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**Ravindra Reddy Kotla**  
Lovely Professional University,  
Jalandhar, Punjab, India

**Amrita Kumari**  
Assistant Professor, Lovely  
Professional University,  
Jalandhar, Punjab, India

**Abdirahman Hussein Mohamud**  
Lovely Professional University,  
Jalandhar, Punjab, India

**Lahari Yadlapalli**  
Lovely Professional University,  
Jalandhar, Punjab, India

**Corresponding Author**  
**Amrita Kumari**  
Assistant Professor, Lovely  
Professional University,  
Jalandhar, Punjab, India

## Drying of flowers and other ornamental plant parts with different drying techniques

**Ravindra Reddy Kotla, Amrita Kumari, Abdirahman Hussein Mohamud  
and Lahari Yadlapalli**

### Abstract

Dried flower has attained more importance when compared with the fresh flowers in the floriculture industry this happened because of the increasing knowledge on natural environmentally friendly products. Future predictions of the dry flower industry are expected to contribute a lot to the country's economy in comparison to fresh-cut flowers and other live plants. Drying is a process in which there is transfer of mass, in this process there is removal of moisture content from the flower by evaporation. The various techniques of drying are oven drying, embedded drying, sun drying, glycerine drying, microwave drying and freeze drying. Usually, plant materials and the dry flowers is having much more potential as an alternate for the fresh flowers for utilizing them for a variety of other beautiful as well as interior decoration and commercial purposes. Mainly practical data on the drying of various flowers and other ornamental plant parts are used in this review. This could finally be helpful in grabbing the attention of the researchers and various scientists to focus and do some work on it, alongside the entrepreneurs would be directly helped by making use of the knowledge review present in this paper.

**Keywords:** Dehydration, dry flowers, drying techniques, cut flowers, ornamental plants

### Introduction

Flowers have always stayed as an integral part of humankind and love for natural flowers is an inherent instinct. Since Fresh flowers are quite more attractive, but they are very expensive and short shelf-life flowers as well as available only in the particular seasons. As we know that the Dried flower products on the other side, they retain the aesthetic value and long last for many days irrespective of the season (Hiller 1994). The flower drying art is very old practice that is followed in the ancient days for the best utilization of flowers. For the sake of identification of different species of flower, the scientists those belong to the botany department used to make an herbarium using earlier dry flowers (Prasad *et al.* 1997) [3]. In 'The Florist' Pub-lashed in 1860, author had explained the different techniques of drying pansies, stock, red roses, and many other single flowers in the sand for the drying of flowers. It is said that even though flower drying is well known in the olden days but commercially in the Germany for the very first time the flowers were dried (Louis and Gibson 1982).

Dried and stored products which are made from the ornamental plant parts is having a very big scope and demand in the market and they have the qualities like aesthetic properties and long-lasting ability and so on, and they can also be for year around (Joyce 1998). The dried ornamental plant parts are usually much cost effective compared with the fresh flowers and moreover the aroma of the dry flowers is also not lost and stays everlasting with the attractive features in it (Smith 2000) [24]. When compared with the other areas of floriculture very few research and projects were taken on the dry flower industry around the globe. Many numbers of workers have explained the different ways of drying flowers and other ornamental plant parts and make it loose water for the best use (Dubois and Joyce 1989; Bhutani 1995; Westland 1995) [16, 5, 10]. For making different decorations using the flowers like landscapes, hanging baskets on the wall, cards, potpourris and so on can be made by drying of Foliage using different methods like embedded drying, freeze drying, oven drying, microwave oven drying (Bhutani 1990; Bhalla and Sharma 2002) [10, 9]. Potpourris is one of the main segments of dry flower industry and its value is at Rs. 55 crores in India itself (Murugan *et al.* 2007) [17].

Drying and preserving flowers and plant materials is a form of artistic expression that was very popular during the Victorian age and has once again gained popularity. In dry flower industry India is leading and able to contribute major percent in the world market. This industry publishes the increase in growth rate 15% per year.

