Don't be boxed in!

New developments in the use of electronic fly killers

How often in life do we take things for granted? Something has always been done that way and that's the way it stays. A chance conversation at Eurocido with Netherlands-based Ronald van Lierop of Alcochem Hygiene revealed that when it comes to electronic flykillers (EFKs) this company is definitely 'thinking outside the box'. By doing so a more efficient and cost-saving technology has been developed as ***Pest*** editor, Frances McKim, discovers.

In pest control we all know that flying insects spread diseases and so must be controlled, especially if you are dealing with sensitive areas, such as food processing and packaging areas.

One of the main methods of control is the installation and maintenance of electronic fly killers (EFKs) and these now play a staple part of many pest controllers' businesses.

Straightforward theory

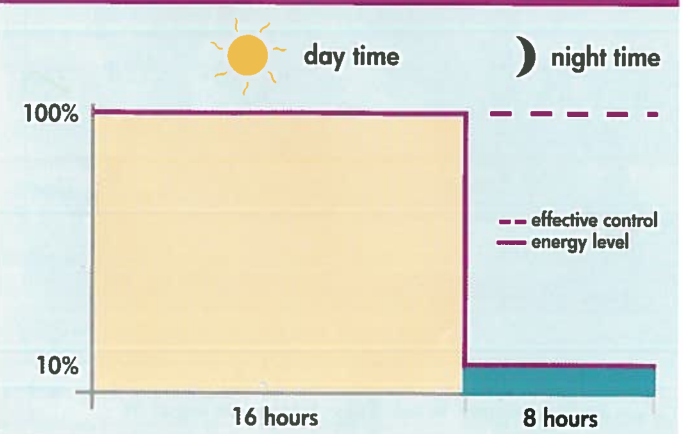
The theory is relatively straightforward. To eliminate a flying insect; first the insect must be attracted (by the light), once attracted they must be killed (by means of an electronic killing grid or glue board) and then the body must be dealt with by means of a catch-tray as your customer is not going to thank you if dead bodies, or fragments thereof, litter the vicinity or become airborne.

EFKs have now been in existence for over 100 years (see box on page 16) yet the basic principles of how they work has altered little.

Improvements

Admittedly, there has been considerable improvement in the use of lures, the introduction of glue boards to capture and retain the dead insects, along with safety improvements and, of course, considerable visual design innovations.

EFK output during day and night hours



Alcochem's Ronald van Lierop

Essentially, however, pest controllers put up the machine, insert the tubes, which run continually for 24 hours a day and, then, simply change the tubes annually.

Technically an EFK consists of one, or more, fluorescent tubes which provide a UV-A light output of around 365nm to attract the flying insects. The tubes require a starter to launch the arc discharge as well as a ballast to stabilise the current through the lamp.

To this day the majority of commercially available EFKs use a magnetic ballast which commonly gets very warm (actually offering the flies an inappropriate attractant) and it can consume anything between 15-25% of the power supplied, so by no means energy efficient.

Unwanted heat

Also far from energy efficient is the fluorescent tube itself. Fifteen watt tubes are the unofficial standard for use in EFKs. Of the power they consume, between 60-67% produces unwanted heat (that's two-thirds), with the remaining one-third producing light. Of the remaining five watts, only just over two watts produces the required UV-A light, with the remaining three watts going into undesired visible light.

The annual running cost of such an EFK unit, based on a four x15 watt tubes in the unit van be calculated. This unit requires 72 watts per hour so over a whole year (8,760 hours) it will use 630,720 watts. At current UK rates for electricity (£0.16 per kWh), a single unit would cost around £100 per year to run. Multiplied-up by the number of units in any one establishment, the cost becomes significant.

Whilst in the longer-term, EFKs fitted with significantly ▶▶▶

more efficient light emitting diodes (UV-A LEDs) will be the way forward, it is likely to be at least five years before a reliable and affordable EFK with LEDs is available.

Thinking outside the box

With this predicted delay in developing a more cost effective and 'greener' fly killing machine, Alcochem felt the time was right to challenge some of the accepted standards – to think 'outside the box.'

As Ronald van Lierop, in charge of Alcochem Hygiene's activities explains: "Just because EFKs have always operated in a certain manner, it doesn't mean this is the only way. We decided to examine two particular variables. Could energy be saved by optimising the design of the ballast?

"And second, EFKs have traditionally always been run at full output for 24 hours a day, seven days a week. During the daylight hours, when flies are active, this is what is needed to achieve insect attraction over a typical radius of 10-12 metres around the unit. But night-time insects are far more light sensitive and do not require such a powerful output. So why run your machine at full output when it's not needed? If you can reduce output and still maintain full efficacy you can save on the electricity consumed."

