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Effect of carbon dioxide sorption in packaged chickpeas on the susceptibility to modified atmospheres of *Rhyzopertha dominica* and *Callosobruchus chinensis*

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ABSTRACT

Modified atmospheres (MAs) with 50 or 90% CO₂ were tested in containers filled with chickpeas at different filling ratios (24, 48 and 96%) to assess the amount of CO₂ sorbed by the pulse. The maximum sorption (1.28 gCO₂/kg of chickpea) was obtained with the lowest filling ratio tested (24%) and with an initial concentration of 90% CO₂. Time needed to reach equilibrium sorption varied between 27 and 141 h, depending on the initial CO₂ concentration and filling ratio. The negative pressure produced by sorption inside the containers incremented with the increase of the filling ratio and the initial CO₂ concentration.

Mortality of the internal feeders *Rhyzopertha dominica* (F.) and *Callosobruchus chinensis* (L.) was assessed in packages filled with two extreme filling ratios (4 and 96% of chickpeas) and with 50 or 90% CO₂. For both pest species, the exposure time to reach 50% mortality ranged from 7 h (larvae with 90% CO₂) to 2 d (pupae with 50% CO₂) at the lower filling ratio tested (4%). When increasing the filling ratio to 96% of chickpeas, mortality of *R. dominica* eggs and adults decreased significantly while did not vary for the internal developmental stages. A similar effect was observed (a decrease in mortality of external developmental stages) in *C. chinensis* at 96% filling ratio with 50% CO₂. However, mortality remained the same for the eggs and pupae at 90% CO₂.

The decline in mortality of external developmental stages of both weevils was probably due to the sorption of CO₂ by the chickpeas, which caused a loss of intergranular levels of CO₂. In conclusion, when chickpeas were packaged with high CO₂ MAs, a decrease in the mortality of the external stages of the pests could be expected due to sorption, whereas for internal stages effectiveness could be anticipated to be the same.

Keywords: Modified atmospheres, Filling ratio, Sorption, Negative pressure, Weevils, Chickpeas, Insect pests, Control, Vacuum, Legumes