

PRACTICAL ASPECTS TO THE USE OF VACUUM AS A METHOD TO CONTROL STORAGE INSECTS

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The recent introduction of flexible transportable sealed chambers made of welded PVC liners has opened new opportunities to implement low pressures (Vacuum treatment) as a competitive and affordable treatment to control storage insect pests. Under vacuum, these chambers shrink over the periphery of the commodity and hold it fast. The system is sealed by an air-tight zipper and is able to retain vacuum. At the base of the chamber an inlet hose enables connection to the vacuum pump that creates the prerequisite low pressure.

Our studies showed that it is not a practical approach to attempt to hold a pressure of below 45 mm Hg because of the energy required for prolonged operation of the pump. Conversely, pressures above 55 mm Hg prolong the time to achieve kill. In contrast to fumigations where schedules are provided by defining dosages to be applied for a predetermined time, at a set temperature range, low pressure treatment schedules must be presented as exposure times at both, a temperature range and a relative humidity that is in equilibrium with the commodity moisture content.

Test insects

We have studied under controlled laboratory conditions of 50 mm Hg, 30°C and 55% r.h. six important stored-product pests: *Trogoderma granarium* (Everts), *Lasioderma serricorne* (F.), *Oryzaephilus surinamensis* (L.), *Tribolium castaneum* (Herbst), *Ephestia cautella* (Walker), and *Plodia interpunctella* (Hübner). The egg is the most resistant stage of all the tested species. At 50 mm Hg, 30°C and 55% r.h., the times needed to obtain 99% mortality being 46 h, 91 h, 32 h, 22 h, 45 h, and 49 h respectively. Eggs of *L. serricorne* are the most resistant and this is critical where this species is likely to infest the commodity and to determine the time needed for treatment.

All six species and additional two storage pest: *Callosobruchus chinensis* (L.) and *Sitophilus oryzae* (L.) were exposed to five days vacuum treatment at several semi-commercial field tests conducted under summer conditions of Israel. In all the field tests a total mortality of all test insects was achieved.

Tested commodities

Ten durable commodities were exposed to five days vacuum treatment: corn, corn chips, garden peas, chick peas, wheat, wheat flour, rice, sun flowers seeds and semolina. The commodities were packed in different ways. Commodities as corn, garden peas, chick peas and sun flower seeds were stored in 1-tonne capacity big-bags. Wheat, rice and semolina were stored in 50 kg bags and corn chips and wheat flour were stored in 25 kg bags loaded on wooden pallets. The temperature of the stored commodities ranged from 26°C to 33°C and relative humidity ranged from 35% to 50%. In all tested commodities the treated product was well preserved and in cases where initial infestation was detected, complete mortality of insects was observed.

The advantage of this treatment is that no toxic chemicals are employed. In comparison with phosphine, exposure times to provide kill are comparable and the exposure time of five days falls within a range suitable for quarantine treatments where no rapid treatment is essential. Where the commodity can be placed in flexible liners, and packed in a manner that can withstand the low pressure, vacuum treatment can provide a good solution. As for fumigation, treatment schedules must be developed for low-pressure treatments by establishing a database on the relative susceptibilities of different insect species at all their stages that are liable to infest the commodity.

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