

**EFFECT OF 1-METHYLCYCLOPROPENE (1-MCP) ON POSTHARVEST
QUALITY AND SHELF LIFE OF OKRA**

H.R.P. FERNANDO, M.R. PRASANGIKA AND W.G.B.R. ARIYARATNE

Agriculture Research and Development Centre, Girandurukotte, Sri Lanka

EXTENDED ABSTRACT

Okra (*Abelmoschus esculentus* L.) is one of the widely consumed and economically viable vegetable crops grown in tropical and sub-tropical areas. Fresh okra is commonly used in various food items including soups, stews, curry and steamed vegetables. It is also a good source of fibre, protein, minerals and vitamin C and diet-viscous mucilage. Fresh okra is a perishable vegetable, which has a short postharvest life. Loss of quality in harvested okra is usually manifested with shrivelling, toughening, and chlorophyll degradation would change the colour and texture of fresh okra leading to rejection by the consumer. The actions of ethylene contribute to making above changes. Ethylene quickens the deterioration process of okra and reduces the market life of the pods. The gaseous ethylene blocking compound 1-methylcyclopropene (1-MCP) prevents ethylene-dependent responses, has been used for decades to maintain postharvest quality of various products. Therefore, the objective of this study was to investigate the effects of 1-MCP fumigation on postharvest quality parameters and shelf life of harvested okra during storage.

Half mature green okra pods of the variety Haritha were selected for uniformity in green colour, size and free from defects or physiological disorders. Selected pods of okra were randomly divided into three lots with the first lot being fumigated with $0.5\mu\text{L L}^{-1}$ of 1-MCP for three hours (Blankenship and Dole, 2003) at $28\pm 2^\circ\text{C}$, second lot with $1\mu\text{L L}^{-1}$ of 1-MCP for three hours at $28\pm 2^\circ\text{C}$, and the third lot was used as the control without 1-MCP treatment. The experiment was arranged in a Complete Randomize Design (CRD) with four replicates. The treated materials were stored for 12 days at $28\pm 2^\circ\text{C}$ and 85% RH. Weight loss, Total soluble solids (TSS), crude fibre content, disease incidence, pod colour change, marketability, and shelf life were measured during 2 days intervals as the quality parameters.

Both 1-MCP concentrations used reduced the weight loss compared to the control at $28\pm 2^\circ\text{C}$. The reduction of weight loss could be due to the suppression of respiration rate. Scientists have reported that 1-MCP treatments inhibited the level of increase of ethylene-induced respiration in fruits and vegetables. Suppression of weight

loss and respiration rate was correlated as 1-MCP reduced the respiration rate through inhibition of ethylene synthesis. The 1-MCP at the concentration of $1 \mu\text{L L}^{-1}$ reduced the weight loss at a higher rate compared to at $0.5 \mu\text{L L}^{-1}$ and the control.

Increasing of TSS in fruits during maturation and ripening due to degradation of starch into soluble sugar within the cell. TSS content of all treatments used in this study decreased from day 0 to 8. The reduction in TSS content is a typical character in okra due to decrease in the content of viscous mucilage and soluble sugars with lignifications of tissues. Both 1-MCP treatments retained the TSS at higher levels than in the control. Therefore the low lignification rate has a direct impact on the samples fumigated with 1-MCP.

The crude fibre content of all samples increased during storage. The crude fibre content of okra fumigated at 1-MCP concentrations were significantly lower ($p < 0.05$) than the crude fibre content of the control from day 4 to day 12. These results suggest the relationship between ethylene production and the fibre development of harvested okra. The 1-MCP is an anti-ethylene compound, which blocks ethylene receptors in the tissues and prevents or delays the ethylene production. The lower fibre content of okra fumigated with $1 \mu\text{L L}^{-1}$ of 1-MCP than that in the concentration of $0.5 \mu\text{L L}^{-1}$ suggest that the fibre formation of harvested okra has a direct relationship with the ethylene concentration.

The bright green colour of all okra samples started to reduce after 2 days. The colour change of the control sample was more marked than those fumigated with 1-MCP. After day 12, 1-MCP at the concentration of $1 \mu\text{L L}^{-1}$ significantly conserved ($p < 0.05$) the green color of okra than in those the control. Yellowing of many fruits and vegetables due to chlorophyll degradation has been accelerated by ethylene. Results of the present study have confirmed that 1-MCP at concentrations of 1 and $0.5 \mu\text{L L}^{-1}$ have delay yellowing of okra. This is probably the result of delaying chlorophyll degradation through 1-MCP action.

The disease incidence of all okra samples progressed during the storage. The disease incidence of okra treated with $1 \mu\text{L L}^{-1}$ 1-MCP was significantly low ($p < 0.05$) compared to the control from day 4 to 12. The disease incidence of okra fumigated with $0.5 \mu\text{L L}^{-1}$ of 1-MCP and that in the control increased in a similar manner until day 6. No disease symptoms were observed in okra fumigated with 1-MCP at $1 \mu\text{L L}^{-1}$ from day to 4. Thereafter, the disease incidence of okra in the control increased rapidly compared to okra treated with 1-MCP. Previous studies have reported of the action of 1-MCP against diseases and physiological disorders of fruits and vegetables. 1-MCP contributes to

accelerating of some antioxidant enzymes of plant tissues through inhibition of ethylene evolution could be a reason to the development of resistance in tissues through strengthening the natural defence mechanism in plant tissues.

Marketability of all okra samples started to reduce after day 2 of storage in a similar pattern. The marketability of okra samples treated with 1-MCP started declining later than those in the control. The marketability of okra in the control became zero at the 12th day of storage, while it was low compared to those fumigated with 1 $\mu\text{L L}^{-1}$ of 1-MCP after day 6. The general consumer preference of okra depends on fresh appearance; pod shape, green colour, toughening and shrivelling, and disease development were maintained at acceptable levels after fumigation with 1-MCP. However okra fumigated with 1 $\mu\text{L L}^{-1}$ of 1-MCP showed a better marketability than those treated with 0.5 $\mu\text{L L}^{-1}$ of 1-MCP.

Shelf life of okra samples determined at 50% marketability in the control, and fumigated with 0.5 and 1 $\mu\text{L L}^{-1}$ of 1-MCP was 7, 9 and 11 days, respectively, based on standard criteria proposed by National Agricultural Research Institute of Ghana. The marketability of okra in the control reached 50% level at day 7 while those fumigated with 0.5 and 1 $\mu\text{L L}^{-1}$ of 1-MCP reached the 50% marketability level at 9 and 11 days, respectively. Shelf life of okra fumigated with 1 $\mu\text{L L}^{-1}$ of 1-MCP recorded the maximum shelf life (11 days) due to delayed chlorophyll degradation, fibre formation, water loss and disease development.

Fumigation of okra with 1-MCP is a favourable technology for the commercial application for maintaining quality, extending shelf life and reducing postharvest losses at storage temperature of 28 ± 2 °C. The 1-MCP at 1 $\mu\text{L L}^{-1}$ showed better performance than 0.5 $\mu\text{L L}^{-1}$ on improving postharvest quality and shelf life of okra.