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Effect of Embedding Media on the Quality of Tinted Chrysanthemum (*Dendranthema grandiflorum*) cv. Pusa Shwet Flowers Dried in Hot Air Oven

Jujhar Singh [a*], Prabhjot Saini [a] and Harpreet Kaur [a]

[a] *Department of Agriculture, Mata Gujri College, Sri Fatehgarh Sahib, Punjab – 140407, India.*

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

To enhance the aesthetic beauty of chrysanthemum (*Dendranthema grandiflorum*) cv. Pusa Shwet, tinting is successful approach to achieve desired colors at post harvest stage. Artificial colouring to white flowers fetches more prices as compared to white florets. To preserve tinted chrysanthemum flowers for long time, drying medias with different combinations were used in the experiment entitled, "Effect of embedding media on the quality of tinted chrysanthemum (*Dendranthema grandiflorum*) cv. Pusa Shwet flowers" in hot air oven. To determine the best colour and embedding media in hot air oven, six different combinations were used for drying tinted chrysanthemum flowers i.e., sand, borax, silica gel, sand + borax (1:1v/v), sand + silica gel (1:1v/v), borax + silica gel (1:1v/v). The data was recorded on different parameters like percentage moisture loss, sensory

**Corresponding author: E-mail: jujhar220@yahoo.com,jujhar22-0@yahoo.com;*

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parameters and percent reducing sugar were subjected to analysis with Factorial CRD. The findings of experiment concluded that sand is the most suitable media for drying tinted chrysanthemum flowers in hot air oven. Among used edible food dye colours, yellow colour showed more uniform colour on florets of chrysanthemum when dried in hot air oven.

Keywords: Chrysanthemum; drying media; food colour; dry flowers; hot air oven.

1. INTRODUCTION

Flowers look more attractive when tinted with desired colours to enhance weak or faint colour pigments. It is a successful strategy for getting the appropriate colour at the post harvest stage by altering the colour according to the desired wish [1]. For tinting, white colour flowers are more suitable and desirable than other colours. For decoration purposes when a specific colour is required, tinting of white flowers may be the only option to get the desired colour. Chrysanthemum, tuberose and lillium are popular cut flowers, globally these blooms come in a variety of brilliant, vivid and cleared colours making them the perfect addition to any arrangement [2]. Pusa shwet is white in colour and more acceptable in local market as lose or cut flower. The ease in availability and white coloured florets make it more suitable for tinting. Fresh flowers are very attractive though quite expensive, perishable in nature and available only for a particular season. So, to preserve flowers for a long time, different drying methods are used. The practice of drying flowers is very old age practice. On the other hand, dried flower products have long shelf life and maintain their aesthetic value for a long period of time [3]. Dried flowers and plant parts play an important role and constituent about 70 percent of the total share of floriculture exports from India [4]. Chrysanthemum is also one of them which are suitable for drying purpose. Dehydrated chrysanthemum flowers are in considerable demand in global market. For the quality drying of tinted chrysanthemum flowers and to achieve better results, the hot air oven is used. The hot air oven is selected for getting quality dried flowers at the uniform temperature for the required time period. Therefore, keeping in this view the popularity of dried chrysanthemum flowers, the current studies were made to standardize the drying technology for tinted chrysanthemum flowers (*Dendranthema grandiflorum* L.) with the aim of selecting a most desirable drying embedding media and most suitable tinting colour for dried chrysanthemum.

