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Package of Practices for Freeze Dried Rose Flower

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Abstract: ***The study was conducted during 2011-2012 to explore a method of preserving inherent qualities of dried rose flower. This experiment was designed to explore the preservative treatments whereby freshly cut flowers subsequently dehydrated by a freeze-drying process. This process rapidly sets the arrangement such that wilting and distortion are minimized. Roses make beautiful decorations and it is recognized as a symbol of love, sympathy. The qualitative characteristics of flowers were evaluated by expert panel. Results revealed during hydration process hydrate flowers with STS and it was observed that flowers can remain fresh up to 8 days. When flowers are ready for processing, use (T_9) a ready composition developed out of different chemicals consisting of dehydration solvent, colour fixative, environmental fixer, bio-fixer, shatter resistant polymer and a softening agent as Pre treatments. Arrange flowers in floral freeze dryer that is pre-cooled to 25^{o}c. After 24 hours, turn on secondary freezer and vacuum pump and the flowers remain in freezer, until the temperature is raised to room temperature. Spray acrylic clear spray as seal film to protect flower from external environment and conditions such as dust, light, humidity.***

Keywords: Drying Method, Preservation, Forever flowers, Permanent flowers

1. Introduction

Flowers are a visual expression of love, sympathy, and respect. They are means of lending support and sharing the burden of grief (Azarov, 2008). The most promising area in floriculture is the dry flower industry. Dried flowers and plants have been exported for the last 40 years and today, India is one of the leading countries in the field. India, with its vast resources, varied products and experience in the field of dried flowers and plants enjoy a distinct advantage. Dried flower products are in very high demand and add an enriched value to the flourishing industry. Dried flower products on the other hand are long lasting and retain their aesthetic value irrespective of the season (Malcolm, 1994; Smith, 1993 and Christie, 2010).

Roses are a popular crop for both domestic and commercial cut flowers. Rose is known as the 'Queen of flowers. It is basically a shrub flower. The flowers of the rose grow in many different colors, from the well known red rose to yellow roses and sometimes white or purple roses. Roses are widely used across the world as symbols of love, sympathy or sorrow. There are thousands of rose cultivars that people grow in gardens and on farms. Roses are multi-petal flowers available in an array of colours. Generally they are harvested and cut when in bud, and held in refrigerated conditions. The most effective method of flower preservation is freeze drying used to preserve a perishable material which removes moisture from flowers to maintain their original shape, texture and colour better than the other drying techniques. Richard *et.al.* (1996) explains that freeze-drying did not alter the concentrations of phenolic glycosides or tannins, compared to vacuum-drying and it was a better alternative and cause no changes in levels of secondary compounds during the drying process. Chen *et al.* (2000) evaluated the effect of different freezing time (2 and 4 hours), freezing temperature (-35ºC) and vacuum drying temperature (27ºC, 37ºC, 47ºC) on, moisture content, stem and petal strength of roses and carnations. Lower vacuum drying temperatures resulted in flowers with closer to fresh flowers. This research is an attempt to provide a novel method and means for flower preservation in storage and transport and for evolving package of practices.

2. Materials and Methods

The study was conducted at Department of Resource Management and Consumer Sciences, College of Home Science, Acharya N.G. Ranga Agricultural University, Hyderabad during the year 2011- 2012 with Floral Freeze Dryer equipment by adopting experimental research design. Each of these flowers had different formation in terms of colour, form, texture and appearance. Fresh and partially bloomed flowers suitable for freeze drying process were selected for the study. Treated flowers were analyzed quantitatively and qualitatively to explore the effect of these treatments on following physical characteristics (colour, form, texture and appearance) of selected Orchid flower.

