Abstract

We tested the sorptive capacity of a number of non-target materials found in apple storage rooms on their capacity to remove 1-MCP from the storage atmosphere and thereby compete with the fruit for the active compound. Further, we evaluated the impact of temperature and moisture. Non-target materials included bin construction materials [high density polyethylene (HDPE), polypropylene (PP), weathered oak, non-weathered oak, plywood, and cardboard] and wall construction materials (polyurethane foam and cellulose-based fire retardant). Each piece had and external surface area of 76.9 cm^2. We placed our 'non-target' materials in 1-L mason jars and added 1-MCP gas to the headspace at an initial concentration of approximately 30 $\mu L \cdot L^{-1}$. Gas concentrations were measured after 2, 4, 6, 8, 10 and 24 h. The concentration of 1-MCP in empty jars was stable for the 24-h holding period. Little to no sorption was detected in jars containing dry samples of HDPE, PP, cardboard, polyurethane foam, or fire retardant. Inclusion of plywood, non-weathered oak, and weathered oak lead to a loss of 10, 55, and 75 percent of the 1-MCP after 24 hours. Using dampened materials, no sorption resulting from the inclusion of HDPE, PP, polyurethane foam, or the fire retardant. However, the rate of sorption of 1-MCP by dampened cardboard, plywood, weathered oak, and non-weathered oak increased markedly, resulting in a depletion of approximately 98, 70, 98, and 98 percent, respectively. For oak bin material, the rate of sorption was not impacted by temperature, and increasing the surface area by approximately 100% only marginally increased the rate of sorption. When dampened oak bin material was included with apple fruit in a proportion similar to than found in fruit storage, 80% depletion occurred in 5 hours compared to approximately 24 hours for fruit alone. The data suggest that in situations where 1-MCP levels can be compromised by wooden and cardboard bin and bin liner materials, but not by plastic bin materials or typical wall construction materials.