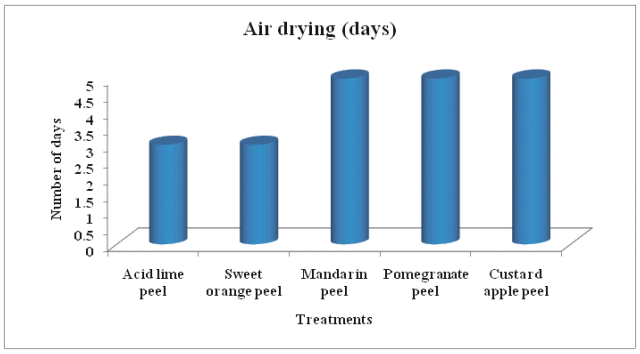

Fig. 1 : Influence of air drying on time taken to dry different fruit peels and skins for making potpourris.

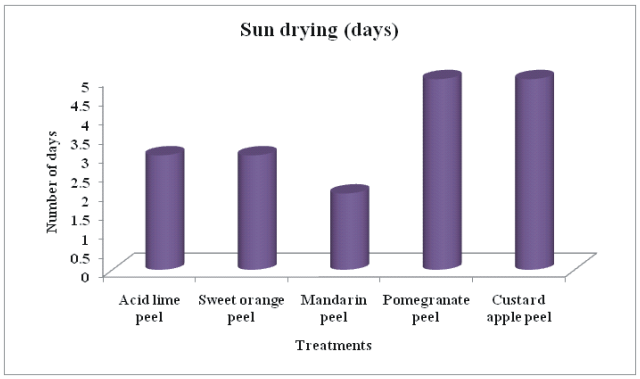

Fig. 2 : Influence of sun drying on time taken to dry different fruit peels and skins for making potpourris.

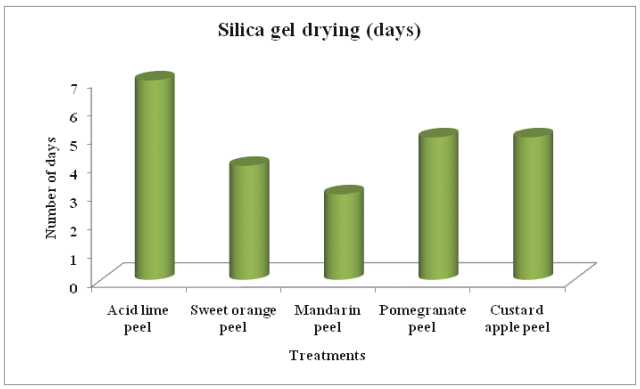

Fig. 3 : Influence of silica gel drying on time taken to dry different fruit peels and skins for making potpourris.

Maximum loss of moisture was noticed from mandarin peel dried by hot air oven, uniform temperature in the oven removed the moisture and due to small size of the peels are used, moisture was lost at a faster rate. From the discussion, its concluded that drying the mandarin peel in electrically operated hot air oven at 40^0C was found to be the best. Pomogranate rind dried by microwave oven drying was recorded in lowest loss in moisture may because of less initial moisture and drying completed in minutes.

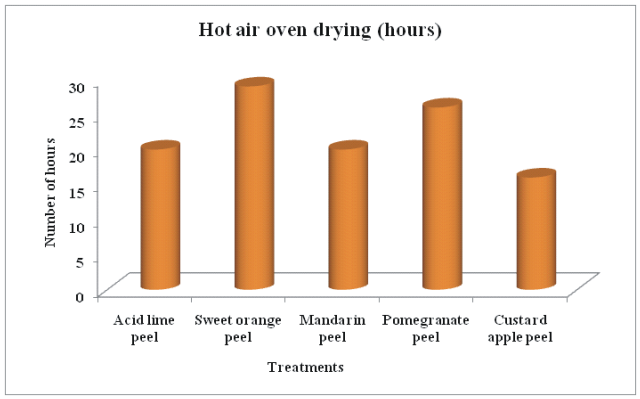

Fig. 4 : Influence of hot air oven drying on time taken to dry different fruit peels and skins for making potpourris.

