

Abstract:

The effect of insecticidal controlled atmospheres on insect and mite mortality is discussed in relation to its use for quarantine or stored product pest control in fresh, harvested fruits, vegetables and cut flowers. Mortality generally increases at higher CO₂ and lower O₂ concentration. Mortality at a given atmosphere generally increases with increasing temperature, and can also increase as temperature decreases near 0°C. Arthropods and lifestages within arthropods can vary considerably in their susceptibility to a given atmosphere. Effective treatments have been developed at cold storage temperatures and at high temperatures. Sequential CA treatments, including a short exposure to an extreme atmosphere followed by a longer exposure to a moderate or mild atmosphere or low temperature storage in air, have been very effective. The advantages of sequential treatments include improved commodity tolerance and the ability to conduct the follow-up mild atmosphere or cold storage during marine transit. Carbon dioxide has been used in combination with various fumigants to enhance the activity of the fumigant. Both low O₂ and high CO₂ atmospheres appear to induce metabolic arrest or a reduced metabolic rate in arthropods, resulting in low ATP levels, loss of membrane function, and eventual cell death. In addition, CO₂ appears to have direct effects on membrane permeability; therefore, the failure of membranes under elevated CO₂ could result from both energy insufficiency and increased membrane permeability. Therefore, it becomes more likely under elevated CO₂ that the decreased energy supply due to metabolic arrest will not be able to meet the needs of maintaining a more permeable membrane.