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Effect of Bactericides and Sucrose Pulsing on Longevity and Vase Life of Rose Cut Flowers

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Abstract

The vase life of rose cut flowers was determined by various Physiological factors that determine the rate of their senescence. The vase life of the rose cut flowers studied was pronged by the 8-HQS treatment. The best concentration was 100 ppm, when combined with sucrose 3% gave negative effect. AgNO3 in different concentration, significantly Result in maximum vase life compared to other treatment, while sucrose recorded the lowest vase life especially under lower concentration. The percent of wilting was minimized as a result of using this treatment . However the percent of wiling increased .With the increasing in concentration of 8-HQS , that wilting occurred after 10,8 and 7days of vase life for 100,200, and of 8-HQS in rose. The longest period to reach percent of wilting was obtained by AgNO3 at 30ppm13 days for rose. The best treatment of each chemical retarded the chlorophyll as well as carbohydrate degradation during postharvest life. These physiological processes are connected to cut flower longevity and quality.

Keywords: bactericides; Sucrose; longevity; vase life; rose.

1. Introduction

Ornamentals are categorically classified into cut flowers, foliage, plant Parts, life plants , and dried flower and plants. Flowers are used for enjoyment, Expression and decoration around the word .They are also used to communication emotions, and to create pleasant atmosphere at Home or work [1, 2].

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Florists mainly use in a floral arrangement : (1) line materials, usually Includes tall spikes with blossoms along the stem to establish lines and the outline design (2) mass materials, mainly ball- shaped, rounded and quite massive with many petals, in a design to achieve weight and bulk, and are generally used at the focal point or area. The most popular flowering plants can be available in Sudan are roses, carnation, Snapdragon, chrysanthemum, etc. Roses and carnation are the most popular where ever gardening is done .Cut flowers have different vase –life , from as 1 to 3 days in cut flowers such as delphinium , orchid (vandal) Alstromeia, candytuft columbine, clarkia, gaillardia, Lupine and vote , 7 to 10 days in cut flowers such as protea, gladiolus, ginger , primrose and heliconia , 1 to 2 weeks in cut flowers such as garden , marigolds , snapdragons ,orchids and rose; or as long as 3 to 4 weeks in cut flowers such as statics , tulips , anthuriums , carnation and chrysanthemums(USDA-ARE,2004).The problem with the distribution is that flowers nowadays have to be transported all over the world , for example from Holland to Sudan, from Colombia to Europe to achieve these savings , the save life of flower s must be extended to provided the consumer with equivalent flower quality [3]. The longevity and quality of cut flowers depend also upon the consumption of the ambient Atmosphere .the most adverse effects on cut flowers are caused by ethylene .some deleterious effects of ethylene exposure include leaf yellowing flower (or petal) drop ,irregular opening and premature death [4]. Because of diverse effects of ethylene on a wide range of plant species , many of which are harmful , it would be highly Beneficial to mage the effect of ethylene during the postharvest life of cut flowers .The main objective of the present study is to investigate factors contributing to extend Vase life and longevity of rose cut flowers ;in this regard the following treatments should be investigated . The effects of sucrose pulsing on flower longevity for different cultivars of cut flowers under study.

- The effect of sucrose pulsing on the physiological processes related to cut flowers longevity (senescence, and on the ethylene production).
- The effects of bactericides, silver nitrate (AgNO3) and 8-hydroxquinoline sulfate (8-HQS) as preservative on cut flowers longevity.
- The effect of the interaction between sucrose and bactericides (one of them which is more effective) on cut flowers longevity.

2. Materials and method

Practical work, of this study done in Al- **Taife University Laboratory of Biology** and had been completed in **Khartoum University,** the central Laboratory –shambat campus. Experiment (1) Cut flowers of rose are used for different trials. The flowers were obtained directory from the commercial grower .flowers were brought to the laboratory as soon as possible. The flowering stems were trimmed to a uniform length of 25 cm for roses. Analytically pure 8-hydroxyquinoline sulfate (8-HQS) was obtained from a trading company in Saudi Arabia .8-HQSwas applied as a continues treatment at concentrations of 100,200,300 ppm .The flowers were placed in 250ml glass bottle . AgNO3 was applied as a continuous treatment at concentration of 20, 30, 50 ppm. The flower were placed 250ml glass pottle. Sucrose also was analytically pure and applied Continuously at concentration of 1% ,2% and 3% w/v [5]. The flowers were placed in 250 ml glass bottle containing [6]. The different concentration of 8-HQS, AgNO3 and sucrose were prepared by dissolving the chemicals in sterilized distilled water and autoclaved 250c for two hours as described by [7, 8, and 9].