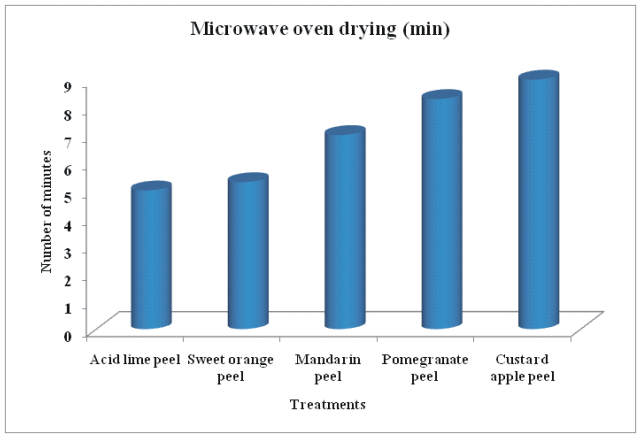

Fig. 5 : Influence of microwave oven drying on time taken to dry different fruit peels and skins for making potpourris.

Time taken for drying (days/hours/minutes)

Drying process for fruit peels/skin was significantly different for type of fruit peel and method of drying. Among the methods dried range 3-5 days in air drying and sun drying, 3-7 days in silica gel drying method, 16 hours to 29 hours in hot air oven and 5-9 minutes in microwave oven method drying. Among the peels under air drying process acid lime and sweet orange peel took least num of days (3 days) to dry, while mandarin peel, pomegrante rind and custard apple peel took 5 days to dry (fig. 1). Under sun drying method (fig. 2) mandarin peel dried in a minimum of 2 days followed by acid lime and sweet orange peel (3 days), where as maximum time (5 days) by pomegranate rind and custard apple skin. In silica gel drying method, less number of days (3 days) recorded to dry mandarin peel followed by pomegranate rind and custard apple peel (4 days) where as maximum of 7 days were taken to dry acid lime peel and 5 days were taken by sweet orange peel (fig. 3). The drying time for different peels was varied differently in hot air oven (fig. 4). It was observed that custard apple skin took less

Acid lime peel

Sweet orange peel

Mandarin peel

Pomegranate rind

Custard apple peel

Plate 1 : Effect of drying techniques on different fruit peels and skin.

Plate 2 : Dried different fruit peels used as potpourris.

Plate 3 : Dried produce arranged as potpourris.

Acid lime peel

Custard apple peel

Sweet orange peel

number of hours (16 hours) to dry completely followed by 20 hours and 20 hours 30 minutes for acid lime peel and mandarin peel. However maximum time was taken by 29 hours sweet orange peel and pomegranate rind (26 hours). The time taken to dry acid lime peel in microwave oven drying (fig. 5) was recorded 5 minutes, while maximum time taken by 9 minutes for custard apple skin followed 8.30 minutes pomegranate rind, 7 minutes to mandarin peel and 5.30 minutes sweet orange peel for completed drying.

Conclusion

From the investigations, it can be concluded that effects of fruit peel and drying methods, combinations of D_4T_3 (Hot air oven + Mandarin peel) (19.00 g) produced

Mandarin peel

Pomegranate rind

lowest dry weight fruit peel. Whereas, highest dry weight (34.67 g) was recorded in treatment combination D_5T_4 (Microwave oven + Pomegranate rind)**.** Highest moisture loss was recorded in combination of D_4T_3 (Hot air oven + Mandarin peel) (81**.**00%), whereas minimum moisture loss was recorded in D_5T_4 (Microwave oven + Pomegranate rind) (65.33%). Among the peels under air drying process acid lime and sweet orange peel took least number of days (3 days) to dry. Under sun drying method, mandarin peel dried in a minimum of 2 days. In silica gel drying method, less number of days (3 days) recorded to dry mandarin peel. It was observed that custard apple skin took less number of hours (16 hours) to dry in hot air oven. The time taken to dry acid lime peel in microwave oven drying was recorded 5 minutes. From the results of this study, it is understood that even though different methods can be used for drying, certain techniques are suitable only to some fruit peel. Of all the methods tried, the method suitable for most off lowers which is economically and commercially Microwave, hot air oven drying is the best. The dried in these techniques were used for potpourri. Mixture of dry flowers, plant parts and farm plant waste *etc*. with additional natural flavours can be made into potpourris and can generate income out of waste.

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