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RESEARCH ARTICLE :

Post dehydration quality and anthocyanin content of dried rose buds cv. FIRST RED as influenced by microwave duration, setting time and storage conditions

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SUMMARY : Two experiments to study post microwave dehydration quality of cut buds of rose cv. 'FIRST RED' were conducted.First experiment comprised 9 treatment combinations involving 60, 120 and 180 seconds of microwaving in combination with 2, 4 and 6 hours of post microwave setting time. Changes in physical parameters were studied in terms of weight loss and reduction in bud diameter. Dried rose buds were subject to Aesthetic evaluation based on a 9 point score at 1, 15 and 30 days after dehydration treatment. 180 seconds of microwaving followed by 6 hours of setting time resulted in highest scores and best quality and excellently shaped buds. Second experiment involved estimation of anthocyanin content of dehydrated rose buds stored under 7 different conditions. 1. Stored in an open plastic container 2. Air tight transparent plastic container 3. Air tight clear plastic container with silica pouch4.Airtight opaque container5. Airtight opaque container with silica pouch 6. Air tight cellophane sleeve 7. Air tight cellophane sleeve with silica pouch. Least degradation of anthocyanin content of in buds at 10, 20 and 30 day was recorded in buds stored in opaque plastic containers with silica pouch.

KEY WORDS :
Drying, Dehydration, Rose, Microwave, Anthocyanin

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BACKGROUND AND OBJECTIVES

Dry flowers constitute more than two-thirds of the total floriculture exports from India.The demand for dry flowers is increasing atan impressive rate of 8-10 per cent annually thus, offering a lot of opportunities for the Indian entrepreneurs to enter in the global floricultural trade (Singh, 2009). Fresh rose flowers though exquisite in their beauty are highly perishable and delicate in nature and cannot retain their beauty and fresh look for a long time in spite of using best chemicals for enhancing vase life. Dried flowers can be effectively used for making decorative floral craft items for interior decoration and commercial exploitation (Ranjan and Misra, 2002). Moreover, fresh flowers are not available all-round the year in all places (Datta, 2004). In this context rose flowers canbe dried, preserved and processed to retain its beauty as well as everlasting value. The quality and appearance of dried flowers and other ornamental plant parts is greatly influenced by the method of drying or the drying techniques being followed. Various techniques involved for the production of dried ornamental plant material includes air drying, press drying, embedded drying, oven drying and freeze drying etc. Hot air and microwave ovens are being used for faster drying and to improve the quality of dry flowers. In these methods, plant material is kept at controlled temperature for specified time typical to the plant species.Considering the potential of roses in dry flowertrade and limitation of farmers in Kashmir valley to rely on fresh cut flower trade due to land bound situation and lack of post-harvest cold storage facilities, the present studies were undertaken to study the effect of microwave duration, setting time and duration of drying to obtain better quality dried flowers of roses.

RESOURCES AND METHODS

Stems bearing slightly open rose buds of cv. 'FIRST RED' were cut from the greenhouse in the afternoon and brought to the laboratory. The cut stems were placed in the de-ionized water until the buds opened to one-half of their final size. Buds along with 2 inches of the stem were separated and placed side by side (open side up) in a 20 x 12 x 8 cm microwave proof tray filled with 5 cm thick layer of 120 mesh oven dried silica gel crystals. Additional silica gel crystals were gently poured over and around the buds with the help of a spatulla. Rose buds were buried under a 2 cm layer of silica gel crystals. Trays were later on placed in microwave oven at 750 watt. power for 60, 120 and 180 seconds. The trays were rested and allowed to cool for 60, 90 and 120 minutes. In all 9 treatment combinations were tried (60, 120 and 180 seconds of microwaving in combination with 60, 90 and 120 minutes of setting time) in a Completely Randomized Block Design. After the stipulated time rose buds were gently removed from the trays. Excess silica gel crystals from inside the rose buds was removed with the help of a soft brush without damaging the petals. Weight and diameter of 5 buds placed in the centre of the tray was recorded before and after the microwave treatment. Rose buds were stored in transparent sealed plastic boxes along with a100 g silica a gel wrapped in flax cloth pouch. Appearance of roses was evaluated and recorded on a 9 point scale by a panel of semi trained judges at 0, 10 and 20 days of storage. Data were statistically analyzed and are presented in Table 1.