There are many reasons for the well development of dry flower industry in India they are very much Easy availability of products from forests, chance of availability of human power for labour intensive craft preparation and making the products available of wide range of products throughout the year are the key reasons for well development of dry flower industry in India. This industry provides direct employment to around 15,000 persons and indirect employment to around 60,000 persons.

**Time taken for drying (DAYS)**

The given below table depicts the difference in drying time that takes among the drying techniques used for drying of flowers (Jatropha pandurifolia), foliage (*Tabernaemontana divaricata*, *Murraya paniculate*, *Terminallia mentalis*, *Grevillea robusta*, *Nephrolepis exaltata*, *Raphis excelsa*, *Juniperus chinensis*), bracts (*Bougainvillea* spp) and pods (*Koelreutaria panniculata*) was found to be non-significant in inverted in dry flower industry and it is proved from this is that vertical drying technique is significantly lower than water drying. Verma *et al.* 2012 told that that might be because of the replacement of moisture present in plant parts through evaporation resulting in taking more time for drying.

**Time taken for drying (Hours)**

The given below table depicts the difference in drying time that is taking among the drying techniques used for drying of

flowers and that resulted in time taken to dry the plant parts of different species was considerably different from each. When compared with the other techniques the flowers which are dried with press drying technique took higher time for drying. The reason behind this may be because of texture of foliage and the flowers which leads in taking deliberate time for removal of moisture. Among all the flowers maximum time is taken by the Foliage of *Murraya paniculata* which was dried with the press drying and preserved with glycerine which was considerably higher from air, sand plus oven and sun drying techniques. When it comes to the Foliage of *Tabernaemontana divaricata* when it is preserved with glycerine took considerably higher time for drying than other drying techniques. In case of *Grevillea robusta*, foliage dried with air drying took considerably much time for drying when compared with other techniques. The reason behind this may be because of texture of foliage and the flowers which leads in taking deliberate time for removal of moisture from it and took more time for drying in air drying technique.

When compared with the other methods of drying, drying the ornamental plant parts with sand and silica gel in hot air oven took very less time that's because the specimens were kept under high temperature and with gradual increase in the temperature the air inside decreases and results in the increase in the vaporization rate, resulting in the removal of moisture in short duration at higher temperature.



**Drying Techniques**

There are different methods to dry flowers and foliage. The method we choose to dry flower depends mainly on the character of the plant, that is to say whether the plant is succulent or not succulent, hardy or delicate in nature.

Since all the flowers contains of more moisture content, dehydration is very essential for getting flowers dried.

Methods used for removing water from plants are air drying, oven drying, embedded (combination of sand, borax and the silica gel, these materials), glycerine (glycerinating), microwave oven drying, freeze drying, press drying.

**Air drying**

Air drying is one of the cheapest methods of drying in which

flowers are hung for the sake of drying. Healthy and bit immature stages are selected for drying. Flowers are tied into bunches, ventilated with warm air in the dark area. Flowers take about 1-2 weeks for drying and it depends upon the moisture content present in the surroundings, humidity and temperature (Shailza Rana, 2018).

### Press drying

Press drying is effortless and one of the cheap methods among all the methods. In this method, a flower is put in folds of blotting paper, newspaper, old notebook paper etc. and at the top of it, a heavy object is placed. For drying of flowers, it takes about 3-4 weeks because it depends upon the water content of the tissue in flowers. Time should be reduced if flower folded sheets is put in oven at appropriate temperature.

### Hot air drying

Flowers are dry in the convection chamber; it has a fan inside. For drying, the temperature should maintain between 30 to 35°C. This method takes a few hours to many days to dry flowers. In the chamber, flowers are being placed in slots in a wire mesh. In this process time for drying of flowers depends upon the many numbers of flowers dried at one time within the chamber.

