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Standardization of methodology for drying and value addition of non-traditional ornamental flowers

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Abstract
The present investigation was conducted to standardize the methodology for drying and value addition of non-traditional ornamental flowers. The harvested flowers were subjected to different drying methods by embedding them in silica gel. The maximum sensory score for colour (3.70), brittleness (3.63), shape retention (3.99) and appearance (3.86) of non-traditional ornamental flowers was recorded in ambient drying at lab condition for 24 hours where as maximum texture (3.75) was recorded in hot air oven drying at 40 ºC for 6 hours. Among different materials evaluated for drying, *Cassia fistula* recorded maximum sensory score for colour (3.85), texture (3.53) and brittleness (3.43) where as *Euphorbia milii* recorded maximum score (3.60) for shape retention and appearance (3.38) than others. With respect to different methods of drying, minimum dry weight (0.032 g) and maximum moisture loss per cent (85.34%) of the dried non-traditional ornamental flowers was recorded when subjected to hot air oven drying for 6 hours at 40 ºC and ambient drying for 24 hours at lab condition respectively when compared to the microwave oven drying method.

Keywords: Methodology, drying, value addition, non-traditional ornamental flowers

1. Introduction

Flowers are synonyms of delight and blissfulness due to their power to make people happy and cheerful and have become an integral part of human life from the dawn of civilization and love for them is considered the most natural instinct in human being from birth to death. Fresh flowers are quite attractive, but very expensive, short lived and they are integral parts of indoor decoration as they bring outdoor into homes and offices. Every year more than 8 MT of flowers are dumped in the river as a part of temple waste. A colourful solution to save this flower waste is dehydration or drying which maintain the charm of flowers and also renews the life of flowers once again. Flower drying or dehydration is an exotic physical process with the unique ability to preserve a life appearance and colour in beautiful blooms. The most common methods of drying of flowers include press drying, air drying, desiccant (borax, silica gel and sand) drying, microwave drying and hot air oven drying.

2. Materials and Methods

The present investigation was carried out during 2020-2021 in the Department of Post Harvest Technology, KRC College of Horticulture, Arabhavi of Belgaum district, Karnataka, India to assess the different methods of drying on dried flower quality of non-traditional ornamental plant parts. The experiment was laid out in Factorial CRD design with three replications. The plant parts were harvested with sharp secateurs in early morning within 9 am. Immediately after picking, five flowers per replication were imposed for each treatment. The harvested flowers are placed in trays and subjected to different drying methods by embedding with silica gel. After the completion of drying process, the containers were gently inclined over to remove the dried flower from embedding material without making any mechanical damage. The dried flowers were lifted up by hand; clean the embedding material which is adsorbed on the flower by inverting them and tapping the stems with fingers slowly. Remaining desiccants were finally cleaned by using fine brush and these flowers were kept for storage in transparent pet jars to assess the storage quality of dried flowers with different parameters such as fresh weight (g), dry weight (g), moisture loss (%), time taken for drying and moisture retention (%), sensory evaluation (colour, shape, brittleness, texture and over all acceptability) were recorded.

3. Result and Discussion

3.1 Dry weight (g), moisture loss (%) and time taken for drying in freshly prepared dried flowers

The influence of method of drying and material used on dry weight of flower (Table 1) during storage period was found to significant however, The minimum dry weight of 0.004 g was recorded in treatment combination D_3M_5 (Hot air oven drying + *Ixora chinensis)* and D_1M_5 (Ambient drying + *Ixora chinensis*) while, it was found maximum 0.083 g in the treatment combination D_1M_3 (Ambient drying + *Tabernaemontana divaricata*). These results are in accordance with Joshi and Jadhav, (2020) [3] illustrating among different drying techniques maximum dry weight was observed in silica gel drying technique with mean score 0.54. Anuroopa *et al*. (2016) [1]; carnation var. Soto and gerbera embedded in silica gel recorded maximum dry weight of 1.79 g under hot air oven.