Control treat meant: Flowers was trimmed keep in 250ml sterilized distilled water for the duration of the experiment, as a control treatment for the three previous trials

Vase life determination of Rose cut flowers: Visual rating of flowers was carried out on the basis of scale from 1 to 4 when :1=entirely fresh flowers ,2= initation of wilting in 20% of petals and beginning of bent neck 3= wilting in 20-50% of petals and increasing the bent neck 4= wilting in 50-100% of petals .The longevity of rose cut flowers was defined as the number of days in vase life required for 50% of flowers to reach stage 2 or more advanced stage [10], Chemical treatments: (8-HQS) +Sucrose treatments: 8-hydroxyquinoline sulfate (8-HQS) was applied as continuous treatment at consternation of 100ppm whether with or without sucrose at3% concretion, which were the best consternation in the previous Experiment ,with three replications .the two compounds was dissolving in sterilized distilled water ,In glass bottle containing 250 ml as an interaction to study the effect of their interaction ,while each ,One of them had dissolve in the same volume (AgNO3)+sucrose treatment: Silver nitrate (AgNO3) was applied as a continuous treatment at consternation of 30 ppm whether with Or without 3% sucrose, which, were the best concentration in the previous experiment, with three replication . The two compounds was dissolve in sterilized distilled water in glass bottle containing 250ml to study the effect of their interaction, also each one of them had been dissolve in the same volume. Sucrose treatment: Also sucrose at3% consternation were applied separately and dissolved in 250ml glass bottle for the whole duration of experiment. Control treatment: Flowers were trimmed and keep in 250ml distilled sterilized water for the duration of the experiment; As a control treatment for the three previous trills.

Vase life determination: Rose cut flowers: Vase life of rose cut flowers were taken as mentioned in experiment (1).

Determination of carbohydrate concernation: Soluble carbohydrate determined on the stem of the best terminate of each chemical for the rose cut flowers tested in the study samples were taken on the same days as mentioned in chlorophyll determination . One flowering stem from each replicate was used for carbohydrate. Dried samples of the three replicates were ground together into a homogenized fine powder was using a household. Garlic crusher [11]. A 0.5g sub –sample of this powder was used for extracting the soluble carbohydrate by dissolving in mixer of (methanol 25% and distilled water 75%) and then had been filtrated .the same method was used for preparing the flower samples . the carbohydrate was separated by a high performance liquid chromatography (HPLC) .A 20 u 1 pail was employed for the different sample . Different al refracts meter (RID-10A) .Was used of fructose, glucose and sucrose. The stationary vase was Ammonium propyl. Column (250x4mm).the mobile vase consist of mixture of acetonitrile –water (80:v/v%).Peak identity was confirmed using authentic carbohydrate. Peak area was determinate by integrator, and percent of each carbohydrate content was calculated of mg. W=A1 XV1 XM1 X100 /A2XV2XM0

WHER A1= Peak heights of the given sugar compound in the sample solution expressed as units of area, length or integration.

A2= peak height of the given sugar compound in the standard solution, expressed as units of area length or integration .V1=total volume of the sample solution in ml .V2= total volume of the standard solution in ml.M1=

mass amount of sugar in grams in the total volume of the standard . M0 = sample weight in gram .The result was rounded to one decimal place [12].

3. Results

The vase life of rose cut flowers was extended as a result of using different concentrations of 8-HQS, as compared to control. (Tablel). The vase life was longer in 8-HQS at 100 ppm which results in 8, 9, 7 days compared to other concentrations. (Table I) shows that the AgNO3 significantly increased the vase life of rose cut flowers, at all level compared to control. The longest vase life was attained by applying AgNO3 at 3oppm which gave 13 days compared to control 5 days (table I).Sucrose resulted in the lowest vase life in comparison to 8-HQS and AgNO3 treatments at different concentration .However, it also prolonged the vase life of cut flowers compared to control .The vase life was increased gradually with easing the concentration of sucrose. The longest vase life result when applying sucrose at 3% concentration (w/v) which gave 6 days in comparison to 5 days for untreated control (table 1).

Table (1) Effect of 8-HQS, $AgNO_3$ and sucrose on the vase life of rose cut flowers (Rosa hybrid).