### Glycerine drying

It is one the cost-effective technique that can be followed for drying of foliage's and flowers. This technique attracts the high-water attracting capacity from the specimen (Joyce 1998). When we place the foliage's by either immersing or keeping in 33% glycerol solution, we can get successfully preserved specimens (Dana 1983). preserving foliage and berries in hot water solution and glycerine can make the specimen stay for long duration of time without damaging Westland (1995)<sup>[26]</sup>. It is said that the specimen which is dried by glycerine drying technique is good in quality of product that is because of exchanged moisture content that is present in the flower with blend of water and (Paul and Shylla 2002).<sup>[11]</sup> It is reported that drying in glycerine is successful with most of the foliage's. the ideal mixture of glycerine is 1 part of glycerine mixed with hot water double the amount of glycerine for about 26 plant species to absorb at room temperature Semant *et al.* (1993). Unless and until full absorption has taken place the specimen should be placed in the solution only. Since the Glycerine acts as a good source for micro-organisms we need to place small amount of antibiotics in the media to prevent the growth of the microorganisms in the dried specimens (Prasad *et al.* 1997)<sup>[3]</sup>. To preserve the magnolia stems the ratio of glycerine and the hot water is at a ratio of 1:2 volume/volume (Sell 1993). As they easily translocate the solution ready to the stems He concluded and reported that mature leaves respond very well to this treatment. It is said that glycerolizing exchange water content of leaves giving them a strong and soft nature Verey (1994) and he mentioned that this method is more suitable for plants like magnolia, hydrangea, ivy. In glycerol preservation generally gelatinous feeling on the specimen is observed but the glycerol and microwave preservation maintained the flexibility of the flower McCallister 1988. After preserving the foliage's of various ornamental plant parts for different durations of time he noted and concluded that Mahonia spp. Took 3-6 weeks, Aspidistra spp. took 12 weeks followed by Fatsia japonica (7-10 weeks), Mahonia spp. (3-6 weeks), Magnolia spp. (3-4 weeks) and a minimum of 2-weeks by

Eucalyptus spp. Healey (1986)

### Embedded drying

Borax, silica gel, sawdust, sand, perlite and combination dehydration of these are used as the media for the embedding flowers. Among these, sand and borax are the cheapest but it takes more time for drying flowers. For delicate flowers like dahlia, carnation, roses, etc., silica gel is the ideal drying agent as per Prasad *et al.* 1997<sup>[3]</sup>. The desiccant method is a very useful method which helps in removing moisture from all the delicate flowers that might fall apart when air-dried as recommended by Thomler in 1997<sup>[21]</sup>. Among the desiccants like cornmeal, borax, sand, and silica gel used, silica gel as a desiccant is one of the best media for drying of flowers.

Champoux in 1997<sup>[20]</sup> reported silica gel as the best medium for getting excellent dried flowers that retain colour and shape. Desh Raj 2006 found that it is difficult to avoid shrinkage and changes in the morphology of the dehydrated ornamental plant material during hang-drying mainly due to the loss of moisture from the cells. The flowers and foliage need to be embedded very carefully during embedding of flowers in various desiccants such as sand or silica gel in a suitable container during air drying to avoid the shrinkage and other morphological changes that might occur Datta 1997<sup>[19]</sup>.

When we embedded the flowers in very deep containers that can accommodate whole ornamental part of a plant part without disturbing its own form and shape of the specimen like chrysanthemum, dahlia (pompon), bougainvillea, candytuft, gerbera, marigold, roses, etc. (Bhutani 1995)<sup>[10]</sup>. Drying zinnia flowers in sand resulted in good quality dried flowers with attractive flower colour and smooth petal texture (Singh *et al.* in 2004.) Orduno and Baltazar 1995<sup>[1]</sup> mentioned that silica gel is not actually a gel but he said that it is granular in shape like sugar. Silica gel is called gel only since it is a xerogel of silicic acid.