With these objectives in mind, researchers based at the Alcochem facilities in the Netherlands and in China set-about this challenge. Night-time flying insects, such as the Indian meal moth (*Plodia interpunctella*), are far more sensitive to UV-A and require a far smaller stimulus – 10% being sufficient – to attract them as the table, left, illustrates. (Figure 1)

Relative lamp efficiency

The efficiency of light production varies by type of lamp (bulb) employed.

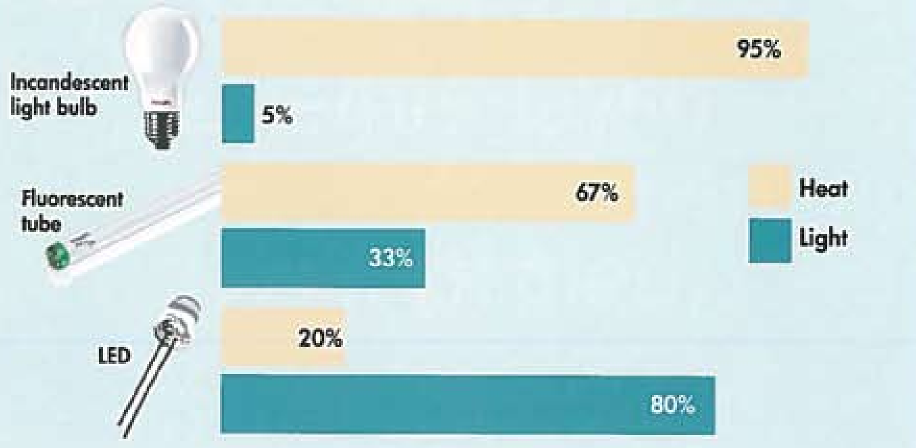


Figure 1: Fly control at 100% and 10% power. Summary of test results

Test species: Indian meal moth (*Plodia interpunctella*).
Site conditions: Wind speed 0.2 to 0.3 m/sec; Humidity 64% RH; Temperature 25.8 to 26°C; Light intensity in night mode: 400 Lux. Units were operated for either one or two hours, between 22.00 and 06.00.

Unit and power output	Average kill rate %	Range %
EFK i-trap 125 at 100% light output	62	47 to 74
EFK i-trap 125 at 10% light output	59	47 to 72

Conclusion:
Both power outputs resulted in almost identical kill rates.

Night-time insects are far more light sensitive. The timer allows you to reduce the power overnight and still maintain efficacy

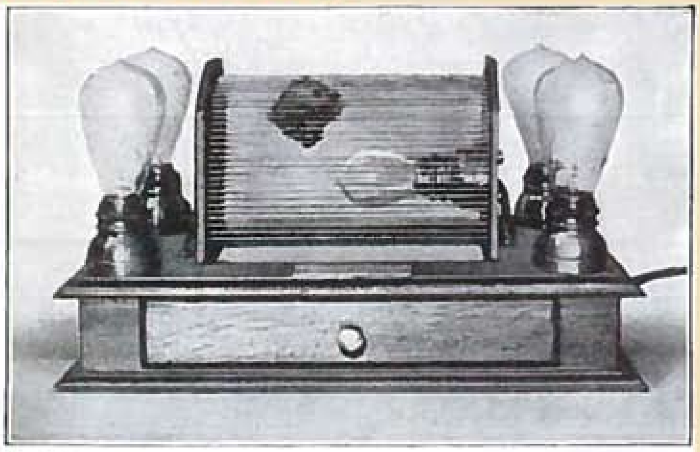
EFKs: a hundred year history

The first published reference to what has become an electronic fly killer was in *Popular Mechanic* magazine in October 1911.

It contained all the elements we still use today but at the time was judged as too expensive and impractical. Designed by two unnamed men from Denver, USA it consisted of five incandescent light bulbs, a grid with wires spaced 3.17 mm apart using a voltage of 450 volts. Users were supposed to bait the interior with meat.

The first commercial design was patented in the USA in 1934 by William F Folmer and Harrison L Chapin.

Separately, Dr W B Herms, a professor of parasitology at the University of California had been working on large commercial insect traps for over 20 years for protection of California's important fruit industry. In 1934 he introduced the electronic insect killer that became the model for all future bug zappers.



The Flies are Supposed to be Attracted by Bait within the Cage and be Electrocuted When They Attempt to Get at It

A typical night species: *Plodia interpunctella*

A typical day species: *Musca domestica*

Having established that night-time insects would be attracted at this reduced light output, extensive testing of both the ballast and lamp was required to ensure that the dimmed lamps would compromise neither start-up characteristics, lamp output, nor lamp life. This work was undertaken in the laboratories of Philips, as all such Alcochem EFKs use Master Actinic BL lamps.

