Print : ISSN 0970-7662
Online : ISSN 2455-7129

# Journal of Tree Sciences

*online available at www.ists.in*

Volume 35 No.2 December, 2016

## Dehydration Techniques for Silver Oak (*Grevillea robusta* A.Cunn. ex R.Br.) leaves

**Nandita A Patel and SJ Patil***

Department of Fruit Science
ASPEE College of Horticulture & Forestry
Navsari Agricultural University, Navsari-396450, Gujarat
*E-mail: goldmedalist@rediffmail.com

DOI: 10.5958/2455-7129.2016.00015.7

## ABSTRACT

An experiment was conducted on dehydration of silver oak (*Grevillea robusta)*leavesinvolvingthree temperatures [40$^0$C ($T_1$), 45$^0$C ($T_2$) and 50$^0$C ($T_3$)] and embedding media [River bed sand ($M_1$), Sea sand ($M_2$) and Silica gel ($M_3$)]. Experiment was tried with factorial concept in Completely Randomized Design during 2008-09 at P.G. Laboratory, ASPEE College of Horticulture and Forestry, NAU, Navsari. Quantitative and qualitative parameters influenced by drying temperatures and embedding media. At higher temperatures increased transpiration, respiration and ethylene released recorded which in turn increased per cent moisture loss, which consecutively leds to higher per cent weight loss and lower per cent moisture content in leaves of silver oak as compared to lower temperature. Drying with river sand and sea sand provided good quality of dried foliages with attractive colour and smooth texture but required more drying duration. On the other hand, drying with silica gel was faster without much deterioration in quality of silver oak leaves and therefore it showed good quality of dried foliages with high per cent weight loss, low moisture content and increased per cent moisture loss.

**Keywords:**

Silver oak, embedding media and temperature

## INTRODUCTION

Dehydration of ornamental foliages is a scientific approach to dry fresh foliages in such a manner as to retain their natural colour and shape even after drying, hence the freshness and charm of foliages is extended over a long period of time. Dehydration technology has a great practical application and in increasing demand worldwide, where, dried decorative flowers and foliages are globally accepted as natural, eco-friendly, long lasting and inexpensive. Foliages are useful for drying purposes like a pasting on greeting cards, used in vase, wall hangings, and table decoration in preparing bouquets, pot pourries, wreaths, etc. Thus, it has potentiality to generate employment on large scale in India.

## MATERIAL AND METHODS

The present investigation, dehydration techniques for Silver oak (*Grevillea robusta*) was carried out in the P. G. laboratory of ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari An experiment was conducted with different temperatures *viz.*, 40°C ($T_1$), 45°C ($T_2$) and 50°C ($T_3$) with three embedding media, River bed sand ($M_1$), Sea sand ($M_2$) and Silica gel ($M_3$). Experiment was tried with factorial concept in Completely Randomized Design and repeated thrice.

## RESULTS AND DISCUSSION

### Effect of temperature

#### Per cent weight loss

The results presented in table 1 clearly indicated that temperature had significant effect on per cent weight loss in Silver oak. It might be due to at higher temperature, rate of liberation of moisture from flower and foliage tissue (transpiration) was more, conduction and convection of heat to the foliage tissue and its evaporation from the surface was also rapid because of higher DPD (Diffusion pressure deficit) with decreased relative humidity in out side conditions that caused weight loss. Similar response in case of seed drying was observed by Brandenberg et al. (1961) and Singh et al. (2003) recorded in zinnia flower drying. Thus, at higher temperature, the faster drying leads to more weight loss. This is very clear from the temperature effect, where increasing temperature increased weight loss. Also with increase in wind velocity, transpiration rate was increased. Rapid respiration rate at higher temperature leads to weight loss. It was observed that per cent weight loss was increased with drying duration but the rate of loss was higher initially and later on decreased with duration of drying. Thus, initially drying rate was higher with higher rate of moisture loss but later on it slow down. This might be due to initially foliages were turgid and DPD out side was more due to more difference in moisture content in tissue and outside condition, so, rate of moisture loss might be more. But later on moisture remained inside the foliage tissue was very less which decreased rate of moisture loss. Similar, results of higher moisture loss initially and declining later on have also been reported by Pandey *et al.* (2000) in coriander drying.

