Title Experimental errors in hypobaric laboratory research

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Abstract

The hypobaric method (LP) controls [O_2] by regulating the storage pressure, and without imposing a significant refrigeration load decreases the concentrations of [CO_2], ethylene, and volatile contaminants in the incoming air-changes by up to >99% due to expansion during entry into the vacuum chamber. The high gaseous diffusion rate at a low pressure eliminates the commodity's surface to center [O_2] gradient created by respiratory O_2 consumption, causing different commodity types to have nearly identical low [O_2] tolerances, near 0.1%. Increased gaseous conductivity at a low pressure also promotes the escape of CO_2, ethylene, and NH3 from within the commodity, and air-changes flush the released gases from the storage chamber. The low [O_2] concentration intensely inhibits respiration, and even in 0.14% [O_2] a respiratory CO_2 inversion point is not reached. Humidity is kept close to saturation, and so little respiratory heat is produced that water loss is minimized. Without injuring the commodity, LP reduces [O_2] and [CO_2] sufficiently to inhibit ethylene production and prevent bacterial and mold growth, while low [CO_2] causes stomates to open in darkness, prevents CO_2-damage, inhibits toxic succinate formation, limits ascorbic acid loss, and inactivates ethylene forming enzyme. Differences between insect and plant gas-exchange systems cause all insect life stages to perish at the low hypobaric pressures which benefit horticultural commodity storage. Hypobaric intermodal containers are structurally less demanding than the simplest ISO tank container class and do not pose an insurance or implosion problem. They consume the same amount of energy as standard refrigerated intermodal containers and are mechanically simpler than CA containers. The cost per shipment is similar in LP and CA. Experimental errors in published laboratory LP research are reviewed.