

Effect of Some Natural Compounds on Prolonging Vase Life and Keeping Quality in Rose Cut Flowers

I. Carbohydrates content

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ABSTRACT : Short postharvest vase life is one of the most important problems on the cut flowers . In this study we investigated the effect of some natural components as sucrose, salicylic acid (SA), proline, peppermint extract (PE) and ascorbic acid (ASA) on sugars and starch content in (*Rosa hybrida* L.cv. "Avalanche" & "Bella vita") flowers. The treatments were control, sucrose (25, 50 and 75 g/L), salicylic acid (1, 2 and 3 mM), proline (5,10 and 15 mM), peppermint extract (25, 50 and 75 g/L) and ascorbic acid (50, 100 and 150 mg/L).Results showed that the two higher concentrations 75 and 50 g/L of sucrose and peppermint extract,10 and 15 mM of proline,150 and 100 mg/L of ascorbic acid and the lowest concentration 1mM of salicylic acid significantly increased the starch content in two seasons for both cultivars compared to control, while the same previous concentrations caused a significant decrease in percent of sugars content (total sugars, reducing sugars)in two seasons for both cultivars compared to control, all treatments which used did not affect on non-reducing sugar content) compared to control in two season for both cultivars .

Key words: Rose, Total sugars, reducing and non-reducing sugars, Starch content

INTRODUCTION

Roses (*Rosa hybrida* L.) belong to family Rosaceae and Genus Rosa which contains more than 200 species and 18,000 cultivars (Gudin, 2000). Rose enjoys superiority over all other flowers being extensively used for decorative purposes and is prized for its delicate nature, beauty, charm and aroma. Rose is recognized for their high economic value, which are used in agro-based industry especially in cosmetics and perfumes. Additionally, roses play a vital role in the manufacturing of various products of medicinal and nutritional importance. However, the main idea of rose plant cultivation is to get the cut flowers, which greatly deals with the floricultural business (Butt, 2003). Several chemical solutions which used as pulsing or preservative solutions for increasing the longevity of cut flowers, were very expensive and most harmful preservative for human causing irritating to skin, eyes and respiratory tract , in contrast using natural products did not have large attentions and safe in vase solutions.Sucrose has been found to be the most commonly used sugar in prolonging vase life of cut flowers, and the exogenous application of sucrose supplies the flowers with much needed substrates for respiration and materials for building structures for the plant organs and contributed to cell wall synthesis (Ichimura, 1998) . In the same context, the word salicylic acid (SA) was derived from Latin word "Salix", meaning willow tree (Raskin *et al.*, 1990). In addition, Salicylic acid is a well known phenol that can prevent ACC-oxidase activity (Amino-Cyclopropane carboxylate- oxidase) . Proline has been proposed to act as a compatible solute that adjusts the osmotic potential in the cytoplasm (Bartels and Sunkar, 2006). Osmotic adjustment is one of the major physiological vital phenomena for sustaining growth of plants under osmotic

stress (Serraj and Sinclair, 2002). Peppermint plant belongs to family labiatae their antibacterial, antifungal (Karamanoli *et al.*, 2000) and antioxidant properties (Ozcan, 2003) It is known to be an effective chemo preventive agent, an antimutagenic (Minnunni *et al.*, 1992). Ascorbic acid (Vitamin C) is product of D-glucose metabolism which effect on some nutritional cycles activity in higher plants and play an important role in the electron transport system (El-kobisy *et al.*, 2005). Ascorbic acid also has been associated with several types of biological activities in plants such as enzyme Co factors, antioxidant and as a donor / acceptor in electro transport at plasma membrane or in the chloroplast (Conklin, 2001). Therefore, the aim of this work is to investigate the effect of some natural components which safe and environmentally friendly substances among these components (Sucrose, Salicylic acid (SA), Proline, Peppermint extract (PE), Ascorbic acid (ASA)) and the effect its (in general) as natural materials on prolonging the vase life of rose cut flowers and find out the most natural material which extend the vase life of two cultivars of rose cut flowers (Bella vita & Avalanche) on March and November 2013 .

MATERIALS AND METHODS

This experiment was carried out at laboratory of the Ornamental Department of Horticulture Plants, Faculty of Agriculture, Alexandria University, during two successive seasons (March and November 2013), on two cultivars "Avalanche" and "Bella vita" and the cut flowers were harvested in half-open stage from "3 H" nursery in Ismailia Government, which took from mother plants developing in greenhouse (relative humidity was 70%, air temperature 27^o C) in uniform size, length and shape, at normal harvest maturity (Sepals starting to reflex) almost all flowers had the same stems 50 cm length and weight 30 g in the morning and transported with appropriate covers immediately, stems of cut flowers recut under water to(40 cm length).

The treatments were:

- Control (Tape water)
- Sucrose (25, 50 and 75 g/L)
- Salicylic acid (1, 2 and 3 mM)
- Proline (5, 10 and 15 mM)
- Peppermint extract (25, 50 and 75 g/L)
- Ascorbic acid (50, 100 and 150 mg/L)

Each treatment was replicated three times placed in laboratory, the temperature was 18(±2)^oC, relative humidity (R.H.) was about (50-60%) and light was from a white fluorescent lamp (4000 Calvin).

The following measurements in the initial day (0 day), 5th day and 10th day, in each sample; total, reducing and non-reducing sugars and starch were determined.