In the second experiment buds of cultivar first red were stored under seven different conditions, each storage condition replicated thrice in a Completely Randomized Block Design. 1. Stored in an open plastic container 2. Air tight transparent plastic container 3. Air tight clear plastic container with silica pouch 4. Airtight opaque container 5. Airtight opaque container with silica pouch 6. Air tight cellophane sleeve 7.Air tight cellophane sleeve with silica pouch. Each silica pouch contained 100 gm of microwave dried 120 mesh silica gel wrapped in flax cloth sachet.

One gram sample of fresh petals was drawn from buds under each storage condition and the anthocyanin content was extracted by grinding in 0.5 % HCL-methanol. After filtration through Whatman No. 1 filter paper, anthocyanin extract was diluted to a standard volume (1/100th dilution). The absorbance of the solution was read at 525 nm in a spectrophotometer. Reference to a standard curve was developed from a serial dilution of Congo Red (Rutland, 1968). Following equation was used to estimate the anthocyanin content in the petals

Mg Congo Red g^{-1} weight of petals = 2.3 x optical density x dilution factor

where, 2.3 was the specific absorption co-efficient (Î) developed from the selected standard curve using the following formula:

Î = A / C x l

where, Î is the specific absorption co-efficient, A is the absorbance, C is the concentration (g l^{-1}) and l is the cuvette path length (cm) .Data were recorded, analyzed and presented in Table 2.

OBSERVATIONS AND ANALYSIS

Dehydration of flowers is one of those rare areas of research where scientific inquiry has to be balanced with the aesthetics. In order to give a quantifiable and replicable dimension to the study changes in aesthetics of rose buds as a result of microwaving certain physical parameters have to be studied. In the current study changes in bud weight and diameter of rose buds as a result of varying microwave duration and setting time were recorded. Data reveal that increasing duration of microwaving resulted in significant weight change most of which can be accounted for by moisture removed from the flower tissues as a result of generation of heat. A 60 second exposure followed by setting time of 2 hours resulted in 67.09 per cent of weight loss. However, increase in post microwave setting time from 2 hours to 4 and 6 hours did not increase moisture content of the buds significantly. Microwaving for 90 seconds followed

Table 1: Response of silica gel embedded Rose cv 'FIRST RED' to microwave aided dehydration

Sr. No.	Treatments	Initial wt. g/flower	Final wt. g/flower	Per cent wt. loss	Initial dia. (cm)	Final dia.(cm)	Per cent change	Score after One day	Score after 10 days	Score after 20 days	Remarks
1.	MW60sec+60MST	6.17	2.03	67.09 (54.99)*	6.40	6.05	5.70 (2.48)**	6.56	5.48	5.20	Poor shape, petal consistency
2.	MW60sec+90MST	6.24	1.98	68.26 (55.70)	6.50	6.20	5.80 (2.50)	6.85	5.55	5.37	--DO-
3.	MW60sec+120MST	6.35	5.78	69.96 (56.76)	6.40	5.98	6.56 (2.65)	7.16	5.62	5.30	Moderate
4.	MW120sec+60 MST	6.21	5.85	75.52 (60.34)	6.70	6.26	6.56 (2.65)	6.55	5.75	5.45	Poor bud shape
5.	MW120sec+90 MST	6.14	1.40	77.19 (61.47)	6.55	6.00	8.39 (2.98)	6.90	5.85	5.57	Poor bud shape
6.	MW120sec+120 MST	6.27	1.42	77.35 (61.58)	6.45	5.83	9.61 (3.17)	6.93	5.93	5.63	Poor bud shape
7.	MW180sec+60 MST	6.18	1.14	81.55 (64.56)	6.60	5.98	9.39 (3.14)	7.15	7.05	7.10	Moderate bud shape
8.	MW180sec+90 MST	6.24	1.08	82.26 (65.09)	6.40	5.79	9.68 (3.19)	7.26	7.20	7.24	Moderate bud shape
9	MW180sec+120 MST	6.21	1.05	83.09 (65.71)	6.50	5.85	10.00 (3.24)	7.95	7.85	7.80	Bud shape excellent
	C.D.(P=0.05)			(3.84)			(0.12)	0.33	0.45	0.26	