Treatments	Vase life (Days)
8-HQS 100 ppm	8.97 be
8- HQS 200 ppm	7.64 d
8-$HQS_3$00ppm	7dc
$AgNO_3$2Oppm	9.3b
$AgNO_3$ 30 ppm	10.97a
$AgNO_3$ 5oppm	7.97 cd
Sucrose 1%	5.77e
Sucrose 2%	5.97 ce
Sucrose 3 %	7.07d
Control	*4* f

4.1.2. Wilting percentage**:** Table 2 shows that. However the % wilting increased with the increasing in concentration of 8-HQS, that wilting occurred after 10, 8 and 7 days of vase life for 100,200 and 300 of 8-HQS respectively, compared to control (table 2),The longest period to reach % of wilting was obtained by AgNO3 at 3oppm (13 days) which was the best treatments (table3,5) while, sucrose resulted in the lowest period to reach

wilting % thus, wilting was deled until day 6.7 and 8 for sucrose concentration at 1,2 and 3% respectively, compared to 5 days for control (table 4,5).

Table (2). Calculation of percent wilting in rose cut flowers treated with different concentrations of 8-HQS.

Treatments	Mean of days	Days after treatments
8-HQS 100 ppm	2.6%	Day2
	16.5%	Day4
	46.6%	Day6
	78.6%	Days 8
	95.3%	Day 10
	98.5%	Day 11
8-HQS 200 ppm	3.7%	Day2
	18.8%	Day4
	57.9%s	Day 6
	93%	Day8
	97%	Day 10
8-HQS 300 ppm	5.3%	Day2
	26.7%	Day 4
	63.9%	Day 6
	93.6%	Days8
	96%	Day9

* Reading of % wilting was done every two days after treatments.

Table (3). Calculation of percent wilting in rose cut flowers treated with different concentrations of AgNO3

Treatment	Means of days	Days after treatment
$AgNO_3$ 20 ppm	1%	Day2
	14.5%	Day4
	25.9%	Day6
	52.9%	Day8

	91.6%	Day 10
	98%	Day 11
$AgNO_3$ 30 ppm	0.1%	Day2
	11.3%	Day4
	25.5%	Day6
	50.6%	Day8
	82.3%	Day 10
	96.3%	Day 12
	96.5%	Day 13
$AgNO_3$ 30 ppm	2.9%	Days 2
	15.4%	Day 4
	38.3%	Day 6
	79.7%	Day 8
	93.8%	Day 10

Reading of % wilting was done every two days after treatments.

Table (4) calculation of percent wilting in rose cut flowers treated with different concentrations of sucrose.\

Treatments	Means of days	Days after treatments
Sucrose 1%	3.9%	Day 2
	26.2%	Day4
	74.3%	Day6
	93.3%	Day7
Sucrose 2%	3.6%	Day2
	25.3%	Day4
	56.6%	Day 6
	94.8%	Day 7
Sucrose 3%	2.4%	Day2
	22.6%	Day 4
	61.9%	Day6
	92.3%	Day8

* Reading of % wilting was done every two days after treatments.

Table (5) Calculation of percent wilting in roe cut flowers of control.

Means of days	Days after treatment
3.6%	Day 2
54.9%	Day 4
88.5%	Day 5

Effect of the best treatment for 8-IIQS, AgNO3 and sucrose on vase life and postharvest quality of rose cut flowers: (Table 6) shows that, the treatments of 8-HQS at 100 ppm prolonged the vase life of rosés cut flowers with or without sucrose compared to control. When sucrose was added to l00ppm 8-HQS it shortened the vase life .Such that, the vase life was prolonged for 10 days without sucrose compared to 9 days when sucrose was added.

On the other hand the AgNO3 at 30ppm with or without sucrose significantly increased the vase life of rose cut flowers compared to control. The best treatment was AgNO3 3Oppm+ 3% sucrose, which result in maximum vase life 15 days, compared to all treatments in experiment (2) included the control 5 days (table 6 and).However, sucrose at 3% alone, result in the lowest vase life which, was 7 days and also it extended the vase life in compared to control 5 days (table 6).

Table (6) Effect of the best treatment of 8-HQS, AgNO3 and sucrose on vase life and postharvest quality of rose cut flowers.

Treatments Days of vase life

Treatments	Days of vase life
8-HQS l00ppm	10 c
8-HQS l00ppm+ sucrose 3%	8.5d
$AgNO_3$30ppm	12.5b
$AgNO_3$ 30ppm+ sucrose 3%	14.5 a
Sucrose 3%	7e
Control treatment	5 f

Means followed by different letters differ significantly for each other according to Duncan multiple range test at P= 0.05.CD1.45% .

