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Method for Preserving Bird of Paradise Flower through Freeze Drying Process

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ABSTRACT

Flowers preserved from special occasions, evoke the past, and leave us with sentimental thoughts. They help us commemorate good times punctuating every celebration in our lives. Freeze drying flowers retains the shape and colour of the flowers almost as if they are still fresh, original colour and shape for many years to come. This study was taken to protect the physical characteristics of Bird of Paradise flower through freeze drying technique Different preservatives were identified and tested for hydration, pre and post treatments to retain the physical characteristics of flowers. Among the different methods, the flower treated with preservative **(**a blend of Sprite and Bleach) in luke warm water during hydration process, followed by pre treatment with (T_5) which includes composition was evolved by blending chemicals meant for dehydration solvent, colour fixative, environmental fixer, biofixer and shatter resistant polymer. After hydration and pre treatments, those flowers were dried with freeze drier followed by **a**pplication of DMP as sealant as post treatment was found to be effective for retaining inherent qualities of the flowers.

Key words: *Freeze Drying Process, Bird of Paradise, Physical Characteristics, Preservative.*

Floral preservation is a process that extracts moisture from the flowers (creating dried flowers), maintains a dehydrated state and seals the flowers to protect their natural beauty Smith (2010). Flower preservation is an art form that requires precision and a professional touch and experience. Floral Preservation has gained resurgence in popularity in the last few years. Exotic Flowers and plants add that extra special touch to gardens, homes, and all occasions such as weddings, celebrations, banquets and formal occasions among which Bird of Paradise is one of the most colorful flowers in the world. The name Bird of Paradise comes from its spectacular flower shape which resembles a bird's beak and head plumage. Birds of Paradise, also known as Crane flowers are one of the most beautiful Exotic Flowers. A series of highly colored bracts, or modified leaves, are formed into green, red, and or purplish canoe-like structures. Each Birds of Paradise flower is made up of three upright orange sepals and three highly modified vivid blue petals. Two of the petals are joined together in a structure resembling an arrowhead with the third petal forming a nectary at the base of the flower. To preserve the best quality of cut-flowers after harvest and to make resistant to fluctuations in environmental conditions, treatment with floral preservatives is recommended (Zencirkiran, 2010).

Freeze-drying has been rated as the best floral preservation method, available in the market today (Good Housekeeping Magazine, 1999). Freeze Drying is the modern, high tech method, with the passion for rigorous quality control, clearly produces the best & most versatile product. As Freeze-drying is a simple process that removes water (moisture) from frozen material or keepsakes while they remain in a frozen state, thereby maintaining shape and biological structure. Murugan *et al*. (2007) stated that freeze drying is the only process of preservation that does not damage the cell structure of the flowers or petals, so that the original shape, size & form are preserved. The objective of the study is to evolve package of practices for freeze dried bird of paradise to retain physical characteristics of flowers.

MATERIAL 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 40-45^{0}c.

T_3:150mg of Aspirin powdered and added to a litre luke warm water 40-45^{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 6 ml 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. (T1, T2 & T3) in different qualities**Improved Composition: It is an improvement to basic treatments to improve shatter resistance with a polymer I- Ethyl Vinyl Acetate (EVA) (T4, T5, and T6).***Advanced composition: Further modified to improve pliability of the flower with polymer II- Poly Ethylene Glycol (PEG) (softening agent) (T7, T8 & T9).

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 departmen (Reddy et.al., 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.

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

Table 1. Effect of hydration treatment on Physical Observation scores of Bird of Paradise.

Days/Treatments	C	T1	T2	T3	T4	T5	T6
Day 1	12	12	12	12	12	12	12
Day 2	9	9	12	12	10	10	11
Day 3	8	8	12	10	10	9	9
Day 4	4	5	12	11	8	4	6
Day 5	4	4	12	9	7	4	4
Day 6	4	4	12	6	4	4	4
Day 7	4	4	10	4	4	4	4
Day 8	-	-	10	-	-	-	-
Day 9	-	-	10	-	-	-	-
Day 10	-	-	10	-	-	-	-

Treatments: C: Control;T1: STS ; T2: SBW; T3:AW; T4:LSBW;T5:SBLW; T6:EBSW

Table 2. F test and t- Test of Physical Observation score on Bird of Paradise.