The total sugars content were determined as described by (Dubois *et al.*, 1956) and expressed as percent. Reducing sugars were determined by using Nelson arseno molybdate colorimetric method which described by (Malik and Singh 1980) and expressed as percent. The percentage of non-reducing sugars was calculated by the difference between the total and the reducing sugars. In addition the percentage of starch was determined in petals according to (A.O.A.C.1994).

The experimental design was factorial in randomized complete block design, and all data obtained throughout the course of this study were statistically analyzed by the analysis of variance as described by Steel and Torrie (1980) and all analyses were done by means of (SAS, 2002) statistical software.

RESULTS AND DISCUSSION

1-Total sugars percent: The effect of some natural components on total sugars percentage were described in Tables (1 and 2) .

In general, in Tables (1 and 2) the highest concentration (75 g/L) of sucrose treatments significantly decreased the total sugars content , compared to control and the lowest one (25 g/L) in two seasons for both cultivars , except between the highest (75 g/L) and the lowest (25 g/L) concentrations in the second season for "Bella vita" . Data also, showed that significant difference was found between the intermediate concentration (50 g/L) compared to control and the lowest concentration (25 g/L) in the second season for "Avalanche". In the meantime, significant difference was found between 75 compared to 50 g/L treatments, in the second season for "Avalanche". El-Zohairy (1999) mentioned that sucrose decreased total sugars percentages of *Rosa hybrida* cv. Mercedes and Eiffel Tower .The prolongation of the vase life was attributed to the additional supply of sugars that provide extra food or substrates for respiration resulted in a higher respiration to flowers (Pun and Ichimura, 2003). The important factor which causes wilting is water stress which occurs when rate of transpiration exceeds the rate of water uptake (Lama *et al.*, 2013) on rose. In contrast, Pun and Ichimura (2003) stated that sucrose at lower concentrations prolonged the vase life of gladiolus by increasing the uptake, where as higher concentrations seemed to impede the uptake.

As for salicylic acid treatments in Tables (1 and 2), data showed that, the lowest concentration of salicylic acid (1mM) caused significant decrease in total sugars content compared to control in both seasons for the two cultivars. Data also, showed that significant decrease was found between the lowest concentration (1 mM) compared to the two higher concentrations (3 mM) and (2 mM) in the second season for "Avalanche", in one side and compared to the highest one (3 mM) only in the first season for "Bella vita", in the other side. Later, it was found that the intermediate concentration of salicylic acid (2 mM) significantly decreased the total sugars content of petals compared to the control and the highest concentration (3 mM) in the second season for "Avalanche" . Mei-hua *et al.* (2008) showed that the salicylic acid and sucrose treatments extended the vase life and improved flower quality with reduced respiration rate and delay senescence, decrease lipid peroxidation and malondialdehyde content on gerbera. In contrast , salicylic acid activate the consumption of soluble sugar metabolism by increasing osmotic pressure and this lead to increase the sugar content in leaf of *Salvia officinalis* (Sahar *et al.*, 2011) .

In general, proline treatments decrease the total sugars content. The highest concentration (15 mM) significantly decreased the total sugar compared to control and the lowest concentration (5mM) in two seasons for two cultivars , except between the highest (15 mM) compared to the lowest one(5 mM) in the second season for " Bella vita" . Data also showed that significant difference was found between the intermediate concentration (10

Table (1): Effect of some natural component treatments on prolonging the vase life of cut rose cv. "Avalanche" flowers on total sugars (percent) at 18(±2)°C and R.H. (50-60%)

Periods (days)	Treatments																Average
	Control	Sucrose (g/L)			Salicylic acid (mM)			Proline (mM)			Peppermint extract (g/L)			Ascorbic acid (mg/L)			
		25	50	75	1	2	3	5	10	15	25	50	75	50	100	150	
"March"																	
0	2.43	2.38	2.25	2.13	2.11	2.29	2.38	2.34	2.24	2.08	2.40	2.27	2.13	2.38	2.28	2.14	2.26
5	4.17	4.09	3.99	3.85	3.87	4.03	4.10	4.08	3.95	3.79	4.05	3.91	3.76	4.06	3.93	3.78	3.96
10	6.30	6.24	6.10	5.94	6.00	6.13	6.16	6.21	6.05	5.91	6.24	6.10	5.91	6.22	6.08	5.88	6.09
Treatments Average	4.30	4.24	4.11	3.97	3.99	4.15	4.21	4.21	4.08	3.93	4.23	4.09	3.93	4.22	4.10	3.93	
L.S.D _{0.05}	Treatment: 0.26				Dates: 0.11				Treatment x Dates: 0.46								
"November"																	
0	2.70	2.61	2.47	2.26	2.33	2.48	2.61	2.60	2.50	2.30	2.62	2.47	2.28	2.61	2.48	2.29	2.48
5	4.10	4.00	3.88	3.73	3.77	3.91	4.01	3.94	3.80	3.69	4.01	3.88	3.72	4.03	3.92	3.75	3.88
10	5.47	5.37	5.25	5.10	5.14	5.29	5.40	5.36	5.24	5.08	5.39	5.27	5.13	5.39	5.26	5.09	5.26
Treatments Average	4.09	3.99	3.87	3.70	3.75	3.89	4.01	3.97	3.85	3.69	4.01	3.87	3.71	4.01	3.89	3.71	
L.S.D _{0.05}	Treatment: 0.11				Dates: 0.05				Treatment x Dates: 0.16								