Table 1: Fresh weight, dry weight and moisture loss per cent for drying of non-traditional ornamental flowers as influenced by method of drying and materials used

Treatments	Fresh weight (g/flower)	Dry weight (g/flower)	Moisture loss (%)	Time taken for drying (hrs)
Method of drying (D)				
D_1: Ambient drying for 24 hours at lab condition	0.335	0.038	85.34	105.4
D_2: Micro oven drying for 30 seconds at 40 PD	0.245	0.035	81.78	0.039
D_3: Hot air oven drying for 6 hours at 40 °C	0.206	0.032	84.97	36.00
Mean	0.262	0.034	84.03	47.14
S.Em±	0.011	0.002	0.332	0.001
CD @1%	0.045	0.009	1.310	0.003
Material used (M)				
M_1: *Caesalpinia pulcherrima* (flower)	0.441	0.061	82.05	83.68
M_2: *Euphorbia milii* (flower)	0.093	0.016	82.73	46.00
M_3: *Tabernamontana divaricate* (flower)	0.642	0.077	87.16	24.01
M_4: *Cassia fistula* (flower)	0.083	0.015	79.34	60.02
M_5: *Ixora chinensis* (flower)	0.051	0.006	88.86	22.00
Mean	0.262	0.034	84.03	47.14
S.Em±	0.014	0.002	0.429	0.001
CD @1%	0.058	0.008	1.704	0.004
Interaction effect (DxM)				
D_1M_1- Ambient drying + *Caesalpinia pulcherrima*	0.855	0.078	90.19	191.0
D_1M_2- Ambient drying + *Euphorbia milii*	0.105	0.012	83.82	96.00
D_1M_3- Ambient drying + *Tabernamontana divaricate*	0.594	0.083	85.33	48.00
D_1M_4- Ambient drying + *Cassia fistula*	0.082	0.012	78.35	144.0
D_1M_5- Ambient drying + *Ixora chinensis*	0.039	0.004	89.03	48.00
D_2M_1- Micro oven drying + *Caesalpinia pulcherrima*	0.207	0.054	71.92	0.050
D_2M_2- Micro oven drying + *Euphorbia milii*	0.084	0.024	75.69	0.027
D_2M_3- Micro oven drying + *Tabernamontana divaricate*	0.776	0.079	88.64	0.035
D_2M_4- Micro oven drying + *Cassia fistula*	0.085	0.010	84.02	0.075
D_2M_5- Micro oven drying + *Ixora chinensis*	0.075	0.009	88.65	0.011
D_3M_1- Hot air oven drying + *Caesalpinia pulcherrima*	0.262	0.052	84.04	60.00
D_3M_2- Hot air oven drying + *Euphorbia milii*	0.091	0.011	88.69	42.00
D_3M_3- Hot air oven drying + *Tabernamontana divaricate*	0.555	0.069	87.53	24.00
D_3M_4- Hot air oven drying + *Cassia fistula*	0.083	0.023	75.67	36.00
D_3M_5- Hot air oven drying + *Ixora chinensis*	0.039	0.004	88.91	18.00
Mean	0.262	0.034	84.03	47.14
S.Em±	0.024	0.004	0.742	0.002
CD @1%	0.098	0.017	1.850	0.007

PD – Power density

Interaction effect between the method of drying and material used was found to be significant with respect to moisture loss per cent (Table 1). The moisture loss per cent of the dried flowers was found to be maximum (90.19) was recorded in treatment combination of D_1M_1 (Ambient drying + *Caesalpinia pulcherrima*) while, it was found minimum 71.92 per cent was observed in combination of D_2M_1 (Micro oven drying + *Caesalpinia pulcherrima*). The difference in moisture loss per cent might be due to strong hygroscopic nature of silica-gel. The above findings are in agreement with Joshi and Jadhav (2020) [3]; moisture loss of 93.08% was observed when the dutch roses were embedded in silica gel. Wilson *et al*. (2013) [9]; when chrysanthemum (*Dendranthema grandiflorum* Tzevlev) was subjected to ambient drying maximum moisture loss content of 79.31% was observed.

Interaction effect between the method of drying and material used was found to be significant with respect to time taken for drying (Table 2) The moisture loss per cent of the dried flowers was found to be maximum (96 hrs) when *Tabernaemontana divaricata* was subjected to ambient drying (D_1M_3) while, it was found minimum (0.029 hrs) when *Ixora chinensis* was subjected to micro oven drying at 40 PD (D_2M_5). This might be due to vary in fresh weight and moisture content of different flowers. These results were in accordance with earlier reports of Rathod *et al.* (2021) [4] that the time taken for drying in microoven drying resulted best quality dry flowers within a short time. According to Singh and Dhaduk (2004) [7] reported that drying in silica gel is faster without any deterioration in quality. These results in conformity with earlier findings of Sudeep (2018) [8] by embedding orchid var. Sonia-17 in silica gel it took 48 hours for drying.

