Effect of nanoparticles and organic extract preservatives on vase life of cut flowers: a review

Abstract

Cut flowers are used to express appreciation, affection and express emotions on various special occasions. The international trade in cut flowers has expanded in recent years and is expected to grow with the promotion and use of horticultural plants for their therapeutic benefits. Vase life is the period during which a cut flower maintains its appearance in the vase. This is a crucial factor in determining which plant species are ideal for use in floristry, with long vase life plants being considerably more desirable than short vase life plants. Chemical treatments that extend the life of vases are a major part of floristry. Adding sugars to a vase solution with cut flowers is known to delay aging and extend the life of the vase. Nano-sensors could therefore also help to extend the life of vases with cut flowers and thus enable the monitoring of ethylene concentrations in the warehouses of large growers and wholesalers. In floriculture, nanotechnology has increased yield to potential market value, particularly for essential micronutrients essential for host defence.

KEYWORD: vase life, Gerbera, nano-particles, plant extract, essential oil.

INTRODUCTION

A vase is the period when a cut flower or cut leaves retain their appearance in the vase. This is a major consideration in determining the appropriate types of plants for use in floristry, live plants and short vases. Chemical treatment to extend the life of a vase is a major part of floristry research. Postharvest strategies to achieve long life of a large flower cut should serve the two seemingly contradictory goals of promoting shoot growth and plant development to fully open and inhibiting metabolic processes leading to ripening. These antibodies are made up of carbohydrates such as sugar, inhibitors of ethylene biosynthesis such as silver thiosulfate (STS) and amino ethoxy vinyl glycine, and germicides such as 1-methylcyclopropene, chlorine dioxide and 8-hydroxyquinoline.

Nanoparticles have many uses in all phases of agricultural production, in various ways and processes such as; nano-fertilizer for moderate nutrition, crop development, plant protection (pesticides, fungicides, herbicides), weed control, post-harvest technology (floriculture such as vase life with cut flowers), bioprocessing of nanoparticles for agricultural purposes, aquaculture biosensor, nano biotechnology (gene expression and analysis regulation), to monitor the ownership and quality of agricultural products.

Flower petals are chemical materials used to increase the size, colour and life of a cut vase. Many flower protection products contain germicides, ethylene synthesis inhibitors, growth regulators, essential oils, antioxidants, anti-transparent and other mineral and carbohydrate compounds that are necessary to extend the life of the cut flower vase. Several attempts have been made to extend the life of the cut flower vase using commercial flower containers viz. Florissant, Chrysal, Bloom life, Petal life, Rose life, etc. However, these protectors are very expensive and unaffordable for most cut flower growers, so the use of local flower reserves is paramount. sugar, vinegar, lime juice, neem oil and pongami oil can be useful and cheap.

EFFECT OF NANO PARTICLES:

The short life of the post-harvest vase is one of the most important problems with cut flowers. For these economically important cut flowers, an important qualitative attribute is the preservation of vase life. In this regard, for large-scale applications, a suitable method of extending the life of the vase, which is easy to use, natural, safe and cheap compounds, is always decisive. End of vase life in many cut flowers is characterized by wilting (*He et al.*,). Water balance is the main factor determining the quality and longevity of cut flowers. It is influenced by the absorption and transpiration of water and the balance between the two mentioned processes (Da Silva,). When the amount of transpiration exceeds the volume of water absorption, water deficit and wilting develop. “Low water absorption is often caused by occlusions located mainly at the basal end of the stem (*He et al.*,) and microbes are a common cause of stem blockage (*Van Doorn*). Many agents have been used in cut flower vase solutions to extend vase life by improving water uptake. These include silver nitrate, aluminium sulphate (*Ichimura and Shimizu-Yumoto*) and hydroxyquinoline sulfate" (*Ichimura et al.*,). Therefore; it is important to use these materials in vase solutions to extend the life of cut flower vases.