F-Test Two-Sample for Variances

	Day 4	*Day 5*
Mean	7.142857	6.285714
Variance	10.80952	10.2381
Observations	7	7
Df	6	6
F	4.555814	
P(F<=f) one-tail	0.47456	
F Critical one-tail	4.283866	

t-Test: Paired Two Sample for Means

Day 5	*CONTROL*	*T2*
Mean	4	12
Variance	1.5	3.5
Observations	9	9
Pearson Correlation	0.7092	
Hypothesized Mean Difference	0	
Df	8	
t Stat	-18.14	
P(T<=t) one-tail	4.3808	
t Critical one-tail	1.8595	
P(T<=t) two-tail	8.75-08	
t Critical two-tail	2.3060	

RESULTS AND DISCUSSION

Effect of Hydration Treatments on Bird of Paradise

Freshness of the Bird of paradise was observed for 10 days in selected preservatives. The effect of these treatments on this flower is presented in Table 1.

Results reported in Table 1. revealed the influence of treatments on the exotic flower bird of paradise. Flowers showed the marked variation in retaining their freshness with and without treatments in Plate 1. It can be seen that all flowers were found fresh only on first day and from the second day onwards there was a gradual change in the quality in control and T_1. Flower treated with T_2 treatment retained freshness upto 6th day and there was a minor change from 7th day onwards. From this observation it can be inferred that bird of paradise treated with sprite and bleach in water had positive impact on flower quality when compared to other treatments. The statistical analysis of scores through F test and t-Test reported in Table 2. showed the impact of these treatments on Bird of Paradise.

These scores were statistically analysed to establish the influence of treatments on number of days to retain the qualities of flowers and presented in Table 2. The results revealed that, among 10 days to retain the physical characteristics of bird of paradise were retained well upto 4th day and the quality of the flowers deteriorated significantly from the 5th day onwards, where as in $T_{2,}$ it remained fresh up to10 days (F-Test Two-

Sample for Variance). Among the treatments, treatment T_2 (Sprite, bleach and warm water) was found to be effectively significant over other treatments (t-Test: Paired Two Sample for Means) for period of 10 days, thus the null hypothesis is rejected. This may be due to certain non diet, citric acid-based soft drinks are similar to fresh flower foods because they are rich in sugar and the commonly added "preservative" (germicide) called sodium or potassium benzoate (Paul and George, 1996).

Effect of selected pre treatments on Bird of Paradise

Bird of Paradise was treated with all the nine treatments and freeze dried. Outcome of the findings are presented in Table 3. and in Plate. 2.

The results reported in Table 3. showed the effect of pre-treatments on the colour, form, texture and overall appearance. Comparison of reference flowers to untreated freeze dried flowers had the least score, while the flower treated with T9 received highest scores for all the four parameters. Detailed analysis of scores for three sets of combination revealed that the third base treatment blended with polymer 1 and polymer 1 and 2 in T6 and T9, respectively received the highest score.

Colour: Comparison of colour values in terms of HSB of reference flower (H-23 S-72% B- 92%) to all treatments, T9 was more nearer (H 24 S 83% B 95%) to values except for saturation (S). This proved that freeze dried flowers retained colour more close to nature.

Form: The freeze dried control flower was shrunk and crispy when compared with reference flower. There was a marked change in the shape and size of the flowers in basic, improved and advanced compositions and these were better with T6 and T9. This proved 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 and had the least score. Similar to form, there was a distinct change in the texture of flowers in pure, improved and advanced compositions and these were better with T9. The orange petal and purple sepal retained its natural texture though appeared shrunk. This observation proved the importance of addition of polymer I and II to base composition.

Appearance: Beauty of flower is with sheen and suppleness. Though T9 was better in terms of colour, form and texture, the scores for appearance was less and this may be due to less sheen and highest percentage of moisture loss (78%).

Moisture: This was measured quantitatively and it was found that in all the treatments the moisture loss percentage varied between 78%-93% in all the flowers and it did not remain consistent between experiments. This may be due to variations in chemicals between the treatments which influenced the weight of flower.

These scores were statistically analysed to establish the influence of treatments on overall quality of flowers. Table 4. (Anova one-way classification table) on Bird of paradise revealed that the pre-treatment had significant difference on the overall quality of freeze-dried exotic flowers so the null hypothesis is rejected. From this analysis, it can be drawn that the choice of chemicals influenced the quality of freeze dried Bird of Paradise at 5% level of significance.

From the above qualitative analysis, it can be inferred that basic compositions resulted in excessive dryness in comparison to improved compositions. A study coincided with lab research conducted by Reddy and Kumari (2011) and Shirin (2011). It highlighted the fact that inclusions of polymers with base composition blended polymer I and II resulted in better quality flowers.

Effect of post treatments on Bird of Paradise

Freeze dried Bird of Paradise flowers was post-treated with six different mediums to explore the suitability and these are presented in Plate 3. From the data, it was observed that flower sprayed with DMP looked natural as the flower retained orange and purple hue with mild glossy finish. The next best was for picture varnish with increased gloss. Other treatments were found to be less appealing to eye. Expert panel scores for different flower characteristics are presented in Table 5.