Table (2): Effect of some natural component treatments on prolonging the vase life of cut rose cv. "Bella vita" flowers on total sugar (percent) at 18(±2)°C and R.H. (50-60%)

Periods (days)	Treatments																	Average
	Control	Sucrose (g/L)			Salicylic acid (mM)			Proline (mM)			Peppermint extract (g/L)			Ascorbic acid (mg/L)				
		25	50	75	1	2	3	5	10	15	25	50	75	50	100	150		
"March"																		
0	2.84	2.79	2.70	2.50	2.52	2.69	2.78	2.77	2.63	2.51	2.78	2.66	2.48	2.79	2.73	2.55	2.67	
5	4.08	4.00	3.90	3.77	3.76	3.93	4.02	3.99	3.90	3.70	4.00	3.92	3.80	4.01	3.92	3.75	3.90	
10	5.55	5.49	5.36	5.18	5.20	5.39	5.48	5.46	5.34	5.16	5.50	5.40	5.19	5.47	5.34	5.17	5.36	
Treatments Average	4.16	4.09	3.99	3.82	3.83	4.00	4.09	4.07	3.96	3.79	4.09	3.99	3.82	4.09	4.00	3.82		
L.S.D _{0.05}	Treatment: 0.18			Dates: 0.08			Treatment x Dates: 0.32											
"November"																		
0	2.91	2.86	2.74	2.54	2.53	2.72	2.86	2.84	2.73	2.52	2.83	2.71	2.53	2.86	2.73	2.51	2.71	
5	4.23	4.15	4.03	3.86	3.87	4.08	4.19	4.18	4.04	3.86	4.14	4.02	3.84	4.19	4.07	3.90	4.04	
10	6.03	5.96	5.85	5.64	5.70	5.85	5.96	5.94	5.82	5.61	5.98	5.86	5.68	5.97	5.83	5.64	5.83	
Treatments Average	4.39	4.32	4.21	4.01	4.03	4.22	4.34	4.32	4.20	4.00	4.32	4.20	4.02	4.34	4.21	4.02		
L.S.D _{0.05}	Treatment: 0.36			Dates: 0.16			Treatment x Dates: 0.63											

mM) compared to control in the second season for "Avalanche" and the first season for "Bella vita". Later, significant difference was also found between the intermediate concentration (10 mM) compared to the lowest one (5mM) in the second season for "Avalanche" also only in Tables (1and 2). Chen *et al.* (2006) worked on tomato and suggested that, proline acts as a potent antioxidant against reactive oxygen species. Hua and Guo (2002) showed that an exogenous application of proline enhanced the activity of superoxide dismutase on soybean which acts as a potent antioxidant against reactive oxygen species. In contrast, Kumar *et al.* (2010) stated that besides protective effects proline at high concentration induced the early senescence petals of rose and terminated the vase life of treated flowers earlier than control.

As for peppermint extract treatments data in Tables(1and 2) showed that, the highest concentration (75 g/L) caused significantly decrease in total sugars percentage compared to control and the lowest concentration (25 g/L) in first season for both cultivars in one side, and compared to control only in second season for "Bella vita" in the other side. While, the two higher concentrations (75 and 50 g/L) significantly decreased total sugars content compared to control and the lowest one (25 g/L) in second season for "Avalanche" only. Data also, showed that significant difference was found between (75 and 50 g/L) in second seasons for "Avalanche". Shanan (2012) revealed that application of anise, cumin, geranium oil extracts caused decreasing in transpiration rate which reflect on prolonging the vase life of rose flowers. Antibacterial properties of essential oils assigned to their lipophilic character that accumulate in bacterial membranes causing energy depletion (Conner,1993). Marandi *et al.*(2011) found that ajowan oil at (500 mg/L) caused increase in vase life gladiolus compared to control and the highest concentration (1000 mg/L) .

InTables(1and 2) , the highest concentration of ascorbic acid (150 mg/L) significantly decreased total sugars content in petals compared to control and the lowest one (50 mg/L) in two seasons for two cultivars, except between the highest (150 mg/L) and the lowest one (50 mg/L) in the second season for "Bella vita" .The intermediate treatment (100 mg/L) significantly decreased total sugars content compared to control and the lowest concentration (50 mg/L) in second season for "Avalanche" only. Data also, showed that significant difference was found between (150 and 100 mg/L) in first and second season for "Bella vita" and "Avalanche" respectively. Ascorbic acid also has been associated with several types of biological activities in plants such as in enzyme co factors, antioxidant, and as a donor / acceptor in electron transport at the plasma membrane or in the chloroplast (Conklin, 2001). A high level of endogenous ascorbate is essential effectively to maintain the antioxidant system that protects plants from oxidative damage (Cheruth, 2009). In contrast Abdulrahman *et al.* (2012) showed that ascorbic acid resulted in the lowest vase life of snapdragon flowers .

Resulted in Tables (1and 2) cleared that the total sugars percentage significantly increased throughout the previously mentioned periods, and the 10th day showed the highest value compared to 0 and 5th day. These results attributed that the starch was completely hydrolyzed into soluble sugar such as

glucose, fructose and sucrose as ripening progress (Pila *et al.*, 2010) . There was an appreciable increase in the content of total sugar with the increase of storage periods (Molla *et al.*, 2011). In contrast, the total sugar content in the cut flowers varied throughout the observation period which showed rapid decrease in sugar content (Lama *et al.*, 2013).

