9) GOOD MANUFACTURING PRACTICES: PEST CONTROL

INTRODUCTION

Good Manufacturing Practices (GMP) are designed to assure that the foods are produced under hygienic conditions, and that microbiological, chemical and physical hazards were prevented (Gardner, 1999; Sheridan, 2000). Establishing procedures for pest control is an important component of GMPs. Pests are harmful organisms and can cost the food industry billions of dollars each year (Marriott, 1991). The pests of primary concern are insects and rodents and they are responsible to spread disease through foods. Rodents and insects carry pathogenic bacteria both internally and on their bodies. Birds sometimes may become a problem in food processing area and pose a potential public health hazard also (FAO, 1997).

INSECTS

Although there are more than 700,000 known species of insects primary concern of them in food industry are "crawling insects" and "flying insects" (Gould, 1994).

Crawling insects
The most common types of this group that infest food processing plants and foodservice facilities are cockroaches. It has been demonstrated that many of them carry different approximately 50 pathogenic microorganisms including Salmonella spp., Vibrio cholera and polymyelitis. They contact with foods through biting and chewing. They prefer carbohydrate rich foods, but they may feed on any substance that man consumes. They also consume human waste, decaying materials, dead insects, paper and wood material as feed. They are more active at night and in dark areas where human activities are less. Cockroaches are hidden in small spaces in and between equipment and shelves and under shelf liners. Cockroaches reproduce so rapidly that small egg cases containing 15-40 eggs are produced monthly. Identification of cockroach species helped to determine proper insect control techniques (Marriot, 1994).

German Cockroach
This type of cockroach (Blatella germanica) is the most common one around the world. They are 13-20 mm in length and pale brown with two dark-brown stripes behind the head (Marriott, 1994). Their approximate lifespan is 9 months and they produce about 140 young within this period. The egg cases are hidden in dark and hiding places with abundant food and water (Gould, 1994). They commonly infest food restaurants, food processing rooms as well as storage areas, offices, lockers and rest rooms (Gould, 1994; Marriott, 1994).

American Cockroach
These species (Periplaneta americana) are the largest cockroach, approximately 40-60 mm long (Marriott, 1994). Female hides the eggs as soon as they are produced. Female live up to 18 months and may produce approximately 430 offspring. They are most frequently found in basements, storage rooms, garbage, and drainage areas (Gould 1994; Marriott, 1994).

Oriental Cockroach
The insect (Blatta orientali) grows to approximately 25 mm long. It is shiny and dark brown to black in colour. Female produce 80 young through their lifetime of 5-6 months. They prefer a habitat similar to American cockroach (Marriott, 1994).
Flying Insects
Housefly and field fly are the most common types of flying insects. Although they are seasonal, they may be prevalent year around in warm climates. Houseflies are common worldwide and can carry up thousands of pathogenic bacteria (Gould, 1994) that can cause human diseases. They are prevalent in warm locations protected from the wind and more abundant in the late summer and fall. Flies are most active between the temperatures of 12-35°C. They are camotes at 6°C; death occurs below -5°C and at 49°C. Heat paralysis sets in at approximately 40°C. A housefly lays approximately 120 eggs within a week of mating (Marriott, 1994).

Fruit flies are attracted to fruits and rotten material and cannot always be eliminated totally (Gould, 1994).

Detection of Insects
The easiest method for checking cockroach infestation is to enter a darkened area and or storage room and then turn on the lights. A strong oily odour is also an indicator of their presence. Their faeces as small, black or brown droppings may be found almost everywhere they have been (Marriott, 1994).

RODENTS

Rats
Rats transfer many diseases such as leptospirosis, murine typhus, and salmonellosis to man and compete intensively with human’s food (Marriott, 1994; Troller, 1993). One drop of a rat can carry millions of harmful microorganisms. Dried droppings may be carried into food by air movement (Marriott, 1994).

Rats are dangerous and destructive (Marriott, 1994). In some countries rats may consume up to 35% of harvestable crop. In addition, they invade stored products as well (Troller, 1993). It has been estimated by The National Restaurant Association that the loss from rodent damage could be billions of dollars (Marriott, 1994).

The female rat becomes fertile within 6-8 weeks after birth and is capable of one litter per month with 6-10 young each litter (Troller, 1993). Most rats usually live for 1 year and consume approximately 20 kg of food during their lifetime (Marriott, 1994).

A rat can enter through openings as small as a quarter, climb vertical brick walls, and jump up to a meter vertically and 1.2 meters horizontally. They are strong swimmers and have the ability of swimming through toilet bowl traps (Troller, 1993). The rats need 15-50 ml of free water per day in order to survive. Norway rat or Rattus norvegicus is the abundant kind of rat in the United States. Rats that find enough food do usually not move more than 50 m from their nest if mates are available (Marriott, 1994).

Mice
They are able to enter a building through a hole as small as a nickel. Like rats mice can swim through floor drains and toilet bowl traps. Mice are also filthy as rodents and can spread various diseases. They can survive on water derived from food. They are easily carried into food premises in crates and cartons. Mice are easier to trap than rats and destroyed by the same poisons as rats. Metal and wood-base snap traps are normally effective (Marriott, 1994).
**Indications of Rat Infestation**

Faecal droppings are one of the most important indicators of rodent infestation. The size of rat and house mouse droppings are 13-19 mm length and 6 mm diameter, and approximately 3 mm long and 1 mm diameter respectively (Marriott, 1994).