Colour	Blue purple petal with white, lavender combination of the two colours.
Form	Flat-faced petals and sepals of equal size and strap or cylinder shaped leaves
Texture	Stiff, velvety and glossy petal
Appearance	Five pointed petals that form the shape of a star

The treatments were identified and evaluated for suitability for hydration, pre and post treatments listed below during the freeze drying process

Hydration Treatments

T_1: 5ml of Silver thiosulphate to a litre water
T_2: Sprite 50ml, Bleach 1.5gms to a litre of luke warm water 43-45^{0}c.
T_3: 150mg of Aspirin powdered and added to a litre luke warm water 43-45^{0}c.
T_4: Lemon Soda 50ml, Bleach 0.7gms to a litre of water.

T_5: Sugar 2gm, Bleach 1.5gm, Listerine Mouth Wash 6ml to a litre of water.
T_6: Epsom Salt 2gm, chlorine bleach 2gm, Lemon Soda 50ml to a litre of water.

Pre treatments

*Basic compositions	T_1 – Base 1 T_2 - Base 2 T_3 – Base 3
**Improved composition	T_4 – Base 1 + Polymer I in 50: 50 T_5 – Base 2 + Polymer I in 50: 50 T_6– Base 3 + Polymer I in 50: 50
Advanced composition***	T_7– Base 1 + Polymer I + Polymer II in 50: 45: 5 T_8– Base2 + Polymer I + Polymer II in 50: 45: 5 T_9– Base3 + Polymer I + Polymer II in 50: 45: 5

*Basic three compositions : There were the blend of tertiary butyl alcohol, 1-propanol and 2-propanol, dibasic sodium phosphate, sodium formaldehyde sulfoxylate, citric acid, thiourea, aluminum sulphate, sodium citrate, cupric sulphate, propionic acid, phenol and silicone resin in different proportions. (T_1, T_2 & T_3) in different qualities
**Improved Composition: It is an improvement to basic treatments to improve shatter resistance with a polymer I- Ethyl Vinyl Acetate (EVA) (T_4, T_5, and T_6).
***Advanced composition: Further modified to improve pliability of the flower with polymer II- Poly Ethylene Glycol (PEG) (softening agent) (T_7, T_8 & T_9).

A set of fourteen different chemicals cited in US free Patent 4349459, which fall into the category of exchange medium, biological fixatives, preservatives, environmental fixers, and buffers, mordant's, pH modifiers, were used in this study and were tested on the flower individually and in combination. Florets of the flower were immersed in each solution for five seconds to study the effect of these chemicals. Each of these chemical solvents was found to play a crucial role on colour, texture, form and appearance of flower. These chemical solvents were blended into different compositions in the on-going Freeze dried flowers research project of the department (Reddy and Kumari, 2010)

Post - Treatment
T_1 – Acrylic Clear Spray (ACS)
T_2 – Picture Varnish (PC)
T_3 – Glazing Medium (GM)
T_4 – Gloss Lustre (GL)
T_5 – Dried Material Preservative (DMP)
T_6 – Glazing Dip (GD)

The four distinct variables were selected for assessing physical characteristics of flower such as change in colour, change in form, change in texture and change in appearance. In addition moisture loss in flower was also assessed to explore the extent of evaporation. These were measured through quantitative and qualitative assessment.

- Effect of Hydration Treatments: Qualitative analysis.
- Effect of Pre Treatments: Qualitative and Quantitative analysis
- Effect of Post Treatments: Quantitative analysis

Three point scale was used for scoring the variation in each of these qualities for evaluation by a panel of three experts. The scores obtained for each of these variables were subjected to analysis of variance-one way classification to study the effect of treatments on keeping quality of flower.

3. Results and Discussion

3.1 Hydration treatments for Rose

Roses were treated with six different hydration treatments and the physical observation scores for 10 days are tabulated in Table 3.1.1. From the observations reported in the data, it can be noticed irrespective of the treatments, flowers were fresh up to second day without any change in physical characteristics.

