Potassium Permanganates and Short Term Hypobaric Enhances Shelf-Life of Kiwifruits

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Abstract

Kiwifruits are climacteric fruit and therefore regarded as dependent on ethylene for ripening. Kiwifruits are highly susceptible to ethylene even at very low levels after short periods of storage. The effectiveness of potassium permanganates and short period of hypobaric (LP) treatment, alone or in combination, to increase shelf-life of kiwifruits was studied. Mature and ripe kiwifruits 'Hayward' were treated under hypobaric atmospheric of 200 mm Hg for 6h and held in high density polyethylene plastic bags (40 µm thickness) containing 0 (control), 3, 6 and 12 g potassium permanganate per bag (per kg of fruits) and stored at room temperatures of 20°C for four weeks. Treating fruits with potassium permanganates significantly extended shelf-life of the fruit after 4 weeks storing at 20°C. Also, fruits treated with ethylene absorbant were firmer, with higher content of vitamin C and total soluble solid content, compared to control non-treated fruits. Pre-treatment of kiwifruit by 6h under hypobaric conditions in combination with potassium permanganates was more marked after 4 weeks.

INTRODUCTION

Kiwi fruit (*Actinidia deliciosa*) is climacteric fruit (Manolopoulou and Papadopoulou, 1998). Ethylene and controlled atmosphere environments affect the postharvest quality of this fruit (Macrae et al., 1990). External ethylene even in low concentrations can stimulate the production of internal ethylene and decrease the shelf life of kiwi fruit (Zhenyong and Dilley, 1999). Potassium permanganate has been used commercially to absorb ethylene (Palou and Crisosto, 2003). In low pressure storage, the store pressure is set below its normal range so ethylene and other gases come out of the fruit (Zhenyong and Dilley, 1999). Sending out ethylene before cooling the fruit can prevent tissue softening during storage (Mitchell, 1990).

MATERIALS AND METHODS

Ripe kiwi fruit of the cultivar 'Hayward' was used for this experiment. Eight treatments were used in this study. In four of treatments, fruits were first placed in low pressure tanks with pressure 200 mm Hg for 6 hours, and then they were packed in a polyethylene bag with 40 µm thickness with 0, 3, 6 and 12 g/kg of fruits potassium permanganate in each treatment. The other four treatments did not have the hypobaric treatment before packing. Fruits were stored for 4 weeks in 20°C.

The experiment employed a split-plot design using a completely randomized block design with three replications. Each week physicochemical changes were determined. Tissue firmness using (Penetrometer) (OSK 10576-II) and total soluble solid using Refractometer Hand (k-0032, Brix - 0~32%) were also measured. To determine total organic acid and vitamin C, the titration method with NaOH (0.2 N) and iodine in potassium iodine were used respectively. pH was determined using a digital pH meter. Finally, the data obtained in this way were analyzed using SAS software.

RESULTS AND DISCUSSION

The results of this study showed that fruits treated with potassium permanganate together with low pressure treatment had higher firmness as compared to the control (Fig. 1). Ethylene in a concentration of 0.04 ppm can stimulate the ripening of kiwi fruit. With a rising concentration of potassium permanganate more ethylene was absorbed so the activity of enzymes polygalactronase and cellulose had been decreased (Mitchell, 1990). In this experiment the highest concentration of vitamin C was found in fruits that were packed with 12 g potassium permanganate per bag per kg of fruits together with low pressure treatment and the lowest in the control (Fig. 2). Macrae et al. (1989) reported that during softening of kiwi fruit, the organic acid and the amount of starch decreased and the amount of sugar, particularly fructose and sucrose and sugar/acid ratio, had additional same trends (Macrae et al., 1989). Manolopoulou and Papadopoulou (1998) also reported that the ascorbic acid concentration decreased during the kiwi fruit storage period. Fruits that were treated with 12 g potassium permanganate and low pressure conditions together and the control also showed the highest and lowest organic acid, respectively (Fig. 3). pH increased during the storage period but this additional same trend was slower in fruits treated with potassium permanganate. With increasing concentrations of potassium permanganate, fruit decay decreased (Fig. 4).

Highest and lowest TSS was in fruits treated with 12 g potassium permanganate and low pressure conditions and control, respectively. TSS had increasing same trends in fruits treated with low pressure conditions (Fig. 5). TSS showed a increasing and decreasing procedure, at the beginning and the end of the experiment, respectively. Low pressure treatment can send out internal oxygen so this can prevent changing starch to soluble solid (Matsumoto et al., 1983).