Table 1. Literature review and its associate results

S. No.	Author	Parameters	Result
1.	Lu *et al.* (2010)	Fresh weight of the	Silver nano particles (SNP) 50 ppm,

		flower	effectively suppressed the reduction in fresh weight followed by SNP, 20 ppm.
2.	Amingad *et al.* (2017)	Uptake of water	Flowers held in solution containing SNP 20 ppm improved water uptake compare to others.
3.	Amingad *et al.* (2017)	Transpiration loss of water (g/cut flower)	The lowest transpiration loss of water was seen in the flowers held in plain distilled water. Flowers held in SNP @50 ppm exhibited the highest transpiration water loss.
4.	Lu *et al.* (2010)	Vase life	Stems treated in 10 mg/l of nano silver, extended the vase life of cut roses by 3.8 days. Pulse treatment with 10 mg/l NS+ 5% sucrose solution extended vase life to more than twice that of the controlled and also prevented petals and leaves from abscission and maintained their colour in vase period.
5.	Hatami *et al.* (2013)	Vascular occlusion	Control flowers showed more vascular occlusion than treated ones.
6.	Ansari *et al.* (2011)	Stem diameter	Distilled water + sucrose @ 4% with 5.98 mm stem diameter was better than controlled (5.49 mm), while humic acid @ 50mg/l + sucrose @ 4% + GA_3 @ 2.5mg/l had lowest average daily stem diameter (5.44 mm), respectively.
7.	Hatami *et al.* (2013)	Bacterial count	The number of bacteria in the vase solution increased over the vase life in the SNP and $AgNO_3$ pulse treatments and controlled flowers.
8.	Mousa Solgi (2011)	Stem strength	In sucrose and SNP + sucrose treatments, stem bending was slight (less than 5) and stable (3-5) during the

			vase period. There was no stem breakage for sucrose or the combination of sucrose with SNP treatments
9.	Amingad *et al.* (2017)	Water balance (g/cut flower)	Flowers held in distilled water showed water balanced values (0.50) of less than 1 on third day itself indicating that the flowers experience higher water loss compare to the other treatment. Flowers held in SNP solutions exhibited better water balanced values.

Abbreviation:

1. SNP: silver nano-particles
2. NS: nano-silver
3. $AgNO_3$: silver nitrate

Extensive research has been done to determine the physiological effects of these carbohydrates added to the mechanism by which they promote vase life. Many authors have studied the carbohydrate content of flowers that were not allowed to flower and were set on plants and compared with flowers collected at different stages with or without the supply of carbohydrates through the stem. Less cut flower crops are more effective in better care than harvesting. Freshly cut flower buds from most plants will have a vase life of about 1 week in tap or distilled water. If you use the best combination of flower preservatives, the life of the vase can be doubled or tripled. Flower life varies depending on the plant and season, and flower life on the planet.

EFFECT OF ESSENTIAL OIL AND PLANT EXTRACT:

"Essential oils and extracts are extracted from flowers, seeds, fruits, bark, leaves, stems, bark, wood and roots. As a safe and environmentally friendly natural plant product with strong antimicrobial properties against several pathogens, it is used as flavouring and medicinal agent". *Bayat et al., 2013; Ozcan and Erkmen, 2001*

“Essential oils of cloves, cinnamon, lemon, rosemary, patchouli, eucalyptus, neem and pongamia have strong antimicrobial properties against several pathogens due to high levels of phenolic, aldehyde, terpenes, alcohol and flavonoid compounds such as eugenol, methyl cinnamon. e-cinnamaldehyde, citral, citral-b, alpha-pinene, beta-pinene, patchouli alcohol, 1-8-cineole, azadirachtin, pongamycin and carancin” (*Prabuseenivasan et al., 2006; Biljana et al., 2011; Khan and Ahmad; 2011; Lavanya and Brahmarakash, 2011*. It also plays a major role in the floriculture industry due to its environmentally friendly properties and antimicrobial properties in extending the freshness and shelf life after harvesting cut flowers.