Table 3.1.1: Effect of Hydration Treatment on Physical Observation Scores on Rose

Days	Control	T_1	T_2	T_3	T_4	T_5	T_6
Day 1	12	12	12	12	12	12	12
Day 2	12	12	12	12	12	12	12
Day 3	11	12	12	10	10	10	11
Day 4	8	12	10	10	10	4	4
Day 5	4	12	6	4	4	4	4
Day 6	-	11	-	-	-	-	-
Day 7	-	7	-	-	-	-	-
Day 8	-	5	-	-	-	-	-

Among the preservatives, T_1 which is commercial preservative prolonged the life of flower upto 5-6 days, but in others the changes were obvious from third day onwards. This fact once again highlights the effectiveness of STS as a good floral preservative and the next alternative was T_2, a simple homemade preservative that retained freshness up to 4 days in Plate 3.1.

Table 3.1.2: F test and t- Test of Physical Observation score of Rose

F-Test Two-Sample for Variances		
	Day 4	*Day 5*
Mean	8.285	5.428571
Variance	1.333333	8.952381
Observations	7	7
df	6	6
F	0.248936	
P(F<=f) one-tail	0.017767	
F Critical one-tail	0.233434	

t-Test: Paired Two Sample for Means		
Day 5	*CONTROL*	*T2*
Mean	4	6
Variance	3	1.5
Observations	9	9
Pearson Correlation	0.235702	
Hypothesized Mean Difference	0	
df	8	
t Stat	-3.20713	
P(T<=t) one-tail	1.906239	
t Critical one-tail	1.859548	
P(T<=t) two-tail	2.612478	
t Critical two-tail	2.306004	

These scores were statistically analyzed to establish the influence of treatments on number of days to retain the qualities of flowers and presented in Table 3.1.2. The results revealed that, among 10 days to retain the physical characteristics, rose flower retained well upto 4th day and the quality of the flowers deteriorated significantly from the fifth day onwards, where as in T_1 it remained fresh up to 8 days (F-Test Two-Sample for Variance). Among treatments, treatment T_1 (STS) was found to have significant difference over other treatments (t-Test: Paired Two Sample for Means) for period of 8 days, thus the null hypothesis is rejected. STS extends vase life, improves post harvest quality and reduces bacterial count in the basal parts of gladiolus and rose stems (Al-Humaid, 2004). Hydration provides an opportunity to administer water soluble chemical inhibitors of ethylene action silverthiosulphate and senescence to flowers (Reid, 2002; Chamani *et.al.,* 2005 and Wang, 1999).

3.2. Effects of selected pre treatments on Rose

Observations of freeze dried roses treated with pre-treatments shown in Plate 3.2. revealed that, except in T_9, others resulted in deep red colour. For flowers, colour is the one of the most important aesthetic characteristics which was explained by Chen *et al.* (2000) conducted a study indicated that freeze drying had a greater effect on the colour values of the red flowers and the reds often become unattractively dark.

In all the treatments the moisture loss percentage varied between 80%-84% in all the flowers and it did not remain consistent between experiments. Basic treatments resulted in excessive dryness in comparison to improved compositions (Pandey, 2001).

Table 3.2.1: Physical Observation score on Rose

Characteristics / Treatments		Colour	Form	Texture	Appearance	Total
Control		2	2	2	2	8
Basic compositions	T_1	2	2	2	2	8
	T_2	1	2	2	2	8
	T_3	2	3	2	2	9
Improved compositions	T_4	2	2	2	2	8
	T_5	3	2	2	2	9
	T_6	2	3	2	3	10
Advanced compositions	T_7	2	2	3	2	9
	T_8	2	2	2	2	8
	T_9	2	3	3	3	11

Expert's panel scores (Table 3.2.1.) on qualitative parameters for rose revealed that T_9 attained maximum score points for form, texture and appearance followed by T_6 and T_3. The values of score more with polymer added composition than Basic composition. This part of the research again proved that, use of certain polymers on flowers help to improve the quality of final output.