Chlorophyll content: Using different chemical treatments lead to a significant delay in degradation of (chl. a and chl. b) in comparison with untreated control .The concentration of chlorophyll a was higher than chlorophyll b at any time point throughout the vase life. The differences in chlorophyll concentration become more and more apparent as the duration of postharvest increased .At the end of the vase life of control flowers day 5, the differences clearly appeared and control flowers lost the chlorophyll rapidly .The initial chlorophyll content was 0.423, 0.2 10 mg I ‘ for chi. a and chi. b respectively while, these values were 1.892 and 0.404,2.762 and 0.391,1.757 and 0.521, 2.299 and 0.407, 0.687 and 0.186, 0.596 and0.070 mg 1^{-1} weight for 8-HQS at 100 ppm,

8-HQS atl00ppm+sucrose at 3%, $AgNO_3$at 3oppm, $AgNO_3$at 30ppm+sucrose at 3%, sucrose at 3% and control respectively (table 7,8 and 9).

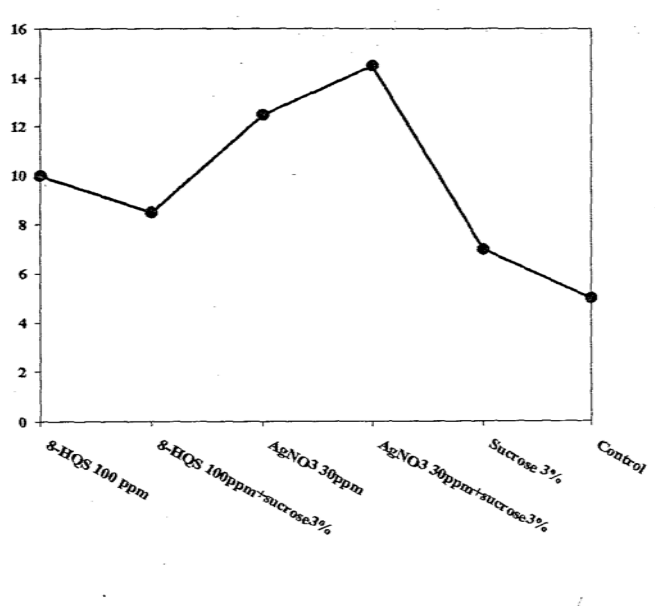

Fig (1) Effect of the best treatment of 8-HQS, AgNO3 and sucrose in comparison to control , on vase life of rose cut flower

Table (7) Effect of 8-RQS ,$AgNO_3$ with or without sucrose and sucrose compared to control on chlorophyll content for rose cut flowers.(unit was mgI^{-1} fresh weight).

Treatments	Days of determinations of chi. a and chi. *b*					
	1st day		3rd day		5th day	
	Chl.a	Chl.b	Chl.a	Chl.b	Chl.a	Chl.b
8-HQS l00ppm	0.672	0.330	1.767	*0.599*	1.892	0.404
8-HQS l00ppm+ sucrose3%	0.734	0.410	1.941	1.163	2.762	0.391
AgNO33Oppm	0.727	0.384	2.402	0.541	1.757	0.521
$AgNO_3$ 30ppm+sucrose3%	0.743	0.400	1.912	0.482	2.299	0.407
sucrose	0.733	0.410	1.421	0.743	0.687	0.186
Control	0.727	0.384	2.940	0.406	*0.596*	0.070

Carbohydrate content: Data of tables (10, 11, 12, 13, l4and *15)* show that fructose, glucose and sucrose were the main soluble carbohydrates in petals as well as stems of cut roses. Fructose was the major component in the petals as well as stems and generally its values were higher than those of stems .The sucrose content in petals and stem were lower than that of glucose. The fructose, glucose and sucrose concentrations of untreated flowers

were sharply decreased both in petals and stems, from day 3 till day 5, which the last day in vase life of control flowers.

