



—Scientific Note—

The Effect of Chlorine Dioxide Gas on Postharvest Preservation of Citrus Fruit During Ethylene Degreening

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Chlorine dioxide (ClO₂) is a strong oxidant often used as a broad-spectrum disinfectant in a variety of applications. This study evaluated the potential for gaseous ClO₂ application during ethylene degreening to control postharvest decay of four varieties of *Citrus*. Separate experiments were used to test fruit from 'Early-pride' and 'Tango' mandarin, 'Ray Ruby' grapefruit, or 'Valencia' oranges. The fruit did not receive any fungicide treatments after harvest. For each experiment, fruit of one variety were randomly placed within modified 44.6-L containers and exposed to one of four conditions with three replicates per condition. Chlorine dioxide gas was generated from ClO₂ slow- or fast-release product (ICA TriNova, Newnan, GA), where each product came as two dried media (A and B) – ClO₂ gas was released when equal amounts of A and B were mixed and reacted with each other. Chlorine dioxide treatments are expressed as grams of slow- or fast-release product per kilogram of fruit. The media was placed within a sachet and mixed at the beginning of each experiment and the sachets were affixed to the underside of each lid. No additional product was added afterward. The chambers were sealed, but two 40 mm ports were installed, one each on opposite side walls of the container. A 40 mm fan was affixed to one port and a hose was affixed over that with the end routed outside the room to slowly draw atmosphere out of the chamber and out of the room so a ClO₂ treatment in one container did not affect other treatments. The ports and fan allowed for a small negative pressure within each chamber to continually draw room air into the chambers. In these experiments, most chambers were placed within continuous degreening conditions containing 5 ppm ethylene, while control chambers were held in similar conditions (temperature and relative humidity) but without ethylene. An additional fan affixed on a middle side wall of each container facilitated air circulation within each chamber.

Fruit of 'Early Pride' placed within degreening conditions at 30 °C with 95% RH but also exposed to 0.5 g/kg of slow-release or 1.25 g/kg of fast-release ClO₂ product each developed significantly less decay than fruit exposed to degreening conditions alone. The specific type of decay was not identified but diplodia stem-end rot (*Lasiodiplodia theobromae*) was most commonly observed. While trends were apparent after 4 d when decay incidence was less than 3%, significant reductions in decay became apparent for the slow-release product after 6 d, and after 10 d for the fast-release product. Between 10 and 14 d (end of observations), there were no significant differences between the non-degreened control (no ethylene) and the slow- or fast-release products, which all had significantly less decay than fruit exposed to degreening conditions without ClO₂. Depending on the variety and time of year, citrus fruit are normally exposed to no more than 1–4 d degreening, but the excessive durations were used in the current experiments to promote greater decay to better show significant differences. Exposing citrus fruit to ethylene during degreening is known to induce decay and it appears the ClO₂ treatments compensated for the ethylene exposure. While there was a clear and significant delay in color development in fruit that were not exposed to ethylene, the ClO₂ treatments were not significantly different from the ethylene-treated control. The only potentially negative effect of the ClO₂ treatments was a significant increase in 'Early Pride' fruit weight loss compared to both controls; the reason for this is unclear and this was usually not observed with the other varieties. Overall, tests with the other varieties also showed both ClO₂ products generally significantly reduced fruit decay compared to the control, but there were no significant differences with 'Valencia', likely because decay pressure was so low that the fruit generally desiccated before decaying.

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