2. MATERIALS AND METHODS

The experiment was carried out in floriculture lab sponsored by DST under WOS-B project at Mata Gujri college, Sri Fatehgarh Sahib, Punjab during 2022-2023. Different food dyes colour like orange colour, yellow colour and green colour were used for tinted chrysanthemum and six different embedding media like sand, borax, silica gel, sand:borax, sand:silica gel and borax: silica gel are used for drying tinted chrysanthemum in hot air oven. Twenty one flowers per replication were selected for experiment and each treatment was replicated thrice. In hot air oven, the flowers tinted with different food dyes were taken for dehydration. The shallow metallic trays of 2.5 inches deep were used for the drying of flowers and filled with media upto the height of tray. Good quality of flowers have been selected for drying and placed into the suitable media. After setting the flowers, the media was poured lightly and uniformly for protecting the petals without damaging them. The media was equally spread to equalize the pressure on all sides of the flower. After embedding the flowers in media, metallic trays had been put in the hot air oven with suitable temperature and duration. The dehydrated flowers had been taken out from the media carefully. The flowers were picked up from the trays and collected properly one by one. The desiccant from the petals of the flowers was removed with the help of smooth camel hair brush so that the original colour of the dried flower could be seen properly. The data was recorded on different parameters like percent moisture loss, sensory parameters and percent reducing sugar were subjected to analysis with Factorial CRD

3. RESULTS AND DISCUSSION

3.1 Moisture Loss (%)

In chrysanthemum, highest moisture loss (82.61%) was observed in sand as compared to flowers drying with other desiccants. This might be because of fact that sand does not react with

the water vapour produced during the drying process of flowers, whereas least moisture loss (68.84%) was observed in silica gel. Similar findings were observed by Nirmla et al. [5] in carnation. Among colours, maximum moisture loss (80.21%) was observed when flowers tinted with yellow food dye colour and minimum moisture loss (75.14%) was noticed on white colour. Similar findings were observed by According to Oren Shamir Deborah [6], the darkening of the bloom may be caused by greater moisture loss, which causes the pigments to concentrate once the water is lost.

The interaction between media × colour showed the maximum moisture loss (85.07%) was recorded when orange colour flowers dried in sand. Moreover minimum moisture loss (58.62%) was recorded when white colour flowers dried in silica gel. This might be because sand has large particle size and heavier in weight and thus absorbs less moisture as well as it not able to retain moisture for longer duration. These outcomes are as stated by Nirmala et al. [5] in the carnation and Dilta et al. [7] in the rose buds and orange red colour in flowers may be due to the joint expression of anthocyanins and yellow – orange carotenoids. Similar results were observed byBradshaw and Schemske [8]Streisfeld and Rausher [9] in coloured Mimulus flowers.

3.2 Sensory Evaluation

Effect of media on sensory parameters like (colour, shape, texture, brittleness and overall acceptability) was found to be maximum (19.54) in sand followed by silica gel, borax + silica gel and borax. This may be due to the uniform temperature maintained inside the hot air oven which facilitated rapid, uniform and gradual removal of moisture from the flowers. Hence it avoids severe dehydration and shriveling of flowers. This helps in obtaining better quality dry flowers. Similar results can be observed by *Zomuansangi* and Devi Singh [10] in china aster. Saxena [11] also noted that chrysanthemum flower embedded in sand also gave best result. There was no change in colour and structure of flowers. Effect of colour on sensory parameters like (colour, shape, texture, brittleness and overall acceptability) was found to be minimum (17.73) in sand + silica followed by sand + borax, silica gel and borax + silica gel. *Meman* et al. [12] also observed that brighter colored flowers when embedded in sand as a medium. Among colours, effect of sensory parameters (colour, shape, texture, brittleness and overall acceptability) was found to be maximum (19.00) in yellow colour. Similar findings were observed by Mishra et al. [13] and Sangama [14] who concluded that yellow blossoms retain their colour properly after dehydration whereas white, red, blue and other bright ones significantly darken. Kher and Bhutani [15] noted that the embedded drying process produced dry flowers of the highest quality in terms of colour, look, texture, and shape.

The interaction between media × colour on sensory parameters was found to be maximum (20.83) when orange colour flowers dried in sand and minimum (15.17) was found when green colour flowers dried in sand + silica. This might be due to the reason that media had an impact on the flower's colour and texture, because there was more moisture in the flowers dried with silica than with sand alone. Drying with sand generated smoother petal texture also. These results can be supported with similar findings of Aravinda and Jayanthi [16] by embedding chrysanthemum cv. Button type in sand.