3.2 Visual quality parameters of the dried flowers as influenced by method of drying and material used on the keeping quality of the dried flowers

The effect of sensory evaluation parameters on method of drying and material used was conducted by a panel of judges. However, among the interaction effect between the method of drying and material used (Figure 4) ambient drying recorded maximum score in *Caesalpinia pulcherrima* for all the sensory parameters this is due to non bleaching action of silica gel and supported with similar findings of Aravinda and Jayanthi (2004) [2] by embedding chrysanthemum cv. Button types in sand where as *Thuja occidentalis* recorded maximum score for texture (4.05) and brittleness (3.95) might be due to silica-gel property of inertness to water vapour or it could be stated that the differences in brittleness of the materials used might be due to varietal character.

Table 2: Influence of method of drying and material used on colour, texture and brittleness of dried non-traditional ornamental flowers as assessed through sensory evaluation

Treatments	Colour	Texture	Brittleness
Method of drying (D)			
D_1: Ambient drying for 24 hours at lab condition	3.70	3.75	3.63
D_2: Micro oven drying for 30 seconds at 40 PD	3.01	2.88	2.92
D_3: Hot air oven drying for 6 hours at 40 °C	3.65	3.38	3.31
Mean	3.45	3.33	3.28
S.Em±	0.09	0.07	0.08
CD @1%	0.27	0.22	0.25
Material used (M)			
M_1: *Caesalpinia pulcherrima* (flower)	3.20	3.13	3.13
M_2: *Euphorbia milii* (flower)	3.43	3.45	3.31
M_3: *Tabernamontana divaricate* (flower)	3.55	3.36	3.38
M_4: *Cassia fistula* (flower)	3.85	3.53	3.43
M_5: *Ixora chinensis* (flower)	3.23	3.21	3.16
Mean	3.45	3.33	3.28
S.Em±	0.12	0.09	0.11
CD @1%	0.49	0.37	0.46
Interaction effect (DxM)			
D_1M_1- Ambient drying + *Caesalpinia pulcherrima*	4.15	4.00	3.80
D_1M_2- Ambient drying + *Euphorbia milii*	3.55	3.90	3.75
D_1M_3- Ambient drying + *Tabernamontana divaricate*	3.60	3.60	3.40
D_1M_4- Ambient drying + *Cassia fistula*	3.97	3.80	3.60
D_1M_5- Ambient drying + *Ixora chinensis*	3.25	3.49	3.60
D_2M_1- Micro oven drying + *Caesalpinia pulcherrima*	2.25	2.30	2.45
D_2M_2- Micro oven drying + *Euphorbia milii*	3.30	3.15	3.05
D_2M_3- Micro oven drying + *Tabernamontana divaricate*	3.10	2.90	3.10
D_2M_4- Micro oven drying + *Cassia fistula*	3.55	3.20	3.15
D_2M_5- Micro oven drying + *Ixora chinensis*	2.85	2.85	2.85
D_3M_1- Hot air oven drying + *Caesalpinia pulcherrima*	3.20	3.10	3.15
D_3M_2- Hot air oven drying + *Euphorbia milii*	3.45	3.30	3.15
D_3M_3- Hot air oven drying + *Tabernamontana divaricate*	3.95	3.60	3.65
D_3M_4- Hot air oven drying + *Cassia fistula*	4.05	3.60	3.55
D_3M_5- Hot air oven drying + *Ixora chinensis*	3.60	3.30	3.05
Mean	3.45	3.33	3.28
S.Em±	0.20	0.16	0.18
CD @1%	0.82	0.65	0.74

PD – Power density

Table 3: Influence of method of drying and material used on shape retention and appearance of dried non-traditional ornamental flowers as assessed through sensory evaluation

Treatments	Shape retention	Appearance
Method of drying (D)		
D_1: Ambient drying for 24 hours at lab condition	3.99	3.86
D_2: Micro oven drying for 30 seconds at 40 PD	2.75	2.78
D_3: Hot air oven drying for 6 hours at 40 °C	3.30	3.29
Mean	3.34	3.31
S.Em±	0.06	0.07
CD @1%	0.26	0.30
Material used (M)		
M_1: *Caesalpinia pulcherrima* (flower)	3.20	3.36
M_2: *Euphorbia milii* (flower)	3.60	3.38
M_3: *Tabernamontana divaricate* (flower)	3.40	3.34
M_4: *Cassia fistula* (flower)	3.40	3.36
M_5: *Ixora chinensis* (flower)	3.13	3.11
Mean	3.34	3.31