Field trials

Having established technical feasibility, Alcochem conducted extensive field trials in commercial situations for the past year to check efficacy with night-time insects.

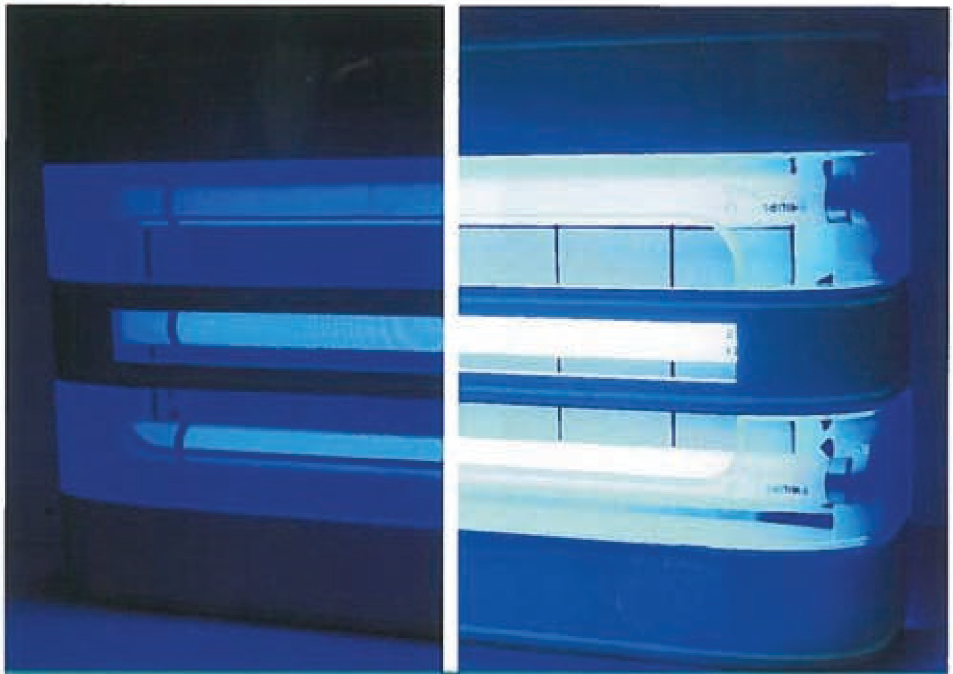
By switching the ballast within the EFK from a magnetic type to an electron version (christened by Alcochem, an eco-ballast), not only could the power consumed by the ballast be reduced by 90%, but the starter is now no longer required and less heat is generated. But probably the greatest advantage is that the eco-ballast means the output of the lamp can be reduced for the night hours with the addition of a programmable timer the unit can be set to dim to 10% output at night.

So what does this mean?

As seen in the calculation in Figure 2 right, when the reduced power required by the eco-ballast is added to the 90% output reduction at night (in this example for eight hours) a total of 1,152 watts are used per day.

If the power requirements of a traditional magnetic ballast are compared with those of an eco-ballast savings of 210,240 watts (33%) over one year can be achieved – equivalent to nearly £35 on one machine alone (see Figure 3 alongside). Industrial clients are likely to have several installed – say ten – so a saving of £350 per annum is far from inconsiderable.

Summing-up these developments Ronald said: "With these savings the cost of the machine itself can be paid-back within three to five years. Surely a win-win situation."



The new Eco-ballast technology offers significant energy and therefore cost savings by switching from full power during the day (right) to low power at night

Figure 2 : Eco-ballast power consumption

Unit: 4x15 watt	1 unit	10 units
Power lamps per day-hour	60 watt	600 watt
Power lamps per night-hour	6 watt	60 watt
Power ballast per hour (day & night)	6 watt	660 watt
Day insects (16 hours x 100%)	1,056 watt	10,560 watt
Night insects (8 hours x 10%)	96 watt	960 watt
Total per 24 hours	1,152 watt	11,520 watt
Total per year (8,760 hours)	420,480 watt	4,204,800 watt

Figure 3: Eco-ballast advantage

Unit: 4x15 watt	1 unit	10 units
Traditional ballast	630,720 watt	6,307,200 watt
Eco-ballast	420,480 watt	4,204,800 watt
Savings (watt)	210,240 watt	2,102,400 watt
Savings (%)	33%	33%
Savings (1 kWh = £0.16)	£33.60/year	£336/year

Availability of EFKs with eco-ballast technology

Two EFK machines utilising eco-ballast technology are being manufactured by Alcochem – the Eco-Trap 2 and the Eco-Trap 3 – and these are being launched across Europe by their distributors.

As ***Pest*** went to press, however, arrangements for the UK were still under discussion.