2. Reducing sugars (percent):- The effect of some natural components on reducing sugars percentage is presented in Tables (3 and 4).

As for sucrose treatments in Tables(3 and 4), the two higher treatments (75 and 50 g/L) significantly decreased the reducing sugars content in petals compared to control and the lowest one (25 g/L) in the first season for two cultivars "Avalanche" and "Bella vita", while in the second season for the two cultivars "Avalanche" and "Bella vita", the highest concentration (75 g/L) significantly decreased the reducing sugars content compared to control and the lowest one (25 g/L).The intermediate concentration (50 g/L) significantly decreased the reducing sugars compared to control in the second season for "Avalanche". Data also, showed that significant difference was found between (75 and 50 g/L) in two seasons for both cultivars, except in the second season for "Bella vita". These results harmony with El-Zohairy (1999) who mentioned that sucrose decreased reducing sugars percentages of *Rosa hybrida* cv. Mercedes and Eiffel Tower. The increase in soluble sugar content of cut roses treated with 8% sucrose due to its lower ability to translocate the sugars towards the flower, which leads to early senescence (Lama *et al.*, 2013). In contrast, Gendy (2000) on gladiolus and (Gendy and Mahmoud, 2012) suggested that sucrose treatment increased total sugars percentage in bird of paradise.

The results in Tables (3 and 4) indicated that, the two lower concentrations of salicylic acid treatments (1and 2 mM), significantly decreased the reducing sugars content compared to control in two seasons for two cultivars ,except the intermediate treatment was no significant in the second season for "Bella vita" . In the meantime, the highest concentration (3mM) significantly decreased reducing sugars content compared to control in the second season for "Avalanche". Data also, found that significant difference was also found between (2 and 1 mM) for both cultivars in first season only. The use of salicylic acid could activate the consumption of soluble sugar metabolism by increasing osmotic pressure, it is supposed that salicylic acid treatment deranges the enzymatic system of polysaccharide hydrolysis (Khodary, 2004) on maize. In contrast with the previous result, Hafez *et al.* (2010) indicated that a continuous steady of salicylic acid increased total soluble sugars content of Le Conte fruit.

As for, the highest concentration of proline (15 mM) showed significantly decreased in reducing sugars content compared to the lowest one (5 mM) and control in two seasons for two cultivars. Data also, found that significant decrease was found between the intermediate concentration (10 mM) compared to control in two seasons for both cultivars , except for the second season for "Bella vita " cultivar . In Tables 3 and 4, significant difference was found between the intermediate concentration (10 mM) compared to the lowest

Table(3): Effect of some natural component treatments on prolonging the vase life of cut rose flowers cv. "Avalanche" on reducing sugar (percent) at 18(+2)°C and R.H. (50-60%)

Period (days)	Treatments																Average
	Control	Sucrose (g/L)			Salicylic acid (mM)			Proline (mM)			Peppermint extract(g/L)			Ascorbic acid (mg/L)			
		25	50	75	1	2	3	5	10	15	25	50	75	50	100	150	
"March"																	
0	2.06	2.04	1.92	1.72	1.76	1.90	2.01	2.03	1.89	1.75	2.03	1.90	1.73	2.00	1.90	1.74	1.90
5	3.50	3.44	3.32	3.12	3.18	3.32	3.47	3.45	3.31	3.13	3.41	3.31	3.12	3.46	3.33	3.15	3.31
10	5.63	5.56	5.42	5.25	5.29	5.46	5.56	5.54	5.39	5.24	5.57	5.46	5.29	5.53	5.36	5.20	5.42
Treatments Average	3.73	3.68	3.55	3.36	3.41	3.56	3.68	3.67	3.53	3.37	3.67	3.56	3.38	3.66	3.53	3.36	
L.S.D _{0.05}	Treatment: 0.13				Dates: 0.05				Treatment x Dates: 0.23								
"November"																	
0	2.07	1.97	1.82	1.64	1.69	1.89	1.98	1.96	1.83	1.66	2.00	1.87	1.68	1.99	1.85	1.70	1.85
5	3.38	3.32	3.21	3.05	3.07	2.90	2.96	3.30	3.20	3.04	3.33	3.22	3.06	3.28	3.19	3.02	3.16
10	4.47	4.37	4.27	4.09	4.11	4.26	4.40	4.37	4.25	4.06	4.39	4.28	4.10	4.40	4.27	4.09	4.26
Treatments Average	3.31	3.22	3.10	2.93	2.96	3.02	3.11	3.21	3.09	2.92	3.24	3.12	2.95	3.22	3.10	2.94	
L.S.D _{0.05}	Treatment: 0.17				Dates: 0.08				Treatment x Dates: 0.28								

Table (4): Effect of some natural component treatments on prolonging the vase life of cut rose cv. "Bella vita" flowers on reducing sugar (percent) at 18(+2)°C and R.H. (50-60%)