From the data it can be observed that T5 - dried material preservative had higher score for colour, form and texture and for appearance it scored less may be because of the shrinkage

Table 3. Effect of Pre-treatments on Physical Observation score on Bird of Paradise.

Characteristics	Control	Basic compositions			Improved compositions			Advanced compositions		
		T1	T2	T3	T4	T5	T6	T7	T8	T9
Colour	1	2	3	3	3	3	3	3	3	3
Form	1	1	2	2	2	2	3	2	2	3
Texture	1	2	2	2	2	2	2	2	2	3
Appearance	1	2	2	2	2	2	2	2	2	2
Total	4	7	8	9	9	9	10	9	9	11

Table 4. ANOVA – One way Classification Table for Bird of Paradise.

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	8.1	9	0.9	3.857143	0.002457	2.210697
Within Groups	7	30	0.233333			
Total	15.1	39				

* - Significant difference at 5 percent level

Table 5. Physical Observation score on Bird of Paradise.

Characteristics	T1	T2	T3	T4	T5	T6
Colour	2	3	2	2	3	2
Form	1	2	2	2	3	2
Texture	2	2	2	2	3	2
Appearance	2	3	2	2	2	2
Total	7	10	8	8	11	8

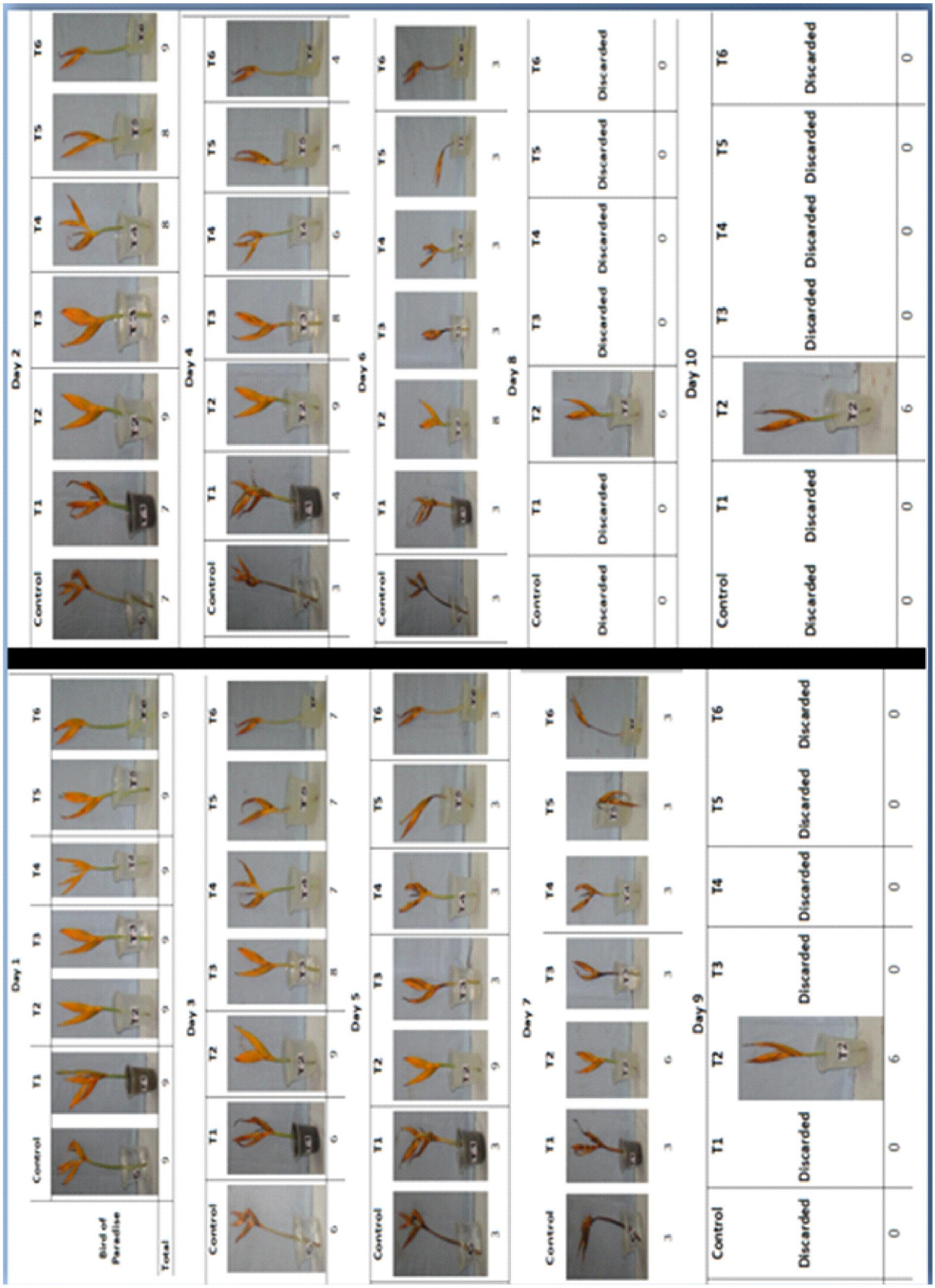
Table 6. ANOVA - One way Classification Table on Bird of Paradise.