**Table 1.** Effect of temperature and embedding media on per cent weight loss of Silver oak leaf

| Treatments | Per cent weight loss | | | |
|---|---|---|---|---|
| | 1st h | 2nd h | 3rd h | 4th h |
| **Temperature (T)** | | | | |
| $T_1$ | 48.17(55.53) | 53.41(64.46) | 57.85(71.67) | 61.27(76.89) |
| $T_2$ | 51.13(60.54) | 55.94(68.54) | 59.48(74.12) | 63.18(79.59) |
| $T_3$ | 57.99(71.88) | 61.61(77.38) | 64.94(82.04) | 67.53(85.39) |
| S.Em ± | 0.18(0.30) | 0.14(0.21) | 0.12(0.18) | 0.16(0.23) |
| C.D. at 5% | 0.55(0.91) | 0.40(0.63) | 0.36(0.53) | 0.48(0.67) |
| **Embedding media (M)** | | | | |
| $M_1$ | 49.40(57.53) | 54.26(65.76) | 58.54(72.64) | 62.78(78.95) |
| $M_2$ | 52.40(62.69) | 57.05(70.30) | 60.54(75.66) | 63.83(80.42) |
| $M_3$ | 55.48(67.74) | 59.65(74.32) | 63.19(79.53) | 65.37(82.50) |
| S.Em ± | 0.18(0.30) | 0.14(0.21) | 0.12(0.18) | 0.16(0.23) |
| C.D. at 5% | 0.55(0.91) | 0.40(0.63) | 0.36(0.53) | 0.48(0.67) |
| **Interaction effect (T X M)** | | | | |
| S.Em ± | 0.55 | 0.41 | 0.37 | 0.49 |
| C.D. at 5% | NS | NS | NS | NS |
| C.V.% | 3.17 | 2.14 | 1.81 | 2.28 |

Figures in parenthesis are actual values while outside parentheses are arcsine transformed values.

**Per cent moisture content**

Temperature significantly influenced per cent moisture content in Silver oakleaf (Table 2) during the entire drying process. Due to high temperature increased moisture loss from foliage, resulted into lower per cent moisture content. These results are correlated with the findings of lower moisture content at higher temperature by other scientists in different horticultural products drying. Pandey et al. (2000) in coriander and methi and Chen et al. (2000) reported low moisture content at higher vacuum drying temperature in rose and carnation drying. Singh et al. (2003) reported low moisture content in zinnia flower under sun drying condition and higher temperature.

**Table 2.**Effect of temperature and embedding media on per cent moisture content of Silver oak leaf

| Treatments | Per cent moisture content | | | |
|---|---|---|---|---|
| | 1st h | 2nd h | 3rd h | 4th h |
| **Temperature (T)** | | | | |
| $T_1$ | 50.25(59.11) | 44.30(48.82) | 36.61(35.80) | 27.77(21.83) |
| $T_2$ | 48.23(55.63) | 41.76(44.42) | 34.69(32.54) | 22.74(15.07) |
| $T_3$ | 44.88(49.83) | 39.61(40.71) | 30.09(25.31) | 16.95(8.62) |
| S.Em ± | 0.30(0.53) | 0.33(0.57) | 0.31(0.50) | 0.20(0.25) |
| C.D. at 5% | 0.90(1.56) | 0.98(1.70) | 0.92(1.49) | 0.59(0.75) |
| **Embedding media (M)** | | | | |
| $M_1$ | 50.13(58.89) | 44.71(49.52) | 37.32(36.88) | 24.70(17.93) |
| $M_2$ | 47.97(55.18) | 41.29(43.61) | 33.68(30.97) | 22.06(14.56) |
| $M_3$ | 45.26(50.50) | 39.66(40.81) | 30.39(25.81) | 20.70(13.02) |
| S.Em ± | 0.30(0.53) | 0.33(0.57) | 0.31(0.50) | 0.20(0.25) |
| C.D. at 5% | 0.90(1.56) | 0.98(1.70) | 0.92(1.49) | 0.59(0.75) |
| **Interaction effect (T X M)** | | | | |
| S.Em ± | 0.91 | 0.99 | 0.93 | 0.60 |
| C.D. at 5% | NS | NS | NS | NS |
| C.V.% | 5.74 | 7.12 | 8.28 | 7.94 |

Figures in parenthesis are actual values while outside parentheses are arcsine transformed values.

**Per cent moisture loss**

Further, increase in moisture loss was significantly influenced by temperature (Table 3). Due to higher temperature, higher evaporation resulting in more moisture loss. This was in conformity with the findings of Bhutani and Kher (1979). Further, increased respiration rate with more ethylene production may have modified permeability of cell membrane, weakened its integrity through cell leakage and thus liberating more moisture from cell as reported by Mayak and Halevy (1980). Pandey et al. (2000) in methi and coriander drying, Singh et al. (2003) in zinnia