Periods (days)	Treatments																Average
	Control	Sucrose (g/L)			Salicylic acid (mM)			Proline (mM)			Peppermint extract (g/L)			Ascorbic acid (mg/L)			
		25	50	75	1	2	3	5	10	15	25	50	75	50	100	150	
"March"																	
0	2.33	2.28	2.17	2.03	2.06	2.20	2.26	2.26	2.15	2.00	2.25	2.15	2.04	2.25	2.18	2.00	2.16
5	3.62	3.55	3.39	3.06	3.28	3.43	3.55	3.54	3.43	3.25	3.51	3.41	3.23	3.48	3.37	3.16	3.39
10	4.80	4.74	4.61	4.44	4.45	4.66	4.76	4.71	4.60	4.42	4.74	4.64	4.45	4.73	4.60	4.39	4.61
Treatments Average	3.58	3.52	3.39	3.18	3.26	3.43	3.52	3.50	3.39	3.22	3.50	3.40	3.24	3.49	3.38	3.18	
L.S.D _{0.05}	Treatment: 0.13				Dates: 0.06				Treatment x Dates: 0.23								
"November"																	
0	2.18	2.14	2.03	1.81	1.85	2.03	2.11	2.12	2.01	1.79	2.14	2.01	1.80	2.10	2.00	1.80	2.00
5	3.17	3.11	2.98	2.73	2.85	3.01	3.12	3.08	2.96	2.79	3.07	2.95	2.74	3.11	3.00	2.81	2.97
10	4.92	4.86	4.74	4.51	4.54	4.76	4.84	4.86	4.74	4.57	4.86	4.75	4.56	4.86	4.75	4.54	4.73
Treatments Average	3.42	3.37	3.25	3.02	3.08	3.27	3.36	3.35	3.24	3.05	3.36	3.24	3.03	3.36	3.25	3.05	
L.S.D _{0.05}	Treatment: 0.26				Dates: 0.11				Treatment x Dates: 0.46								

one (5mM) only in the first season for "Avalanche" . Later, significant decrease was found between the highest (15 mM) and intermediate (10 mM) treatments in two seasons for both cultivars , except in the second season for "Bella vita". Hossain and Fujita (2010) demonstrated that exogenous proline provided a protective action against salt-induced oxidative damage by reducing H₂O₂ and lipid peroxidation level and by enhancing antioxidant defense and methylglyoxal detoxification systems on mung bean seedlings. In contrast to the previous result, Kumar *et al.* (2010) stated that proline at higher concentration induced the early senescence petals of rose.

The two higher concentrations (75 and 50 g/L) of peppermint extract as shown in Tables (3 and 4) significantly decreased the reducing sugars content compared to control in two seasons for both cultivars , except in the second season for "Bella vita" the intermediate concentration (50 g/L) caused no significant decrease . Likewise, the highest concentration (75 g/L) significantly decreased reducing sugars content compared to the lowest one (25 g/L) in two seasons and two cultivars. Data also, showed that significant difference was found between (75 and 50 g/L) in two seasons for both cultivars, except in the second season for "Bella vita". Basiri *et al.* (2011) on carnation they stated that new anti-bacterial agents such as rosemary extract in combination with 6% added sucrose to vase solution had a positive effect on the vase life. Marandi *et al.* (2011) found that ajowan oil at (500 mg/L) caused increased in vase life compared to control and the highest concentration (1000 mg/L). In contrast, Abri *et al.* (2013) found that lipoxygenase activity significantly increased in the control and the ascorbic acid treated flowers during senescence of rose.

Concerning the effect of ascorbic acid treatments in Tables (3 and 4), the two higher concentrations (150 and 100 mg/L) caused significant decrease in reducing sugars content compared to control in two seasons for both cultivars in one side, except for (100 mg/L) in the second season for "Bella vita" and compared to the lowest concentration (50 mg/L) in the first season for "Avalanche" on the other side the highest treatment (150 mg/L) caused significant decrease in reducing sugar content compared to the lowest treatment (50 mg/L) in two seasons for both cultivars. Data also, showed that significant difference was found between (150 and 100 mg/L) in first season only for both cultivars. The ascorbic acid has an ability to scavenge a wide range of reactive oxygen species worked on petunia (Zhang, 2008). In contrast, Abri *et al.* (2013) found that lipoxygenase activity significantly increased in the control and the ascorbic acid treated flowers during senescence of rose.

Results in Tables (3 and 4), cleared that the content of reducing sugars significantly increased with prolonging the vase life throughout the three stages in two seasons for two cultivars, and the increase in 10th day was the highest value compared to 0 day and 5th day in two seasons for both cultivars. Soluble carbohydrates increase the osmotic pool and enhance the turgor pressure which is an essential component in the petal cell expansion processes (Mayak *et al.*, 2001). In contrast, total soluble solids contents of petals decreased with an increase in vase life (Bayleyegn *et al.*, 2012).

Table (5): Effect of some natural component treatments on prolonging the vase life of cut rose flowers cv. "Avalanche" on non-reducing sugars (percent) at 18(±2)°C and R.H. (50-60%)