“Another finding in the longevity treatment of Lisianthus cut flowers *(Eustoma grandiflorum L.)* with Rosemary oil at a concentration of 200 mg/l significantly increased the vase life by 15.6 days” *(Kazemi et al., 2014)*. Then, *Yeganeh et al. (2011)* Some quality characteristics of Rosemary extract in vase and cut carnation flowers *(Dianthus caryophyllus cv.)* reported by *Hasemabadi et al. (2010) Farida*. “In addition, the effect of ajovan oil extract at a concentration of 500 ppm has a beneficial effect on the fresh weight (%) and vase life of cut gladiolus” *Rasul et al. (2011) Marandi et al (2011)* investigated “the effect of ajovan and summer essential oils (500 and 1000ppm) on postharvest quality sensors of gladiolus and cut flowers with 6% sucrose”. *Samadizad (2010)* “gladiolus cv. Dutch rose, Origanum vulgare (1mg/l) is significantly effective in improving post-harvest quality and vase life”. *Mahboobeh et al. (2012)*

Table 2. IMPORTANT RESEARCH FINDINGS:

Flowers	**Essential oil**	**Concentration (ppm)**	**Vase life (days)**	**Reference**
Rose	Ajowan	500	20.00	Marandi *et al.*, 2011
Gladiolus	Ajowan	500	20.00	Marandi *et al.*, 2011
Carnation	Dill	300	16.00	Shanan *et al.*, 2010
Gerbera	Carvacrol	50	16.00	Solgi *et al.*, 2009
Alstroemeria	Pepper mint	100	13.03	Bazaz and Tehranifar, 2011
Carnation	Summer savoury	100	9.5	Bayat *et al.*, 2009
Gladiolus	Clove	500	14.33	Hegazi and Gan, 2009
Chrysanthemum	Thymol	125	19.58	Hashemabadi *et*

				al., 2013

NANOPARTICLES AND NANOPOROUS MATERIAL:

"The use of pulse and vase solutions as a treatment for cut flowers is relatively new. Studies have investigated the effect of cut flowers such as carnations, gerbera, acacia and roses in extending the life of vases" (*Moradi et al., 2012; Nazemi Rafi and Ramezanian, 2013).* "Like other cations (eg K^{+}, Ca_2^{+}), Ag^{+} can positively affect the hydraulic conductivity of plant stems" (*vanieperen, 2007*). "Ag^{+} is considered a general inhibitor of aquaporins (*Niemietz and Tyerman, 2002*), which improves water balance" (*Lu et al., 2010*). In addition to antibacterial and antacid effects, NS has been shown to be an anti-ethylene agent (*Kim et al. 2005*) and NS has been shown to be an anti-ethylene agent in 'dreamland' hybrid Lilium Asiatic and hybrid Lilium 'sibera' (*Lu et al. 2010*).

PROPERTY

Nano silver have a higher surface area to volume ratio and due to this property, they are considered to be more effective in inhibiting the growth of bacteria and other microorganisms than components in the oxidation state of Ag.

ACTION MECHANISM:

"Nano silver releases Ag^{+} (*Lockett et al., 2007*), which interacts with cytoplasmic components and nucleic acids to inhibit enzymes of the respiratory chain and interfere with membrane permeability" (*Russell and Hugo., 1994; Park et al., 2005*)

APPLICATIONS:

"Nano meter-sized silver (Ag+) particles (NS) are used as antimicrobials (*Furno et al., 2004*). The use of NS is becoming increasingly widespread in medicine, textiles, water purification and various other industrial and non-plant applications".

CONCLUSION:

Plant extracts are extracted from medicinal or aromatic plants. Recently aromatic and medicinal plants have received special attention at the national level due to the importance of their essential oils for various industrial applications. Various domestic and foreign companies involved in essential oil refining and marketing sector. As mentioned in this review paper, many authors have reported plant extracts as excellent alternatives for the longevity and quality of many types of cut flowers. Thyme, rosemary, calendula, coriander, artemisia, and mint are some of the aromatic and medicinal plants whose essential oils have been tested and yielded positive responses in the post-harvest treatment of cut flowers. Many more plants were being studied for essential oils. This shows potential for essential oil production in the country.

Silver and other metal nanoparticles can play an important role in improving the post-harvest characteristics of many cut flowers. Their ease of use, non-toxicity, large surface area and durability make them excellent materials for use as preservative ingredients. They have been successfully employed to extend the vase life of cut flowers by reducing bacterial proliferation, inhibiting ethylene biosynthesis, limiting protein and chlorophyll degradation, and improving antioxidant enzyme activity to reduce the effects of oxidative stress.

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