S.Em±	0.08	0.09
CD @1%	0.34	0.38
Interaction effect (DxM)		
D_1M_1- Ambient drying + *Caesalpinia pulcherrima*	4.20	4.40
D_1M_2- Ambient drying + *Euphorbia milii*	4.41	4.00
D_1M_3- Ambient drying + *Tabernamontana divaricate*	3.85	3.50
D_1M_4- Ambient drying + *Cassia fistula*	3.55	3.60
D_1M_5- Ambient drying + *Ixora chinensis*	3.95	3.80
D_2M_1- Micro oven drying + *Caesalpinia pulcherrima*	2.15	2.50
D_2M_2- Micro oven drying + *Euphorbia milii*	3.30	3.10
D_2M_3- Micro oven drying + *Tabernamontana divaricate*	2.75	2.83
D_2M_4- Micro oven drying + *Cassia fistula*	3.20	3.05
D_2M_5- Micro oven drying + *Ixora chinensis*	2.35	2.45
D_3M_1- Hot air oven drying + *Caesalpinia pulcherrima*	3.25	3.20
D_3M_2- Hot air oven drying + *Euphorbia milii*	3.10	3.05
D_3M_3- Hot air oven drying + *Tabernamontana divaricate*	3.60	3.70
D_3M_4- Hot air oven drying + *Cassia fistula*	3.45	3.45
D_3M_5- Hot air oven drying + *Ixora chinensis*	3.10	3.09
Mean	3.34	3.31
S.Em±	0.13	0.16
CD @1%	0.54	0.66

PD – Power density

Similarly *Euphorbia milii* recorded maximum score for shape retention under ambient conditions depicted in figure 5, while, minimum score for color (2.25), texture (2.30), brittleness (2.45), shape retention (2.15) was recorded in *Caesalpinia pulcherrima* subjected to micro oven drying at 40 PD where as minimum score for appearance was recorded in *Ixora chinensis* subjected to micro oven drying at 40 PD. These results were in accordance with earlier reports of Joshi and Jadhav (2020) [3]; silica gel drying technique was found significantly superior for colour and appearance of the dried flowers. Raval and his associates in the year 2020 reported that in silica gel dried flower quality was very well maintained. They concluded that for rose flower, embedded drying technique is best in which shape, size, colour are maintained. Safeena *et al.*, (2006) opined that drying different varieties of rose with silica gel gives good result for colour, appearance and texture. Wilson *et al*. (2013) [9]; Best score of 4.60 for color retention was observed when chrysanthemum (*Dendranthema grandiflorum* Tzevlev) was subjected to ambient drying.

3.3. Development of value added products from dried non-traditional ornamental flowers

The experiment was conducted to assess and evaluate the effect of silicone mould and material used on visual quality parameters of resin embedded products. The trail was laid out in analytical method using description analysis with three replications.

It was evidenced from the present study that, the maximum sensory score for all the visual quality parameters were found highest in paper weight embedded with both flower and foliage. There was no change in any of the visual quality parameters during the four months storage of resin embedded products.

Table 4: Sensory parameters of resin embedded products by utilizing dried non-traditional ornamental plant parts

Treatments	Colour	Shape	Appearance	Contrast	Synchronisation of segments
T_1	3	4	3	3	3
T_2	4	3	4	3	3
T_3	4	4	4	4	4
T_4	3	4	3	3	4
T_5	4	4	4	4	4
T_6	4	4	4	4	4
T_7	3	4	4	3	4
T_8	3	4	3	4	3
T_9	4	4	4	3	3
T_{10}	4	4	4	4	4
T_{11}	4	4	4	4	4
T_{12}	5	5	5	4	5
Mode	4	4	4	4	4

