TEMPERATURE CONTROL FOR INSECT ELIMINATION

by Jerry W. Heaps, B.C.E. & R.S.
The Pillsbury Company, Minneapolis, MN

Abstract

Using temperature control, either heating or cooling of an environment, is not a new technology to eliminate insects. Within our food industry, heat was used at the turn of the century to kill stored product insects (SPI). The procedure was abandoned because of the damage it caused wooden floors and equipment. Belts could melt and grease liquefy, running out of unsealed bearings. Presently, with technology advances in building/equipment design, we've come full circle and utilizing such methods as an integral piece of an overall, plant-wide integrated pest elimination program is viable. This approach is currently being used by several national food companies. (Imholte, 1984. Cooney, 1985. Heaps, 1988).

Whether we agree or disagree with it, Federal, state and local regulatory agencies are, with quickness and regularity, eliminating most of the conventional insecticides the food industry has relied on for years to control SPI. For example, ethylene dibromide (EDB), carbon tetrachloride (CCl4), and, more recently DDVP (Vapona) have been eliminated. True fumigants such as methyl bromide has been classified under the Clean Air Act as an ozone depletor and is subject to cancellation. Phosphine gas is under serious investigation as a chromosome-damaging material. If concluded as such, its cancellation is most likely forthcoming. Our hands will really be tied with the loss of these two materials.

SPI, as with all insects, are excellent at genetically building resistance to conventional insecticides in the organophosphate, carbamate, or even the "newer" synthetic pyrethroid groups.

For all the above reasons, we must find safe, effective, economical and practical alternatives to eliminate SPI versus using conventional insecticides.

Worden (1987) has documented the use of freeze-outs in Canadian flour mills for insect control. Although effective, it's practicality is somewhat limited as is the time of year (i.e. winter) it can be done.

We do know that SPI will show a significant decrease in activity at temperatures below 60°F (15°C) or above 95°F (35°C). The key is not to allow the SPI to acclimate to the temperatures until the critical point is reached where death occurs. Insects' body fluids act like an antifreeze and it is

only below a critical temperature that they will freeze and die. At the opposite end of temperatures, extreme heat kills insects by either dehydration, coagulating body proteins - destroying key enzymes or combinations thereof.

Since the author has been personally involved in facility heat sterilizations (HS) to eliminate SPI, this will be discussed in detail. By simple definition, a HS is a process by which an area/material is heated to target temperatures of between 130°F to 140°F (54° - 60°C) and maintained for an adequate time period to ensure penetration of the heat has occurred into the desired location. This may be a few hours for a simple piece of machinery or 24 hours for a facility.

Cost

Many variables are figured into the cost of a HS. For example, do you want to own the heaters or rent them? Do you want to use portable heaters, build them into the facility, or use a combination of the two options? Also of significance would be the scope of your HS and the amount of energy or BTUs you'll need. The energy source, either natural gas, electricity, steam generated from in-plant boilers or diesel fuel used to power electric generators also varies in cost from region to region and season of the year. State/local/federal taxes may also be added to fuel costs. Rental equipment may also have a freight/set-up charge in addition to the rental fee.

By far though, the most expensive piece of a HS is the plant downtime and labor. Labor from outside sources (i.e. pest control operator, rental equipment personnel) and, more importantly, in-house labor costs add up quickly. Depending on when the HS is done, over a weekend and/or holiday period, wages paid can be time-and-a-half to double-time normal, straight pay. Facility production, sanitation, quality assurance and maintenance personnel will all be involved in preparing for a HS, plus some will be working during the HS providing coverage on all shifts.

Finally, temperature monitoring devices will also need to be purchased for their important role during a HS.

References Cited

Imholte, T. J. Engineering for Food Safety and Sanitation. 219-226 (1984).

Cooney, K. M. 1985. "If You Can't Stand The Heat". *Food Sanitation* 1:24, 37-39.

Heaps, J. W. "Turn on The Heat to Control Insects". *Dairy and Food Sanitation* vol. 8, no. 8, 416-418. (August 1988).

Worden, G. C. "Freeze-Outs for Insect Control" AOM-Bulletin, January, 1987. 4903-4904.

Pillsbury will be
out of commercial
Pest control tools (MBr, phosphine)
by 2000 - will be totally
heat. — Polzy