Title Synergistic effect of carbon monoxide mixed with carbon dioxide in air on mortality of stored-grain insects

Author Feng Wang

Citation Thesis, Master of Science (Biosystems Engineering), University of Manitoba. 72 pages. 2008.

Keywords grain; beetle

Abstract

Rusty grain beetle, *Cryptolestes ferrugineus* (Stephens), red flour beetle, *Tribolium castaneum* (Herbst), and granary weevil, *Sitophilus granarius* (L.), are dominant stored-grain pest species in Canada. A study to determine the effect of carbon monoxide (CO) mixed with carbon dioxide (CO_2) in air on controlling stored-grain insects was conducted in the laboratory. Within modified airtight gas exposure systems, mixed-age adults of rusty grain beetle, red flour beetle, and granary weevil in tough wheat with moisture content of 15% were exposed for 48, 96, 144 and 192 h to three types of gas mixtures in air, 5% CO, 30% CO_2 , and 5% CO +30% CO_2 at 20°C and 30°C, the balance of the gases being air.

Carbon monoxide alone had no effect on mortality of the three insect adults. For *C. ferrugineus,* there was no difference in mortality between by CO_2 alone and CO_2 + CO mixture at either temperature for all exposures. However, both *T. castaneum* and *S. granarius* had higher mortality in the CO_2 + CO mixture than the CO_2 alone at both temperatures. Moreover, *S. granarius* was more susceptible to CO_2 + CO mixture than *T. castaneum.* These results suggest that for certain species CO could be used to increase the efficiency of CO_2 , especially at high temperature. Inhibition by CO to electron transport chain at the cellular level is presumed to exert synergistic influence on inducing greater mortality of some insects under CO_2 stress.