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Figures

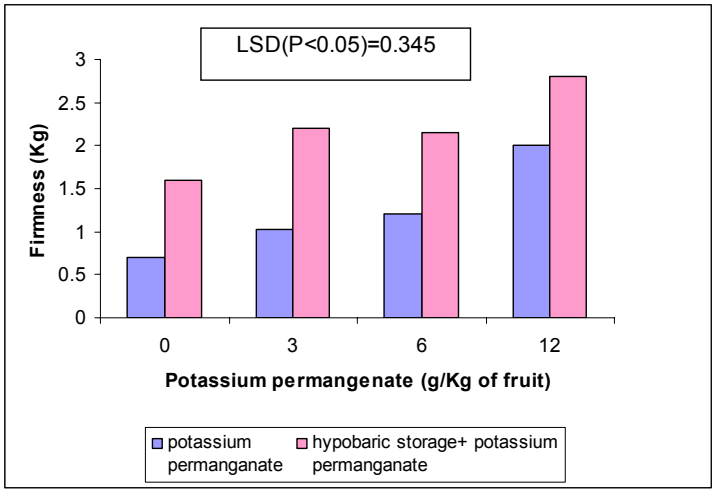

Fig. 1. The effect of different concentrations of potassium permanganate and low pressure treatment on fruit softening of kiwi fruit during storage.

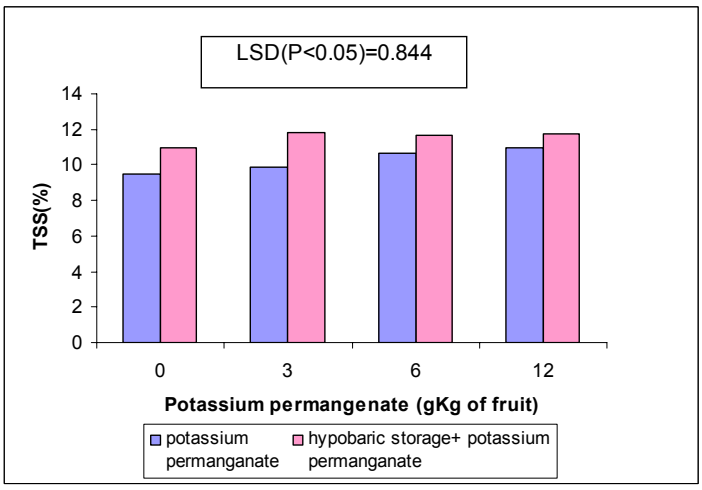

Fig. 2. The effect of different concentrations of potassium permanganate and low pressure treatment on TSS of kiwi fruit during storage.

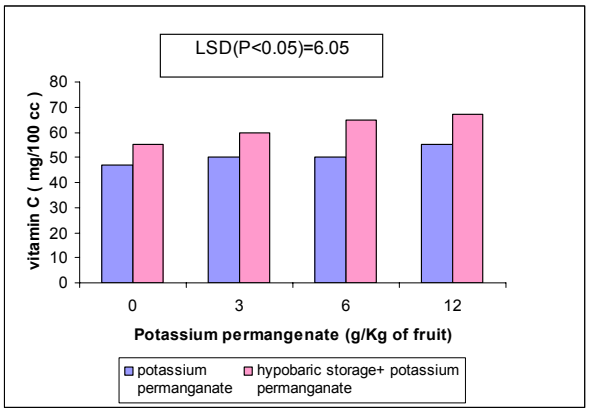

Fig. 3. The effect of different concentrations of potassium permanganate and low pressure treatment on vitamin C of kiwi fruit during storage**.**

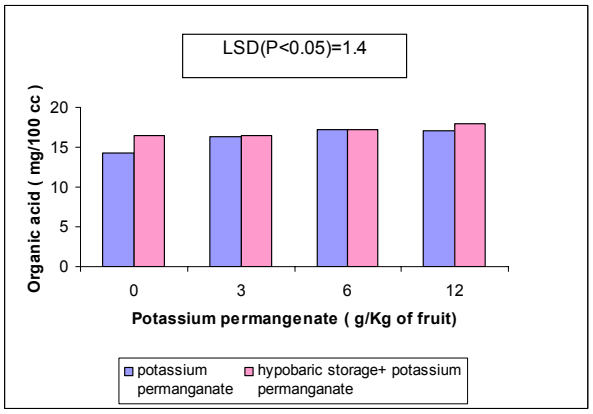

Fig. 4. The effect of different concentrations of potassium permanganate and low pressure treatment on organic acid of kiwi fruit during storage.

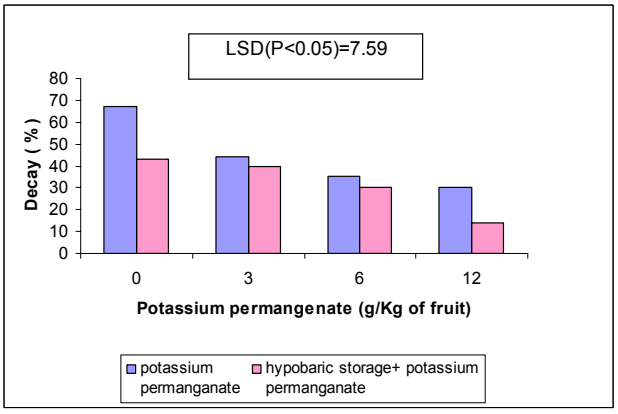

Fig. 5. The effect of different concentrations of potassium permanganate and low pressure treatment on decay of kiwi fruit during storage.