

NITRIC OXIDE FUMIGATION FOR POSTHARVEST CONTROL OF PESTS AND PATHOGENS

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Summary

Nitric oxide (NO) is a new fumigant for postharvest pest control. It is effective against all pests tested to date, including external and internal pests of fresh and stored products. Fumigations with as low as 0.1% NO can be effective for postharvest pest control. Treatment time ranges from 2 h to over 3 days depending on NO concentration, species, and life stages of the pests. There are significant variations in susceptibility to NO fumigation among different pest species.

NO fumigation must be conducted under ultralow oxygen (ULO) conditions because NO reacts with oxygen (O₂) spontaneously to produce nitrogen dioxide (NO₂). NO fumigation for fresh products also needs to be terminated by flushing fumigation chamber with N₂ to dilute NO at the end of fumigation to avoid damage to delicate products by NO₂. NO fumigation was safe in small-scale tests to postharvest quality of all fresh commodities when terminated with N₂ flush. In addition, NO fumigation resulted in better postharvest quality of strawberries and apples as compared with controls, indicating its beneficial effects on postharvest quality of fresh products. NO fumigation also does not increase nitrate or nitrite levels as residues in fumigated products when terminated properly with N₂ flush.

NO fumigation can be controlled to have desired levels of both NO and NO₂ by regulating the initial O₂ level and NO₂ has inhibitory effects against microbes. We conducted NO fumigations with certain levels of NO₂ for control of microbes. NO fumigations with 0.1% NO₂ resulted complete inactivation of *Aspergillus flavus* spores. Various levels of inhibition of microbes on unpasteurized almonds were achieved depending on NO₂ concentrations and treatment times. Therefore, NO fumigation also has potential for controlling microbes on fresh and stored products.

It is possible that one NO fumigation treatment can potentially control both insects and microbes on stored products. Since NO inhibits ethylene biosynthesis and delays ripening of fruit, NO fumigation also has potential in extending postharvest storage/shelf-life of fresh fruit and vegetables in addition to controlling pests and pathogens. NO fumigation, therefore, has potential to replace pesticides and fungicides for postharvest management of pests and pathogens as well as chemical agents for extending postharvest storage of fresh products. More research efforts are needed to explore the potential of NO fumigation for postharvest treatments of pests and pathogens as well as other benefits and to develop practical NO fumigation applications.