Periods (days)	Treatments																Average
	Control	Sucrose (g/L)			Salicylic acid (mM)				Proline (mM)		Peppermint extract(g/L)			Ascorbic acid (mg/L)			
		25	50	75	1	2	3	5	10	15	25	50	75	50	100	150	
"March"																	
0	0.37	0.34	0.33	0.41	0.35	0.38	0.36	0.31	0.34	0.33	0.37	0.37	0.40	0.38	0.38	0.40	0.36
5	0.67	0.65	0.66	0.73	0.68	0.71	0.63	0.63	0.64	0.66	0.64	0.60	0.64	0.60	0.60	0.63	0.65
10	0.67	0.68	0.69	0.70	0.71	0.67	0.60	0.67	0.66	0.67	0.67	0.64	0.61	0.70	0.71	0.67	0.67
Treatments Average	0.57	0.56	0.56	0.61	0.58	0.59	0.53	0.54	0.55	0.55	0.56	0.54	0.55	0.56	0.56	0.57	
L.S.D _{0.05}	Treatment: 0.24				Dates: 0.10				Treatment x Dates: 0.40								
"November"																	
0	0.63	0.65	0.65	0.63	0.64	0.60	0.63	0.64	0.66	0.64	0.62	0.60	0.60	0.63	0.63	0.59	0.63
5	0.72	0.68	0.67	0.68	0.70	1.02	1.05	0.64	0.60	0.65	0.69	0.66	0.66	0.75	0.73	0.73	0.73
10	1.00	1.00	0.98	1.01	1.03	1.03	1.00	0.98	0.99	1.02	1.01	0.99	1.03	1.00	0.99	1.01	1.00
Treatments Average	0.78	0.78	0.77	0.77	0.79	0.88	0.89	0.75	0.75	0.77	0.77	0.75	0.76	0.79	0.78	0.78	
L.S.D _{0.05}	Treatment: 0.14				Dates: 0.06				Treatment x Dates: 0.23								

Table (6): Effect of some natural component treatments on prolonging the vase life of cut rose cv. "Bella vita" flowers on non-reducing sugar (percent) at 18(±2)°C and R.H. (50-60%)

Period (days)	Treatments																	Average
	Control	Sucrose (g/L)			Salicylic acid (mM)			Proline (mM)			Peppermint extract(g/L)			Ascorbic acid (mg/L)				
		25	50	75	1	2	3	5	10	15	25	50	75	50	100	150		
"March"																		
0	0.52	0.51	0.53	0.47	0.45	0.49	0.51	0.51	0.49	0.51	0.53	0.51	0.45	0.54	0.55	0.55	0.51	
5	0.47	0.45	0.51	0.70	0.48	0.50	0.47	0.44	0.47	0.45	0.49	0.51	0.56	0.53	0.56	0.59	0.51	
10	0.75	0.75	0.75	0.74	0.75	0.73	0.72	0.75	0.74	0.74	0.76	0.76	0.74	0.74	0.74	0.78	0.75	
Treatments Average	0.58	0.57	0.60	0.64	0.56	0.57	0.57	0.57	0.57	0.57	0.59	0.59	0.58	0.60	0.62	0.64		
L.S.D _{0.05}	Treatment: 0.11					Dates: 0.05					Treatment x Dates: 0.16							
"November"																		
0	0.73	0.72	0.71	0.73	0.68	0.69	0.75	0.73	0.72	0.72	0.69	0.70	0.73	0.75	0.73	0.71	0.72	
5	1.06	1.04	1.05	1.13	1.02	1.07	1.07	1.10	1.09	1.07	1.07	1.07	1.10	1.08	1.07	1.09	1.07	
10	1.12	1.11	1.12	1.14	1.16	1.10	1.12	1.08	1.08	1.05	1.12	1.11	1.13	1.11	1.08	1.10	1.11	
Treatments Average	0.97	0.96	0.96	1.00	0.95	0.95	0.98	0.97	0.96	0.95	0.96	0.96	0.99	0.98	0.96	0.97		
L.S.D _{0.05}	Treatment: 0.16					Dates: 0.07					Treatment x Dates: 0.28							

3. Non-reducing sugars (percent):-The effect of some natural components on non-reducing sugars was showed in Tables (5 and 6).

The results showed that all treatments, did not affect significantly on non-reducing sugars content, but there were some concentrations of these materials caused slightly increase in non-reducing sugars content as:

The highest concentration of sucrose treatment (75 g/L) in the first season for "Avalanche" and two seasons for "Bella vita" and the intermediate treatment (50 g/L) in first season only showed slightly increase in Tables (5 and 6). In contrast, the preservatives containing 8% and 5% sucrose had higher non-reducing sugar content in petals of rose may be due to the hydrolysis of exogenous sugar in the solutions (Lama *et al.*, 2013).

Likewise, in Tables (5 and 6), in the two seasons for "Avalanche" the two lower concentrations of salicylic acid treatments (2 and 1mM) and the highest concentration (3 mM) in the second season for "Avalanche" and "Bella vita", respectively showed slightly increase in non-reducing sugars content. The treatments of salicylic acid are found to cause lowering of non-reducing sugar compared to control (Pila *et al.*, 2010) worked on tomato.

In the meantime, in Tables (5 and 6), there were slightly increase in non-reducing sugars content in the two lower concentrations of peppermint extract treatments (75 and 50 g/L) in the first season, and the highest one in the second season respectively, of "Bella vita" only. Eshghi and Jari (2013) showed that the sugar decreased in all treatments and carvacrol treatments (50 Thymus oil+50 Carvacrol oil mg/L) in gladiolus.

As for, in Tables (5 and 6) there were slightly increase in non-reducing sugars content was found in the three concentrations of ascorbic acid treatments (150, 100 and 50 mg/L) in the first season for "Bella vita" and the lowest one (50 mg/L) in the second season for "Avalanche" and "Bella vita", respectively. In contrast, all treatment of ascorbic acid resulted in higher total sugars in Le Conte Pear Fruits than the control (Hafez *et al.*, 2010).