The carbohydrate content more significantly increased than in the control, as result of different chemical treatments, till the day 3 and suppressed the decrease of fructose, glucose and sucrose concentration till the end of the vase life of control. Generally, there were no significant differences between 8-HQS, AgNO3 and sucrose treatments. The concentration of fructose, glucose and sucrose in rose petals for untreated control when its flowers were terminated (day 5) were 1.03, 0.93 and0.42 mg g^{-1}dry weight while these values in the same time for 8- HQS, 8-HQS +sucrose and sucrose were (2.26, 3.26and O. 17), (6.40, 5.30 and 1.41) and (3.35, 1 .97and 0. 93) mg g^{1} dry weight respectively (tables 10 and 14). At the beginning of experiment, the stem contents of fructose, glucose and sucrose were 0.91,0.30 and 0.08 mg g^{-1}dry weight, respectively .Mean values for the previous sugar at the end of vase life of control flowers, (day 5) for control, 8-HQS,8-HQS+sucrose and sucrose were(0. 11 ,0.O7andO. 03),(2. 87,2.08 10.69),(1 .51,1 .40 and3.84) and (1.37,1.08 and 0.32) mgg^{-1}dry weight, respectively.(tables 11 and 14).When petal of roses were treated by AgNO3 the value of sugars for AgNO3, AgO3 +sucrose and sucrose were (2.73, 1.91 and 0.76), (3.71, 2.03 and 1.93) and73 (3.71, 1.97and 0.91) mg g^{-1}dry weight at the end of experiment respectively (tables 12 and 14). At the beginning of experiment, the stem contents of fructose, glucose and sucrose were 0.91,0.30 and 0.08 mg g^{-1}dry weight, respectively .Mean values for the previous sugar at the end of vase life of control flowers, (day 5) for control, AgNO3,$AgNO_3$+sucrose and sucrose were (0.65,0. l8and 0.06),(5. 17,0.62 and 1 .76),(1 .77,4.58 and0.09)and(1 .37,1.08 and 0.32) mgg dry weight, respectively (tables 13 and 15).

Table (8) Effect of 8-HQS,AgNO3 with or without sucrose and sucrose on carbohydrates content for petals of rose cut flowers. (Unit was mgi1 dry weight).

Treatment	Days of determination of carbohydrate content								
	1st day			3 day			5th day		
	Fructose	Glucose	Sucrose	Fructose	Glucose	Sucrose	fructose	Glucose	Sucrose
8-HQS l00 ppm	1.87	2.97	0.11	2.06	2.99	0.08	2.26	3.26	0.17
8-HQS lOOppm +sucrose3 %	4.18	3.55	1.23	5.97	4.34	0.99	6.40	5.30	1.41
AgNO3 3ppm	1.48	1.22	0.04	1,58	1.24	0.07	2.73	1.91	0.76
AgNO3 .3oppm+sucrose	2.99	2.01	0.89	2.27	1.79	1.03	3.71	2.03	1.93
Sucrose	3.35	1.97	0.93	2.99	1.55	0.22	1.37	1.08	0.32
Control	0.91	0.30	0.08	0.13	1.03	0.42	0.65	0.18	0.06

Table(9) Effect of 8-HQS,AgNO3 with or without sucrose and sucrose on carbohydrate content for stem of rose cut flowers.

Treatment	**Days of determination of carbohydrate content**								
	1st day			3 day			5th day		
	Fructose	Glucose	Sucrose	Fructose	Glucose	Sucrose	fructose	Glucose	Sucrose
8-HQS l00ppm	1.95	2.00	0.16	2.43	2.00	*0.45*	2.87	2.08	0.69
8-HQS l00ppm +sucrose3%	1.21	1.30	2.07	1.53	1.11	3.17	1.51	1.40	3.84
$AgNO_3$ 3oppm	4.00	0.31	1.40	4.09	0.33	1.46	5.17	0.62	1.76
$AgNO_3$ 30ppm+sucrose	**1.33**	1.55	0.03	1.44	1.67	0.05	1.77	*4.58*	0.09
Sucrose	1.37	1.08	0.32	1.66	1.23	0.44	2.00	1.87	0.61
Control	0.91	0.30	0.08	0.99	0.60	0.11	1.01	0.18	0.24