Bhutani 1993<sup>[10]</sup> reported that embedding in the silica gel is perhaps one of the easiest and the best methods of embedded drying. Silica gel consists of a huge network of interconnecting microscopic pores which absorbs and holds the water content that is present in flowers by a process known as physical adsorption and capillary condensation. Through this kind of process, it acts as a water removing agent for flowers in removing moisture present in the petals of flowers (Safeena *et al.* 2006b). Silica gel has also been reported that it is the fastest media desiccant in removing the moisture content from the flowers Neave in 1996. Trinklein in 2000 told that because silica gel completely dries flowers very fastly and so many flowers can be moved to and fro using the mixture during a single season.

This method is mainly useful for certain kinds of flowers like delicate flowers having a high moisture content the flowers that shatter when air-dried completely. In order to avoid the petals shrinking problems we can prefer the embedded drying technique for drying which is resulted as one of the best methods of drying. In this method moisture content in the flower is completely removed by the desiccant material surrounding that is present around the flower. The desiccants are commonly used silica gel, cornmeal, borax, etc.

By using this, desiccants moisture is removed very fast from the flowers than the air-drying method and besides that maintains the flowers in natural form. At the seashore, fine white sand (river sand) is found which can be used for the embedding method because it is easily handled and available also. For the excellent quality of dry flowers, retaining colour

and shape, silica gel is the best desiccant.

If embedded for a long time it can't brittle or shrink because it does not cause bleaching. It has an aerogel of silicic acid which is why it is called gel and it has granular in shape. For removing the moisture content from flowers, we need to take desiccants, silica gel (60-120 mesh) is one of the best absorbents (Shailza Rana, 2018).

**Activity:** Embedded the flowers in the silica gel and sand enclosed them with the lid and kept a side



### Conclusion

The main reason for drying the flowers is that the fresh flowers hardly last for about 10 days but the dry flowers last for long time. Among the different drying techniques, the air drying is simple technique to dry the flowers but that technique is not suitable for all kind of flowers.

It is clear that for some kind of flowers particular type of drying technique only suitable for drying when compared with the other technique for that particular type of flowers. For instance, we can the condition in case of *Murraya paniculata* and *Tabernaemontana divaricata*. Among all the flowers maximum time is taken by the Foliage of *Murraya paniculata* which was dried with the press drying and preserved with glycerine which was considerably higher from air, sand + oven and sun drying techniques. When it comes to the Foliage of *Tabernaemontana divaricata* when it is preserved with glycerine took considerably higher time for drying than other drying techniques. In case of *Grevillea robusta*, foliage dried with air drying took considerably much time for drying when compared with other techniques. The reason behind this may be because of texture of foliage and the flowers which leads in taking deliberate time for removal of moisture from it and took more time for drying in air drying technique.

**For embedded drying, sand and borax are the cheapest**

### but it takes more time for drying flowers

Verma *et al.* 2012 told that that might be because of the replacement of moisture present in plant parts through evaporation resulting in taking more time for drying.

Embedding the flowers in a granular, desiccating material is probably the most commonly used method and many consider it is the best all-around method.

Dried flowers are long-lasting, Dried flowers last an average of one year and when the dried flowers are dyed, they even last for couple of years. That's due to loss of water from the flowers they are able to last for years. Finally, I would like to make it clear and conclude that unlike fresh flowers that easily lose their marketable value and quality, dried ornamentals offer longer periods of sale if properly preserved, packaged, and handled. The unique characteristic of dried flowers is that they are versatile in nature. According to one's preferred style they can be arranged into different crafts, design, and use. The dry flower industry is waiting to be explored and needs to be popularized. When we discuss regarding why should we dry flowers we can see many reasons for drying ornamental parts of a plant and one of them is the plenteously available materials. It is assessed that about 80% of flower species can be used for drying and preservation successfully. Educated training and costly equipment are not needed to come up with variety of designs.

Embedding in the silica gel is perhaps one of the easiest and the best methods of embedded drying. It is proven that for particular flowers only particular type of drying technique is suitable for instance if look at the rose only embedded drying technique is suitable because the flower colour, size, and shape are maintained carefully without any damage Along side if we see the gerbera press drying and microwave drying are preferred as the best method for gerbera in which the size, colour and shape are maintained safely.

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