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HEAT TREATMENT FOR INSECTS

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Abstract Heat treatment has been used to control stored food pests, bed bugs, cockroaches, and other household pests, and structural timber and wood pallets. The energy requirements for treating different materials, spaces, and timber require careful attention to maintaining a heat regimen and training of application personnel.
Key words Insect control, store food pests, structural timber, bed bugs.

INTRODUCTION

The use of heat for insect control in flourmills is not a new idea, it has been used since the early 1900s (Menon et al., 2000). It was shown to be effective in controlling a variety of pests (Sheppard, 1984). However, the use of heat declined after the advent of the gas fumigants. There is renewed interest in using heat to control insects in mills because of phase out of methyl bromide. Typically, the method involves raising ambient temperature to 50° C or above for 24-36 hours to kill insects within the mill, including within machinery. Heat has been used in a controlled environment in the treatment of museum objects and building preservation (Nicholson and Von Rotberg, 1996). Heat treatment is effective for controlling cockroaches (Zeichner et al., 1996), bed bugs (Kells, 2006; Pereira and Koehler, 2011; Hasenbohler and Kassel, 2011; Schrader and Schmolz, 2011), and stored food pests (Fields, 1992; Tang et al., 2007)

Annual space fumigations of flour mills and other food facilities were effective for a few months. However, the months leading up to the next fumigation, insect levels were at dangerous levels in terms of product contamination risk. Fogging only hid adult insects from customer audits and drove real infestation levels deeper into machinery and closer to product. What was needed was an ongoing treatment technique that gave year round control of stored product insects. A system was developed of detailed ongoing inspections of machinery during mill shutdown periods. Control was achieved by a combination of cleaning, insecticidal sprays and dusts to non-food contact surfaces and spot fumigation with a 3:1:1 mixture of carbon tetrachloride, ethylene dibromide and ethylene dichloride to kill eggs, larvae and pupae inside machinery. However, these gases were identified as carcinogens and banned.

HEAT TREATMENTS

Practical heat treatment can be divided into five main types: space treatments,
spot treatments, chambers and kilns, silos and bins, and temporary structures. Heat has been used in the following situations: food industry including confectionary, mills and bakeries, breweries, hotels and hostels, textile pests, fleas and bed bugs, shops, cars, lorries, trains and buses, aircraft, ISPM15 (International Standards for Phytosanitary Measures), timber pests, drying, and combination treatments with insecticides or gas.

The broad concept of heat treatment is to use the following strategy to control all stages of the insect pest life-cycle: detailed inspection by contractor or client biologists or hygiene staff; agree on a treatment strategy with client, including any engineering concerns regarding heat treatment of sensitive machinery, a fire detection and suppression system, and cleaning requirements before and after treatment; and install heating system, ducting and temperature logging sensors.

Heat treatment for bed bug control in hotels is successful using bubble type heating systems and the 56° C for 30 minutes core temperature heat. The same heating requirements have led to the use of heat treatment in timber pest control. This temperature (56° C) has been set to take into account reduced treatment times during pallet manufacturing, or not measuring the cold spots or centre of the thickest piece of timber. Timber beams in houses can be treated to control wood boring insects. The target temperatures of 52° C for 1 hour must be measured in the coldest locations and in the thickest beams. This requires drilling and then filling to locate temperature sensors.

DISCUSSION

That Europe has clearly survived the last 10 years without methyl bromide is testament to the wisdom of the decision to ban it under the Montreal Protocol. Heat treatment has proved more successful in many situations and is safer. Rapid 24 hour commodity treatments remain difficult, and the food supply industry has learned to factor in the 5 days or more needed for phosphine fumigation Training of is crucial to successful treatment without damage. There is commercial focus on different types of machinery, more efficient or more powerful heaters. The success is in how it is applied and the understanding the operator has of how the heat is behaving in the target treatment area.

CONCLUSIONS

For the future, heat treatment of some commodities is possible. However because of the time and energy required for heat to penetrate packaging, treatments will more likely be in fixed in – line installations, or in adapted heat treatment containers. The previous methods of covering commodity with a sheet and treating; heating shipping containers is not feasible due to lack of internal air circulation. Phosphine and CO_2 are still available for commodities and both work well in conjunction with heat. In Europe, applicators allow 5 days instead of 24 hours for fumigations. Heat and phosphine combinations may bring this time down when using phosphine.

The future for heat treatment is good, and its benefits are for all industry not just the organic market. However, heat treatment is not a panacea but should be used in conjunction with a proper integrated pest management system. Good cleaning in conjunction with other pest control techniques should be used to target eggs and larvae hidden in areas inaccessible to conventional pest control measures.

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