



1-MCP microbubbles reduce chlorophyll degradation and maintain the quality of *Dendrobium* cv. Burana Jade orchid flowers

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ABSTRACT

The effect of 1-methylcyclopropene microbubbles (1-MCP-MBs) on reducing chlorophyll degradation, prolonging vase life and maintaining the quality of *Dendrobium* cv. 'Burana Jade' inflorescences was investigated. The inflorescences were immersed in 50 ppm 1-MCP-MBs or tap water (control) for 5 min and then held at 23 ± 1 °C for 12 days. The 1-MCP-MB-treated inflorescences exhibited increased water uptake and significantly higher fresh weight than the controls. The results also showed that 1-MCP-MBs remarkably delayed bud opening and flower abscission, accompanied by suppression of ethylene production and a lower respiration rate than that of controls. Additionally, the treatment maintained the green color (hue angle value was comparable to initial storage day) of the inflorescences by delaying chlorophyll degradation related to inhibition of chlorophyllase and Mg-dechelataase activities. 1-MCP-MBs prolonged the vase life of *Dendrobium* cv. 'Burana Jade' up to 12 days, which was 2-fold longer than that of the control (approximately 5 days only). The results suggest that 1-MCP-MBs have the potential to be another alternative to conventional methods (fumigation) in prolonging vase life and maintaining the quality of *Dendrobium* orchids with the advantage of a shorter treatment time.

1. Introduction

Dendrobium belongs to Orchidaceae, which comprises more than 1200 species (Adams, 2011), is among the most requested cut flowers worldwide and contributes to more than 20 % of total orchid sales (Teixeira da Silva et al., 2014; USDA, 2012). However, cut *Dendrobium* inflorescences have a short vase life due to endogenous ethylene-induced senescence. Several studies have also demonstrated that senescence is accelerated if the inflorescence is exposed to exogenous ethylene (Almasi et al., 2015; Uthachay et al., 2007). Ethylene is a plant hormone that is responsible for flower senescence and abscission by affecting flower color and the quality and longevity of cut flowers. Senescence is commonly mediated by a series of highly coordinated physiological and biochemical changes, such as the degradation of macromolecules and increases in degrading enzymes and respiratory activities, which eventually lead to cell death (Teixeira da Silva et al., 2014).

Therefore, the senescence of cut flowers can be delayed by inhibiting

or suppressing ethylene production. Treatment with 1-methylcyclopropene (1-MCP), an inhibitor of ethylene production, is often used to prevent cut flower senescence and prolong vase life. Uthachay et al. (2007) reported that *Dendrobium* orchids fumigated with 100–500 nL L⁻¹ 1-MCP for 4 h reduced abscission during vase life. Almasi et al. (2019) demonstrated that pretreating sensitive cut orchids with 300 nL L⁻¹ 1-MCP fumigation for 4 h significantly improved their postharvest quality. Conventionally, gaseous 1-MCP is frequently applied to cut orchid inflorescences in sealed containers or airtight cold storage rooms for at least 4–24 h depending on the species, cultivar or hybrid. This technique is time-consuming and requires a sophisticated facility, which is inconvenient, particularly for small-scale Microbubble (MB) technology has been used as an innovative delivery system for gases. MBs are bubbles with a diameter size equal to or less than 50 μm with favorable characteristics of wide surface area, long stagnation and shrinkage in water due to the self-pressurization effect (Takahashi et al., 2003). In our previous study, 1-MCP-MB was developed by encapsulating gaseous 1-MCP into water using MBs and tested on banana. Satisfactory results

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