- **Colour**: Comparison of colour values in terms of HSB of reference flower (H 349 S 68% B 75%) to all treatments, T_9 was more nearer (H-346 S-75% B-33%) to values except for brightness (B). This proved that Freeze dried flowers retained colour more closer to nature (Sohn *et al.,* 2003).
- **Form:** There was a remarkable change in the shape and size of the flowers in pure, improved and advanced compositions and these were best with T_9 and T_6 when compared with the basic compositions. This proves that chemicals blended to prepare different compositions had strong influence on the quality of flower.
- **Texture**: The freeze dried control flower was over dried and brittle when compared with reference flower. Similar to form, there was a distinct change in the texture of flowers in pure, improved and advanced compositions and these were best with T_9 and T_6. This observation proves the importance of addition of polymer I and II to pure composition.
- **Appearance:** In nature Rose colour appears smooth and glossy, T_9 was better in terms of colour, form and texture, the scores for form, texture and appearance. Yun (2004)

Table 3.2.2: ANOVA - One way Classification Table on Rose

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	3.01	9	0.34	2.82	0.06	2.21
Within Groups	4.75	30	0.16			
Total	7.78	39				

* Significant at 5% level

These scores were statistically analysed to establish the influence of treatments on overall quality of flowers. Table 3.2.2. (Anova one-way classification table) on rose revealed that there was significant difference in the quality of flowers within treatments and between treatments. It was hypothesized that pre-treatment has no significant difference on the overall quality of freeze-dried seasonal flowers. Since calculated value of F is greater than the table value of F, null hypothesis is rejected. From this analysis, it can be drawn that the choice of chemicals influenced the quality of freeze dried Rose.

From the results emerged out of the experiments with pre-treatments, presents the consolidated information on the effect of treatments for each parameter of the flowers. It gives clear indication that Flowers were influenced by the choice treatments in their own way. Freeze dried flowers produce good quality of flowers with choosy treatment; Pre-treatment is a crucial step to derive good quality flowers. As humidity is enemy to dry flowers, it is necessary to protect them with coating film through post-treatment process.

3.3 Effect of post treatments on Rose

The effect of post-treatment on freeze dried Rose flowers is depicted in Plate 3.3. and Physical observation scores are presented Table 3.3.1. Physical observation scores were higher for T_1- acrylic Spray as it retained the colour, form, and appearance. Score for texture was less may due to mild gloss effect produced by this medium, which is against the natural sheen of rose flower. Other treatments were found to be less appealing to eye for all the parameters. Patricia et al. (2007) reported the use of floral sprays are not harmful to the most delicate materials be thus can be sprayed.

Table 3.3.1: Physical Observation score on Rose

Characteristics	T1	T2	T3	T4	T5	T6
colour	3	2	2	2	2	2
Form	3	1	1	3	2	2
Texture	2	2	1	2	2	2
Appearance	3	2	1	2	2	2
Total	11	7	5	9	8	8

From observation, it can be concluded that acrylic spray is a better among other alternatives as it meets most of the desired qualities. Lewis (2011) stated that acrylic spray keeps dried flowers intact by preventing the petals from easily crumbling, and also helps to keep colours from fading and long lasting.

These scores were statistically analysed to establish the influence of treatments on overall quality of flowers and are presented in Table 3.3.2.

Table 3.3.2: ANOVA - One way Classification Table on Rose

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	4.71	5	0.94	7.53	0.001	2.8
Within Groups	2.25	18	0.13			
Total	6.96	23				

* Significant at 5% level

Anova one-way classification table on Rose revealed that it was hypothesized that post-treatments has no significance difference on the overall quality of freeze-dried exotic flowers and was observed that it was highly significant between and within treatments so the null hypothesis is rejected. Since calculated value of F is greater than the table value of F, null hypothesis is rejected at 5% level of significance.