4. Discussion

Improving effect of 8-HQS on the postharvest quality of cut flowers: One of the greatest problems in postharvest flower physiology is the blockage of the vascular system. This blockage might be due to air or bacterial growth .Another cause of vascular blockage is the plant reactions to the actual cut .Even in the flower stem that is removed from the mother plant, certain enzymes are mobilized to the wounded area where chemical are released in order to try to seal the wound [13]. This process reduces water uptake. This called physiologically blockage .The transport of water and minerals is of vital importance for the flowers development .Obstruction of wood vessels is a commonly occurring problems affecting the vase life of cut flower. The blockage of xylem vessels led to water stress and it is known that the limiting factor of vase life is water stress, that is expressed in the form of early wilting of leaves or flowers [14]. Early wilting occurs as a result of premature loss of cell turgidity and might appear when water uptake and transpiration are out of balance during a lasting period of time. Limited water uptake can be a cause of this unbalance that finally leads to an unrecoverable situation and the premature end of its vase life [15]. 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 [16]. The results show the importance of 8-HQS in increasing the vase life of the two cut flowers studied. Applying 8-HQS prevented the accumulation of microorganisms in xylem vessels and suppressed the xylem occlusion. These results may be due to the role of 8-HQS as antimicrobial agent and hence, it might reduce stem plugging .This explains the short vase life of untreated control and long vase life when 8-HQS was applied.8-HQS treatment also suppressed the plant-induced xylem occlusion because if it had only been active against bacteria,

the plant induced blockage would have resulted in early wilting, so that when we treated the cut flowers with 8-HQS, the period of percentage of wilting takes a long time in comparison with untreated control. A cell consists of the outer wall, which is rigid semi-permeable membrane with structural properties and inner plasma membrane and elastic. If the rate of cellular water loss is too rapid or too excessive then the inner plasma membrane will break away from the cell wall, a phenomenon called permanent plasmolysis, and this irreversible and the normal form of cell will change. This might happened in cut flowers had been studied. These results are in harmony with observations by [17] who mentioned that the more lignin was formed in the phloem of roses held in 8-HQS solution. The effective role of 8-HQS could be explained also by keeping fresh weight and chlorophyll as well as carbohydrates losses by 8-HQS to a minimum. These results are in agreement with the findings of [18, 19, 20, 21].

Effect of AgNO3 on improving the postharvest quality of cut flowers: $AgNO_3$ is very potent inhibitors of ethylene action in plant tissues. The treatment$AgNO_3$ may be decreased the ethylene production by the two cut flowers tested comparison with the control. It also provides some antimicrobial activity inside plant tissues, thus it is beneficial for ethylene-sensitive flowers such as carnation [4]. This might explain the effective role of AgNO3 inthe vase life of these cut flowers. In addition, under the $AgNO_3$ treatment the percentage of wilting and chlorophyll degradation was minimized and as a consequence, the vase life was extended. These results are in harmony with the results of [22, 23, 24].

Improving effect of sucrose on postharvest quality of cut flowers: It is well known that sugar supply increases the longevity of many cut flowers. While sucrose can act as a source of nutrition for tissues approaching carbohydrate starvation, it may also act as an osmotic ally active molecule thereby having a role in flower opening and subsequent water relations. The dissolved the cells of the petals are osmotic ally active substances that draw into the corolla-cells making the cell turgid and hydrolyzing the sucrose for respiration. Similar findings were obtained by [25,26,21,27].

Effect of the best treatment for 8-HQS,AgNO3 with or without sucrose on improving the postharvest quality of cut flowers: Concerning the role of sucrose with $AgNO_3$, the previous results show that adding sucrose extended the vase life and improved the quality of rose cut flowers. On the other hand, the role of sucrose was negative in rose cut flowers when combined with 8-HQS since the vase life was decreased .It is well known that the flower opening is promoted by sugars applied through the stern, but vase life may not be extended because the sugar encourages multiplication of bacteria, which eventually block xylem [19]. The data on of chlorophyll and carbohydrate contents show the positive role of 8-HQS , $AgNO_3$ with or without sucrose and sucrose individually on preserving the leaves in a good condition (stat) by lowering the percent of wilting and inhibiting the chlorophyll and carbohydrate degradation. As a result the vase life could be increased. As a similar tendency, [28] reported that, even in the absence of exogenous ethylene, the life of the flowers was significantly increased by inhibiting ethylene action. The positive effect of $AgNO_3$ may be due to its role in the inhibition of ethylene effects and consequently, increased the per cent of healthy flowers. In addition, these results could explain through the good quality of leaves and the minimum chlorophyll loss obtained by this treatment. Similar results were obtained by [29,30].

5. Conclusion

Based on the previous results it could be concluded that all chemicals used in our study have improved the postharvest quality of the flower crops. The most important suggestions for the professional growers and contributors are as follows: the treatment with 8-HQS solution is re commended in order to control the growth of microorganisms. The best treatment for roes is 8-HQS 100ppm.the application of AgNO3 very useful to extend the vase life of cut flowers .the best concentration of AgNO3 is 30ppm.Also sucrose can be added to the vase solution, with the concentration of 3% which was the best one according to our study.

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