Rats and mice tend to be inactive during daylight hours (Marriott, 1994). Although many of the experts believe that visual sightings of rats are not very reliable indicators, it is possible to observe rats at night with a flashlight (Troller, 1993).

Noises, smudge marks, urine stains and odour are also indicators of rat infestation (Troller, 1994).

**Bird Infestation**

Birds are potential carriers of mites, mycosis, pseudotuberculosis, toxoplasmosis, *Salmonella* and organisms that cause encephalitis and other diseases. Their drippings carry plenty of microorganisms detrimental to humans. Birds can be the cause of insect infestations. Bird infestation can be reduced through proper management and sanitation (Marriott, 1994).

**CONTROL**

Pests should be destroyed without chemicals, if feasible, because of the potential danger of pesticides. But these techniques are not always as effective as it should be. Therefore it is necessary to use pesticides. The best method for the control of insect infestation centres on good sanitation or housekeeping with the use of pesticides under the supervision of a licensed operator. An integrated chemical control and sanitary practices can be more effective and more economical.

Top management should identify a responsible competent person to develop a pest prevention and control program and give them the necessary support to carry out the program. The pesticides should be used in accordance with label instructions. Persons who apply pesticides in the plant have a responsibility to use the right and approved pesticide, to apply it correctly (according to label instructions), and to be certain there is no hazard to man or the environment (Schuler et al. 1999).

**Insect control**

Effective insect control are summarised as follows (FAO, 1997; Gould, 1994; Marriott, 1994):

(a) Elimination of their harbourage areas
(b) Elimination of their food and water (cockroaches come out into the light when food and water sources of them were eliminated)
(c) Prevention their entrance to the plant by proper screening
(d) Storing foods 15-20 cm off the floor
(e) Leaving aisles at least 50cm along the walls
(f) Removing cartons and boxes from the premises as soon as the supplies have been unpacked
(g) Instruction of air currents (they frequently carry flies a much greater distance than they normally travel)
(h) Instruction self closing doors (the doors remain open for minimal amounts of time)
(i) Use of electric fly traps if flies have entered a facility; run all day, and clean the catch basin daily
Destruction of insects with insecticides.

**Insecticides**
Amidnohydrozone chlorpyrifos and diazinon offer potential for the control of cockroaches. Diazinon is sprayed in hiding places and effective if the pests have not developed a resistance to this compound (Marriott, 1994).

Typically on weekends, fumigation is applied in the food industry primarily to control insects that attack stored products are able to reach hidden pests. Fumigants act on insects by inactivation of their respiratory enzymes. Phosphin, ethylene oxide and methyl bromide are widely used fumigants in food industry (Marriott, 1994)

**Other Chemical Methods of Insect Control**
Baits are also used for insect control. They are a combination of insect-attracting foods, such as sugar, and an insecticide.

**Biological Control**
Biological control of insects is frequently incorporated into integrated pest management (IPM) programs. Viruses, fungi, and bacteria can be used for this purpose. Specific sex pheromone traps to catch insects have been developed and are now available commercially. Some other chemical attractants are also available for various species and some are being used to control fruit flies. It was indicated that food aroma attractants are usually more effective than pheromones. Hydroprene is a no pesticide insect growth regulator (IGR), is effective for cockroach control because of its margin of safety and toxicity and been approved by Environmental Protection Agency (EPA) (Marriott, 1994).

**Rodent Control**
Effective rodent control consist of (FAO, 1997; Marriott, 1994):

- a) Elimination of rodent shelters
- b) Elimination of rodent food sources
- c) Prevention of rodents to enter the buildings
- d) Use of tracking powder (may contain an anticoagulant or a single dose poison)
- e) Gassing (if other eradication methods are not effective)
- f) Trapping
- g) Use of ultrasonic device

**PRECAUTIONS AGAINST PESTICIDES**

Chemical pesticides are not considered as a substitute for effective sanitation. Proper sanitary practices are more effective and more economical than pesticides. Pesticides should be applied after the shift, over the weekend, or any time when the food establishment is closed, and should not be sprayed in food areas during working hours (Marriott, 1994). Some of the most important precautions that should be taken into consideration are given below (FAO, 1997; Marriott, 1999):

- a) Reading instructions on containers labels
- b) Use of approved pesticides
- c) Avoiding prolonged exposure and wearing protective cloth
- d) Storing pesticides separately from foods and in properly labelled containers
- e) Disposing empty containers safely
- f) Knowing first aid measures for accidental poisoning
- g) Prevention of pesticide contaminations to food, equipment, and utensils.
h) Calling a physician if an accidental poisoning occurs (if immediate assistance cannot be obtained, treatment should include induction of vomiting)

i) Storing pesticides in a dry area with a temperature of ≤35° C.

j) Storing pesticides in their original containers

INTEGRATED PEST MANAGEMENT

Integrated pest control programs based on predicted ecological and economic consequences have been developed because of limitations of chemical pesticides. This program is called “integrated pest management” (IPM). The major objective of IPM is to control pests economically through environmentally sound techniques (Marriott, 1994). IPM implies that pests are “managed” and not necessarily eliminated.

INSPECTION

An inspection program is necessary for an effective pest control system. Inspection is a preventive, monitoring control measure that is time consuming but important and cost effective. Inspection should be done regularly by using a checklist developed for pest control (Schuler et al. 1999). Monitoring should include raw materials, adjuncts, and production and storage premises should be monitored. Laboratory testing of samples should be carried out by using a filth test method. Insects, insect fragments, eggs, larvae and rodent hairs and excrement should be identified (Marriott, 1994).

REFERENCES