**Table 3.** Effect of temperature and embedding media on per cent moisture loss of Silver oak leaf

| Treatments | Per cent moisture loss | | | |
|---|---|---|---|---|
| | 1st h | 2nd h | 3rd h | 4th h |
| **Temperature (T)** | | | | |
| $T_1$ | 31.79(27.93) | 39.45(40.50) | 48.74(56.41) | 58.98(73.37) |
| $T_2$ | 34.76(32.67) | 42.81(46.27) | 51.16(60.59) | 64.79(81.77) |
| $T_3$ | 40.41(42.14) | 46.71(53.01) | 57.35(70.75) | 71.70(90.03) |
| S.Em $\pm$ | 0.32(0.53) | 0.34(0.59) | 0.32(0.53) | 0.21(0.28) |
| C.D. at 5% | 0.95(1.56) | 1.01(1.73) | 0.94(1.57) | 0.61(0.83) |
| **Embedding media (M)** | | | | |
| $M_1$ | 32.32(28.87) | 39.28(40.20) | 48.14(55.44) | 62.55(78.24) |
| $M_2$ | 35.47(33.82) | 43.64(47.70) | 52.49(62.77) | 65.61(82.43) |
| $M_3$ | 39.17(40.04) | 46.06(51.87) | 56.61(69.54) | 67.31(84.50) |
| S.Em $\pm$ | 0.32(0.53) | 0.34(0.59) | 0.32(0.53) | 0.21(0.28) |
| C.D. at 5% | 0.95(1.56) | 1.01(1.73) | 0.94(1.57) | 0.61(0.83) |
| **Interaction effect (T X M)** | | | | |
| S.Em $\pm$ | 0.96 | 1.02 | 0.95 | 0.62 |
| C.D. at 5% | NS | NS | NS | NS |
| C.V.% | 8.06 | 7.09 | 5.42 | 2.85 |

Figures in parenthesis are actual values while outside parentheses are arcsine transformed values.

flower drying, observed increased moisture loss with increasing in temperature. Bhalla et al. (2006) had observed that loss of maximum moisture was recorded when flowers were embedded in silica gel and dried at 60°C for 48 hrs in hot air oven.

**Effect of embedding media**

**Per cent weight loss**

Embedding media have significant effect on per cent weight loss in Silver oak (Table 1). Maximum per cent weight loss was recorded in silica gel, followed by sea sand and minimum in river bed sand. This might be due to silica gel absorbed moisture from foliage tissue with its hygroscopic nature. Silica gel can absorb moisture up to 30-50% of its weight (Brandenberg et al. 1961). Sea sand cannot absorb moisture as efficiently as silica gel. The mode of removal of liberated moisture in river sand is different, as sand is not hygroscopic. Sand gets heated up and through conduction, it transfers heat to the foliage tissue. The liberated moisture from foliage tissue escape into outside air in vapour form. This way removal of moisture is slow as compared to silica gel and sea sand. Thus, silica gel removed moisture from foliage tissue more quickly and efficiently, compared to sea sand and river bed sand. Similar results reported by Lourdusamy et al. (2003) that silica gel required less time for drying compared to sand.

**Per cent moisture content**

Silica gel exhibited lowest per cent moisture content in Silver oak, followed by sea sand while river sand recorded highest per cent moisture content through out the drying duration (Table 2). As maximum per cent moisture loss was recorded in silica gel might be due to its strong hygroscopic nature, it showed minimum moisture content. This was also in close conformity with the findings of Bhutani and Kher (1979) in ornamental foliages.

**Per cent moisture loss**

Embedding media show significant effect on per cent moisture loss (Table 3). Per cent moisture loss was maximum in silica gel, followed by sea sand and it was minimum in river bed sand. Silica gel being hygroscopic has chemically strong affinity for moisture and exhibited drying effect through dehumidification. It actually absorbed moisture from the tissue to be dried and also from air. This cause the air in the pore space to become less saturated with water decreased its vapour pressure and ultimately increasing its DPD. This accelerates the process of dehydration as an overall effect (Brandenberg et al. 1961). In the present investigation also, absorption characteristics of the embedding media influenced moisture loss from the tissue.

**REFERENCES**

Bhalla R, Moona SRD and Thakur KS 2006 Standardization of drying techniques of chrysanthemum (*Dendranthema grandiflorum* Tzvelev.). *J Ornam Hort* 9 (3): 159-163.

Bhutani JC and Kher MA 1979 Dehydration of flowers and foliage. *Ext Bull* EBJS, NBRI, Luckhnow pp. 1-20.

Brandenberg RN, Simons JW and Smith LL 1961 Why and how seeds are dried The processing of seeds. In "*Seeds: The year Book of Agriculture*". (Alfred Steferu. Eds.) U. S. Govt. printing office, Washington, pp. 295-306.

Chen W, Gast KLB and Smithey S 2000 The effects of different freeze drying processes on the moisture content, colour and physical strength of roses and carnations. *Scientia Hort* 84(3/4): 321-332.

Lourdusamy DK, Vadivel E and Manavalan RSA 2003 Studies on critical stages of harvest of annual flowers for dry flower production. *South Indian Hort* 51(1/6): 241-243.

Mayak S and Halevy AH 1980 Flower senescence In: "*Senescence in Plants*". (Thiman, K. V., Eds.). CRC Press, Boca Raton pp. 132.

Pandey VK, Sonune AV and Philip SK 2000 Solar drying of coriander and methi leaves. *J Food Sci Technol* 37(6): 592-595.

Singh A, Dhaduk BK and Shah RR 2003 Effect of dehydration on post harvest life and quality of zinnia flowers. *J Ornam Hort* New Series 6 (2): 141-142.