T_1 – Table coaster embedded with only foliage
T_2 – Table coaster embedded with only flowers
T_3 – Table coaster embedded with both flower and foliage
T_4 – Book mark embedded with only foliage
T_5 – Book mark embedded with only flowers
T_6 – Book mark embedded with both flower and foliage
T_7–Wall mount embedded with only foliage
T_8– Wall mount embedded with only flowers
T_9– Wall mount embedded with both flower and foliage
T_{10}–Paper weight with only foliage
T_{11} –Paper weight with only flowers
T_{12}–Paper weight embedded with both flower and foliage

Table 5: Sensory parameters of resin embedded products by utilizing dried non-traditional ornamental plant parts through sensory evaluation

Treatments	Weight compatibility	Handling Feasibility	Transparency	Aesthetic beauty	Overall acceptability
T_1	4	4	4	3	3
T_2	4	4	4	4	4
T_3	4	4	4	4	4
T_4	4	4	4	3	3
T_5	4	4	4	4	4
T_6	4	4	4	4	4
T_7	4	4	4	4	4
T_8	4	3	3	4	3
T_9	4	4	4	4	4
T_{10}	4	4	4	4	4
T_{11}	4	4	4	4	4
T_{12}	5	5	5	5	5
Mode	4	4	4	4	4

T_1 – Table coaster embedded with only foliage
T_2 – Table coaster embedded with only flowers
T_3 – Table coaster embedded with both flower and foliage
T_4 – Book mark embedded with only foliage
T_5 – Book mark embedded with only flowers
T_6 – Book mark embedded with both flower and foliage
T_7–Wall mount embedded with only foliage
T_8– Wall mount embedded with only flowers
T_9– Wall mount embedded with both flower and foliage
T_{10}–Paper weight with only foliage
T_{11} –Paper weight with only flowers
T_{12}–Paper weight embedded with both flower and foliage

4. Conclusion

It was evidenced from the present study that, the sensory score for colour, texture, brittleness, shape retention and appearance for dried flower during storage period as influenced by method of drying and material used was found to be maximum when different flowers like *Caesalpinia pulcherrima*, *Euphorbia milii*, *Tabernamontana divaricate*, *Cassia fistula*, *Ixora chinensis* dried in ambient drying for 24 hours at lab condition by using silica gel as embedding media found ideal for quality dry flower production and the consumers disclosed keenness in learning about developed value added products such as bookmarks, table coasters, paper weights and wall mounts. The existing technology has the potential to employ thousands of people especially to unemployed youths, Schools and College drop-outs, housewives and rural women's as boundless artistic and embellished products can be designed using dry flowers. There is a necessity to generate adequate consciousness about the potential of this technology by workshops, exhibitions and seminars etc.

5. References

1. Anuroopa TR, Sudeep HP, Shivakumar Patil KS, Divya B. Standardization of drying temperature and time in hot air oven of carnation. Envi and Eco. 2016;34:377-380.
2. Aravinda K, Jayanthi R. Standardization of drying techniques for chrysanthemum (*Dendranthema grandiflora* T.) cv. Button Type Local. J of Orn. Hort. 2004;7(4):370-375.
3. Joshi SN, Jadhav VS. A study on dehydration of dutch rose and value added products. Int. J Pharmacogn. Phytochem. Res. 2020 ;9(3):1217-1220.
4. Rathod P, Vala M, Maitreya B. Drying techniques of some selected ornamental flowers. Int. J Dev. Res. 2021;6(4):180-186.
5. Raval R, Jayswal S, Maitrey B. Drying techniques of selected flowers. Int. J Appl. Sci. Eng. 2020;8(6):1608-1611.
6. Safeena SA, Patil VS, Naik BH. Response of drying in hot air oven on quality of rose flowers. J Orn. Hort. 2006;9(2):114-117.
7. Singh A, Dhaduk BK. Dehydration technology for some selected flowers. Indian Soc. Orn. Hort. 2004, 120.
8. Sudeep HP, Seetharamu GK, Aswath C, Munikrishnappa PM, Sreenivas KN, Basavaraj G. Standardization of embedding media and drying temperature for superior quality of dry orchid flower production var. Sonia-17. Int. J Pure App. Biosci. 2018;6(2):69-73.
9. Wilson D, Attri BL, Sharma SK. Evaluation of different methods for drying of chrysanthemum flowers. J Asian hortic. 2013;8(2):743-745.
10. Wilson R, De Sumanthapa LC, Singh DR. Drying technologies of commercial flower. Int. J of Res. in Applied, Natural and Social Sci. 2016;4(3):111-120.