Data in Tables (5 and 6), showed that there were an increase in non-reducing sugars content throughout the 5th day and 10th day compared to 0 day, except between 5th day and 0 day in the first season for "Bella vita". Data also showed that significant difference was found between the 10th day compared to 5th day in the second season for "Avalanche" and the first season for "Bella vita". The emboli might be due to air that is aspired into the conduits that are cut open and to cavitations in xylem conduits that remain unopened (Van Doorn and Cruz, 2000). During rapid cell expansion starch content is decreased and soluble sugar content increased in petals (Sarkka, 2004).

4. Starch content (percent):- The effect of some natural components on starch content was showed in Tables (7 and 8).

As for the treatments of sucrose in Tables (7 and 8), the two higher concentrations (75 and 50 g/L) significantly increase petal starch content compared to control and the lowest one (25 g/L) in two seasons for both cultivars. Data also,

showed that significant difference was found between (75 and 50 g/L) in two seasons for both cultivars. The dissolved sugars in cells of the petals are osmotically active substances that draw into the corolla cells making the cell turgid and hydrolyzing the sucrose for respiration (Pun *et al.*, 2005; Butt, 2005; Delaporte *et al.*, 2005; Elgimabi and Ahmed, 2009; Elgimabi and Sliai, 2013). In contrast, to the previous results as reported by (Pun and Ichimura, 2003) sucrose at lower concentrations prolonged the vase life of gladiolus by increasing the uptake.

The lowest concentration of salicylic acid treatment (1mM) caused significant increase in the starch content compared to the control and the two higher concentrations (3 and 2 mM) in the second season for the two cultivars in one side, and compared to control and the highest one (3 mM) in first season for two cultivars in the second side. No more significant difference was found among the rest treatments in Tables (7 and 8). Salicylic acid influences the plant growth by regulating a number of physiological and biochemical processes (Ashraf *et al.*, 2008). Mei-hua *et al.* (2008) showed that salicylic acid can extend the vase life of gerbera cut flowers with decrease reactive oxygen species and ACC-Oxidase (Amino Cyclo propane Carboxylate-Oxidase).

In the meanwhile, the two higher concentrations of proline treatments (15 and 10 mM) significantly increase petal starch content in two seasons for two cultivars compared to control and the lowest one (5 mM). Data in Tables (7 and 8) also, showed that, significant increase was found between (15 and 10 mM) in two seasons for both cultivars. No significant difference was also found among the rest treatments. An exogenous application of proline enhanced the vase life and concomitantly slowed the senescence (Kumar *et al.*, 2010) on rose. Chen and Dickman (2005) reported that an exogenous application of proline inhibited the reactive oxygen species. In contrast, there are reports which showed lower level of proline coincided with improved vase life of cut OT lily "Mantissa" flowers (Geng *et al.*, 2009).

Likewise, in Tables (7 and 8) the two higher concentrations (75 and 50 g/L) of peppermint extract treatments significantly increased starch content compared to control and the lowest one (25 g/L) in two cultivars and two seasons. Data also, showed that significant increase was found between (75 and 50 g/L) in both cultivars and both seasons. Shanani (2012) found that essential oils as anise, cumin and geranium caused decrease in rate transpiration in rose. In contrast, the greatest decrease in fresh weight of alstromaria flowers was related to thyme oil (Bazaz and Tehranifar, 2011).

In the same time, high significant increase was found between the two higher concentrations (150mg/L) and (100 mg/L) of ascorbic acid treatments compared to control and the lowest one (50mg/L) for both cultivars and two seasons in Tables (7 and 8). Data also, showed that significant increase was found between 150 mg/L compared to 100 mg/L treatments in both cultivars and two seasons. The ascorbic acid contributes to the detoxification of reactive oxygen species that leads to delayed senescence of flowers (Conklin, 2001) worked on gladiolus. In contrast, ascorbic acid at concentration 150 g/L gave a significant increase in percentage of total carbohydrates 0.97% as compared with other concentrations, except control (Abdulrahman *et al.*, 2012) worked on snapdragon flowers.

Table (7): Effect of some natural component treatments on prolonging the vase life of cut rose flowers cv. "Bella vita" on starch (percent) at 18(±2)°C and R.H. (50-60%)

Period (days)	Treatments																Average
	Control	Sucrose (g/L)			Salicylic acid (mM)			Proline (mM)			Peppermint extract(g/L)			Ascorbic acid (mg/L)			
		25	50	75	1	2	3	5	10	15	25	50	75	50	100	150	
"March"																	
0	2.37	2.55	2.79	3.05	2.65	2.46	2.41	2.49	2.81	3.09	2.54	2.90	3.41	2.49	2.87	3.20	2.74
5	3.14	3.28	3.58	3.91	3.48	3.29	3.19	3.26	3.53	3.78	3.27	3.60	3.97	3.31	3.67	3.86	3.50
10	1.59	1.73	1.95	2.15	1.89	1.72	1.66	1.75	2.06	2.38	1.69	2.03	2.49	1.75	2.13	2.42	1.95
Treatments Average	2.37	2.52	2.77	3.04	2.67	2.49	2.42	2.50	2.80	3.08	2.50	2.84	3.29	2.52	2.89	3.16	
L.S.D _{0.05}	Treatment: 0.24				Dates: 0.10				Treatment x Dates: 0.43								
"November"																	
0	1.62	1.80	2.04	2.30	1.99	1.74	1.66	1.82	2.14	2.43	1.74	2.10	2.61	1.78	2.13	2.46	2.02
5	2.76	2.89	3.20	3.42	3.03	2.82	2.77	2.90	3.17	3.41	2.86	3.27	3.64	2.86	3.22	3.41	3.09
10	0.79	0.93	1.15	1.31	1.01	0.84	0.80	0.85	1.16	1.48	0.79	1.11	1.57	0.82	1.21	1.49	1.06
Treatments Average	1.72	1.87	2.13	2.34	2.01	1.80	1.74	1.86	2.16	2.44	1.80	2.16	2.61	1.82	2.19	2.45	
L.S.D _{0.05}	Treatment: 0.20				Dates: 0.08				Treatment x Dates: 0.32								