From the above analysis on the effect post-treatments on freeze dried flowers, it can be concluded that, post-treatments enhances beauty of flower and also protect the flower. However, it is necessary to be alert in choosing the mediums as each medium had resulted in producing different effects on flower. In typical situation, it is necessary to observe the physiological characteristics of flower, and consciously select post-preservative medium to enjoy the lasting beauty of freeze dried flowers and to inhibit re-absorption of moisture, protection from dust and UV rays.

4. Conclusion

The significant conclusion to be drawn as a result of this study is to explore a preservation method for drying flowers to retain natural traits depending up on the morphology of flowers. Freeze drying process preserves natural shape and colour of the flower. Freeze-drying captures the vibrant colors of the flowers, which directly impacts the vibrancy and colors of flowers for keepsake. Freeze drying involves five-step process ensures the highest standard of floral preservation such as Hydration, Pre treatments, Freeze drying and post treatments. The preservatives have influence on the quality of the rose flowers in freeze drying process. The chemicals used in the preparation of composition have influence on inherent qualities of preserved flowers. Vacuum pressure regulator may help to further improve the quality of flowers. Careful selection of treatment ensures good quality flowers. Among which in Roses it was found that for Hydration Treatments Silverthiosulphate (STS) was found to be effective treatments and flowers remained fresh up to 8 days. Floral preservative (T_9) was the best composition which retains inherent qualities of the flowers in Pre Treatments. This combination included chemicals meant for dehydration solvent, colour fixative, environmental fixer, bio-fixer, shatter resistant polymer and softening agent followed by freeze drying this helps to sublimate and dry well. Application of Post Treatments with acrylic clear spray as sealant was found best to protect flower from external environment and conditions such as dust, light, humidity.

5. Other Recommendations

There are a number of additional areas for further research that have been highlighted by the studies undertaken such as to study on packaging technology and the marketing strategies for freeze dried flowers. Similar approaches might be taken to standardize the treatments or preservatives for freeze dried flowers.