* Values in parenthesis are arc sin transformed values of the original: ** Values in parenthesis are square root transformed values of the original
MW= Micro wave : MST = minutes of setting time

Table 2 : Effect of storage conditions on anthocyanin content of dried rose cv 'FIRST RED' (mg of Congo Red/g of petal)

Sr.No.	Treatments	0 days	10 days	20 days	30 days	Mean
1.	Open plastic container	13.733	9.563	9.330	8.413	10.259
2.	Air tight clear plastic container	13.720	10.153	9.933	8.771	10.644
3.	Air tight clear plastic container with silica pouch	13.733	10.733	10.443	9.453	11.090
4.	Airtight opaque container	13.663	11.853	11.680	11.330	12.131
5.	Airtight opaque container with silica pouch	13.733	12.933	12.873	12.539	13.033
6.	Cellophane pouch	13.720	10.233	10.015	8.933	10.725
7.	Cellophane pouch with silica pouch	13.733	10.631	10.330	8.833	10.881
	Mean	13.715	10.871	10.652	9.755	
	S.E.±					
	For days	0.351	0.70	0.530	0.852	
	For treatments	0.700	1.40	1.060	1.704	
	For days x treatments	1.21	2.42	1.852	2.973	

by 2 hours of rest resulted in significantly higher weight loss of the buds (75.52%). Again further increase in weight loss by increasing setting time to 4 and 6 hours after 90 seconds of microwave treatment was marginal. Highest per cent weight loss (83.09) was recorded with 120 seconds of microwaving followed by 6 hours of setting time. Similar findings have also been reported by Dhatt *et al.* (2007); Bull (1999) and Miller (1997).

Decrease in bud diameter after 60 seconds of microwave and 2 hours of setting time was 6.56 per cent. At 4 and 6 hours of setting time diameter of buds decreased by 5.8 and 6.56 per cent. Highest decrease in bud diameter (10%) was recorded at 120 seconds of microwave followed by 6 hours of setting time. This was significantly higher than 9.68 per cent reduction in bud diameter observed under same microwave time followed with 4 hours of setting time. The results indicate that 4-6 hours of under disturbed setting time resulted in greater decrease in bud diameter. This could be due to increased compaction under the weight of the surrounding silica gel. Our results are on consent with those of Alleman (1994) who advocated that silica gel crystals could be used for drying roses. In close conformity to the present investigations, Singh (2003) found that drying of zinnia flowers much faster with silica gel and borax.

There were no significant differences in aesthetic score recorded at one day after the drying process. Only exception was buds microwaved for 120 seconds and left for 6 hours in which a mean score of 7.95 was significantly superior to scores recorded in the rest of the treatments.

Evaluation at 10 day interval revealed that buds microwaved for 120 seconds received significantly superior scores in comparison to the rest of the treatments. Further buds treated with 120 second microwave treatment followed with 6 hour setting time received significantly superior scores in comparison to treatments involving same microwave duration but 2 and 4 hours of setting time, respectively.

At 30 day interval 120 second microwave treatment followed by 6 hours of setting time resulted in significantly highest score. Buds microwaved for 120 seconds followed by 2, 6 and 8 hours of setting time retained an excellent shape 30 days after microwaving.

The changes in anthocyanin content of dried rose buds cv. 'FIRST RED" are presented in Table 2. There were no significant differences in buds stored under different conditions at one day after the drying process. However, at 10 day interval all buds stored in closed containers had significantly higher anthocyanin content in comparison to those stored in open. At 10 day interval buds stored in opaque air tight containers had significantly higher anthocyanin content than those stored in transparent containers. Highest anthocyanin content of 12.93, 12.87 and 12.53 mg of Congo Red/g of petal at 10, 20 and 30 day was recorded in buds stored in opaque plastic containers with silica pouch. Dehydrated plant tissue is hygroscopic in nature and has tendency to regain moisture from the atmosphere. Moisture contributes to breakdown of proteins which lower the pH of plant tissue and hence degrade anthocyanins. Further, anthocyanin is degraded by light which could be the reason behind lower anthocyanin content recorded in buds stored in transparent containers in comparison to those stored in opaque containers. Similar results on anthocyanin degradation was also reported by Angela and Little (1997); Palamidis and Markakis(1975) and Maccarone *et al.* (1985).

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