3.3 Reducing Sugar (%)

Effect of media on reducing sugar was found to be maximum (9.11%) in hot air oven when flowers embedded with silica gel whereas minimum (5.55%) reducing sugar was recorded when flowers dried in sand + borax. According to different studies done on different fruits and vegetables, it is well known fact that drying increases the concentration of reducing sugar. Similar results can be observed by Desrosier and Desrosier [17] reported that a food losses its moisture content when it is dried. For example, Fresh pear contained 17% carbohydrates, whereas after drying composition percentage increased to 65%. Similar results were observed by Gebhardt et al. [18]. Based on the aforementioned findings, flowers that have lost the maximum moisture have a higher sugar retention rate [19].

The interaction between media × colour on reducing sugar was found to be maximum (11.53%) when green colour flowers dried in silica gel whereas minimum (4.97%) was found to be when yellow colour flowers dried in sand + borax. This could be because of the flowers dried in silica gel may be due to the strong hygroscopic characteristics, which causes a great loss of moisture from the flowers. Hence, there is more concentration of

sugar. Whereas sand is made up of large sized particles and heavier in size which results in less sugar content present in cut flowers. Similar results were observed by Dilta et al. [7].

Table 1. "Effect of tinted colour and embedding media for chrysanthemum (*Dendranthema grandiflorum*) cv. Pusa shwet" in hot airoven and their interaction on different parameters

	Moisture Loss (%)	Sensory Parameters (colour, shape, texture, brittleness and overall acceptability)	Reducing Sugar (%)
		Media	
M_1	82.61	19.54	7.61
M_2	77.44	18.98	5.80
M_3	68.84	18.54	9.11
M_4	80.78	18.21	5.55
M_5	75.25	17.73	6.14
M_6	79.33	18.75	6.47
$CD_{0.05\%}$	2.90	1.12	0.23
		Colour	
C_1	76.99	18.93	6.33
C_2	80.21	19.00	7.33
C_3	77.83	17.68	7.26
C_4	74.47	18.89	6.20
$CD_{0.05\%}$	2.37	0.92	0.19
		Interaction	
M_1C_1	85.07	20.83	7.71
M_1C_2	81.49	19.58	8.81
M_1C_3	79.90	18.17	7.70
M_1C_4	83.98	19.58	6.23
M_2C_1	71.23	19.00	5.58
M_2C_2	75.27	19.08	6.85
M_2C_3	82.12	18.58	5.60
M_2C_4	81.15	19.25	5.18
M_3C_1	67.05	18.75	5.11
M_3C_2	77.71	17.58	10.95
M_3C_3	71.99	18.08	11.53
M_3C_4	58.62	19.75	8.86
M_4C_1	81.72	19.25	6.36
M_4C_2	80.89	18.67	4.97
M_4C_3	83.55	17.17	5.22
M_4C_4	76.97	17.75	5.66
M_5C_1	75.09	16.92	5.42
M_5C_2	84.89	19.25	5.80
M_5C_3	71.84	15.17	7.94
M_5C_4	69.17	19.58	5.40
M_6C_1	81.81	18.83	7.82
M_6C_2	81.01	19.83	6.63
M_6C_3	77.57	18.92	5.60
M_6C_4	76.92	17.42	5.84
$CD_{0.05\%}$	5.80	2.25	0.46

4. CONCLUSIONS

From the present studies, it can be concluded that among edible food dye colours, tinting with yellow coloured dye resulted in uniform colour on florets of chrysanthemum and sand is the most suitable media for dehydration of tinted chrysanthemum flowers in hot air oven. The hot air oven is facilitated uniform and gradual moisture loss during the process of dehydration in tinted chrysanthemum results in yielding quality dried flowers without any shriveled petals of flowers. It helps in preserving shape and size to increase its aesthetic beauty for long period of time.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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