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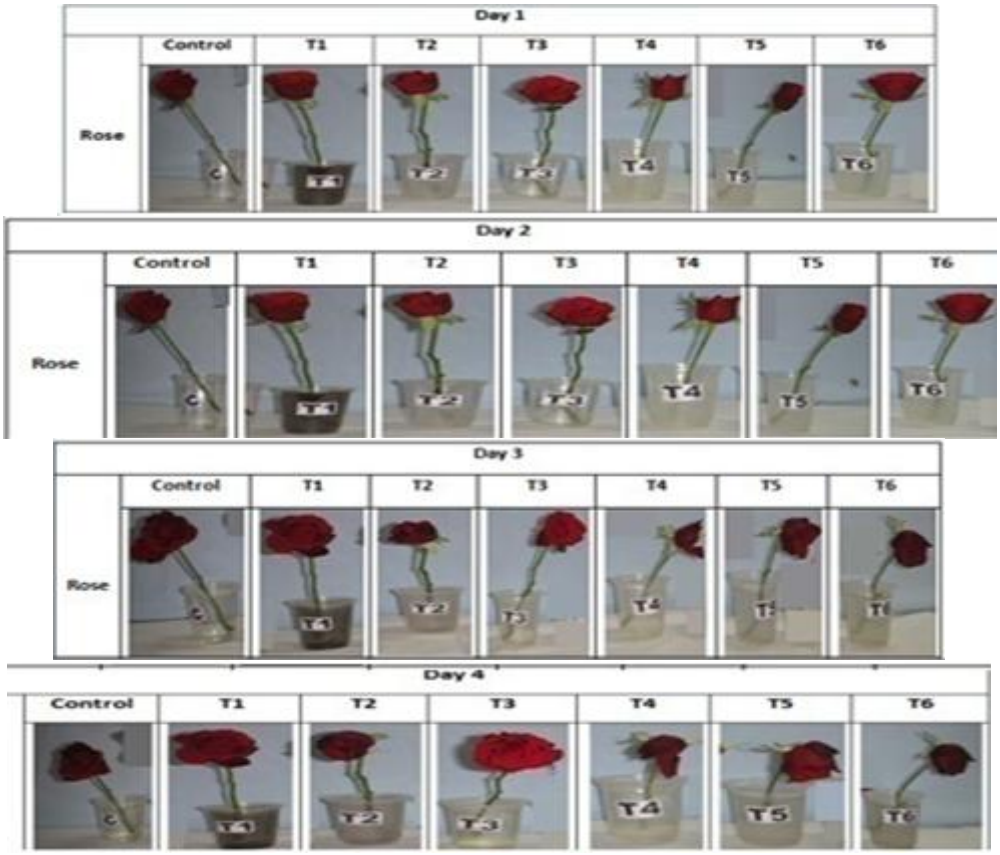
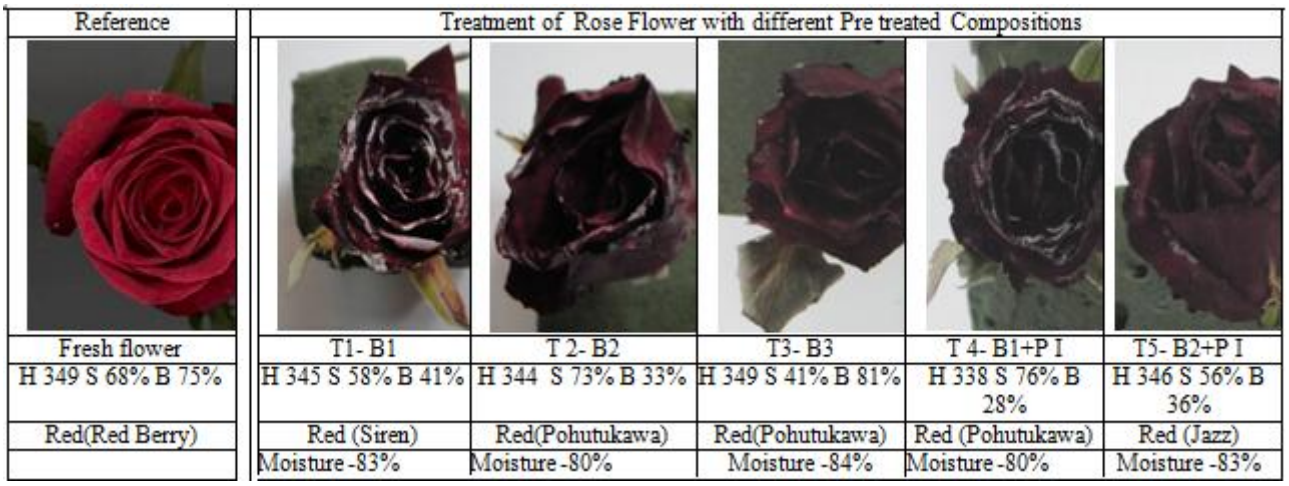


Plate 3.1: Effect of Hydration treatments on Rose



				
Freeze Dried	T6- B2 +P I&PI	T7- B1+P I&PII	T 8- B2 +P I&PII	T9- B3 +P I&PII
H 345S100% B 62%	H 349 S 56% B 53%	H 345 S 72% B 36%	H 342 S 68% B 35%	H 346 S 75% B 33%
Red (Carmine)	Red(Camelot)	Red(Bordeaux)	Red (Pohutukawa)	Red (Pohutukawa)
Moisture- 83%	Moisture -85%	Moisture -81%	Moisture -83%	Moisture -83%

Plate 3.2: Effect of selected pre treatments on Rose

Reference Flower	Acrylic clear spray	Picture Varnish	Glazing Medium	Gloss Luster	Dried Material Preservative	Glazing Dip
						
Rose	T1	T2	T3	T4	T5	T6

Plate 3.3: Effect of post treatments on Seasonal Flowers