Table (8): Effect of some natural component treatments on prolonging the vase life of cut rose flowers cv. "Avalanche" on starch (percent) at 18(±2)°C and R.H. (50-60%).

Periods (days)	Treatments																	Average
	Control	Sucrose (g/L)			Salicylic acid (mM)				Proline (mM)		Peppermint extract(g/L)			Ascorbic acid (mg/L)				
		25	50	75	1	2	3	5	10	15	25	50	75	50	100	150		
"March"																		
0	2.24	2.35	2.61	2.81	2.51	2.38	2.32	2.35	2.65	2.94	2.36	2.62	2.87	2.37	2.57	2.76	2.52	
5	3.69	3.81	4.00	4.22	3.92	3.80	3.74	3.83	4.11	4.39	3.79	4.00	4.25	3.85	4.08	4.43	4.00	
10	1.23	1.34	1.58	1.73	1.53	1.37	1.30	1.37	1.60	1.86	1.33	1.57	1.76	1.35	1.52	1.74	1.49	
Treatments Average	2.39	2.50	2.73	2.92	2.65	2.52	2.45	2.52	2.79	3.06	2.49	2.73	2.96	2.52	2.72	2.98		
L.S.D _{0.05}	Treatment: 0.14				Dates: 0.06				Treatment x Dates: 0.23									
"November"																		
0	2.18	2.29	2.55	2.77	2.45	2.28	2.23	2.24	2.57	2.86	2.31	2.57	2.82	2.28	2.48	2.67	2.45	
5	3.27	3.38	3.55	3.77	3.49	3.36	3.31	3.33	3.68	3.95	3.36	3.57	3.82	3.38	3.61	3.91	3.54	
10	1.67	1.78	2.01	2.16	1.87	1.74	1.68	1.74	2.02	2.31	1.78	2.02	2.20	1.76	1.94	2.15	1.92	
Treatments Average	2.37	2.48	2.70	2.90	2.60	2.46	2.41	2.44	2.76	3.04	2.48	2.72	2.95	2.47	2.68	2.91		
L.S.D _{0.05}	Treatment: 0.12				Dates: 0.05				Treatment x Dates: 0.23									

Regarding the effect of periods on changes starch percentage, the data in Tables (7 and 8) cleared that, the highest significant content of starch was found in 5th day, while the lowest significant value was in 10th day compared to 0 day. These results due to petal growth which result from cell expansion requires the influx of water and osmolytes into the vacule thus, petal area as well as fresh and dry weight increase (Van Doorn, 2001). Certain carbohydrates are osmotically active and important for turgor pressure maintenance (Drüge, 2000). Carbohydrates are essential to flowering of plants (Bernier *et al.*,1993) and an important energy source facilitating flower opening (Marissen and La Brijn, 1995).

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الملخص العربي

تأثير بعض المركبات الطبيعية على عمر وجودة الحفظ لأزهار الورد المقطوفة

1- محتوى الكربوهيدرات

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تهدف هذه الدراسة إلى تقدير محتوى السكريات (كلية , مختزلة و غير مختزلة) ومحتوى النشا فى صنفين من أزهار الورد المقطوفة (افلانش ابيض اللون, بيلا فيتا وردى اللون) , وذلك بمعاملة الأزهار ببعض المركبات الطبيعية مثل السكروز (25, 50 و 75 جم/لتر) , حمض السلسيلك (1, 2 و 3 ملليمول) , البرولين (5, 10 و 15 ملليمول) , مستخلص النعناع (25, 50 و 75 جم/لتر) و حمض الأسكوربيك (50 , 100 و 150 مجم/لتر) , الكنترول وكانت النتائج المتحصل عليها كالاتى: أدى أعلى تركيزين من السكروز ومستخلص النعناع (50 , 75 جم/لتر) , البرولين (10 , 15 ملليمول) و حمض الاسكوربيك (100,150 مجم/لتر) واقل تركيز من حمض السلسيلك (1 ملليمول) الى زيادة معنوية فى محتوى بتلات الأزهار من النشا مقارنة بالكنترول فى الموسمين وكلا الصنفين , بينما التركيزات السابقة المذكورة ايضا من هذه المواد أدت إلى نقص معنوى فى محتوى البتلات من السكريات (كلية ومختزلة) مقارنة بالكنترول فى الصنفين من كلا الموسمين . لكن محتوى البتلات من السكريات غير المختزلة لم يتأثر معنويا بشكل واضح بالمعاملات السابقة فى كلا الصنفين والموسمين معا .