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	2.833333	5	0.566667	4.08	0.011871	2.772853
Within Groups	2.5	18	0.138889			
Total	5.333333	23				

observed in the orange and blue sepals and petals. Picture varnish coating on this flower had also scored next highest and received maximum score for colour and appearance. Flower coated with T1, T3, T4 and T6 received lesser scores may be due to their mismatch finish. These observations revealed that each medium resulted in different output, while meeting the same purpose. These scores were statistically analysed to establish the influence of treatments on overall quality of flowers. Table 6. (Anova one-way classification table) on Bird of Paradise revealed that post-treatment has significant difference on the overall quality of freeze-dried exotic flowers so the null hypothesis is rejected.

It can be drawn from these observations that DMP was the most suitable medium for Bird of Paradise as it produced flower which was more close to nature. This result coincided with the views of Brown (2011) who stated that dried flower or floral arrangements can be sprayed with glaze like “flower fixatives,” or “dried flower preservatives” to preserve them, as these are intended to prolong the life and to retain beauty of dried flowers. Spraying the dried flowers with a clear spray will prevent them from absorbing water during humid

4.1. Effect of Hydration treatments on Bird of Paradise



Reference

Treatment of Bird of Paradise Flower with different Pre-treatment Compositions

Fresh flower
H-23 S-72% B- 92%
Orange(Flemnco)

T1 – B 1
H 21 S 82 B 83%
Orange(Gold Drop)
Moisture -86%

T2 – B 2
H 20 S 72%
B 74%
Orange (SmokeTree)
Moisture -86%

T3 – B 3
H 17 S 70%
B 84%
Orange (Tango)
Moisture -93%

T4 – B 1 + PI
H 21 S 72% B 68%
Orange (Fiery Orange)
Moisture -88%

T5 – B 2 + PI
H 28 S 73% B 71%
Orange (Meteor)
Moisture -84%

Freeze Dried
H 25 S 70% B 58 %
Yellow(Gambage)
Moisture - 86%

T6 – B 3 + PI
H 19 S 70% B 69%
Orange (Vesuvius)
Moisture -84%

T7 – B 1 + PI&II
H 21 S 72% B 62%
Orange(Bourbon)
Moisture -90%

T8 – B 2 + PI&II
H 20 S 76% B 58%
Orange(Rich Gold)
Moisture -83%

T9 – B 3 + PI&II
H 24 S 83% B 95%
Orange(Sun)
Moisture -78%

Plate. 4.7 .Effect of selected pre treatments on Bird of Paradise

Reference Flower

Bird of Paradise

Acrylic Clear Spray

T1

Picture Varnish

T2

Glazing Medium

T3

Glossy Lusture

T4

Deried Material Preservativ

T5

Glazing Dip

T6

Plate. 4.13. Effect of post treatments on Exotic Flowers

periods and prevent dust from sticking and discolouring the petals (Gouin, 1994).

Conclusion

Dried or preserved plant materials complement any home decor in both formal and informal arrangements. They will last almost indefinitely if carefully done and require little care. Flowers and foliage that dry more effectively in freeze drying process. Bird of paradise has thick and glossy petals in orange and thin and delicate sepal in blue colour with unique form, colour, texture. To retain the natural glory of this flower, following treatments were found to be suitable. If flower is procured few hours or days in advance, hydrate with T2 preservative, which is a blend of Sprite and Bleach in luke warm water (43-45^{o}c), flowers remain fresh up to 10 days. When floral freeze dryer is ready, pre-treat flowers individually in preservative (T_5) a combination included chemicals meant for dehydration solvent, colour fixative, environmental fixer , bio-fixer and shatter resistant polymer. Post-treat flower with DMP as sealant was found best to protect flower from external environment and conditions such as dust, light, humidity and to replenish desired colour and protection. Flowers were found to be significantly influenced with different pre and post-treatments. ANOVA one way classification proved that there was a significant difference between the pre treatments at 5% level of significance.Freeze-dried flowers are of sufficient value such that they justify the substantial cost of freeze-drying. Freeze dried flowers can find a market potential as it can be used as attractive accents, while decorating the interiors for any home, commercial centres and as gift articles for any occasions.

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