

Fossilised pest control

Simon Forrester investigates the science behind diatomaceous earth.

Diatomaceous earth (DE) is a fine whitish-grey powder formed from a crushed fossil, used to effectively control insect pests without the use of traditional chemicals. But what is DE, and is there a downside to its use?

Where does DE come from?

DE comes from a naturally occurring soft sedimentary rock that is easily crumbled into powder. The rock is composed of the fossilised cell walls of silica-based microscopic diatoms, which occur naturally in deposits across the world.

Diatomaceous earth is almost pure powdered silica, with some beneficial trace minerals. Under a microscope, it looks like shards of glass (glass is also made from silica). Particle size ranges from 3 to 200 micrometres (0.003-0.2mm), but to kill insects the particles must be as fine as possible. DE has a slight abrasive and desiccant feel to it, though as with all biocides, care should be taken not to come into direct contact.

How does it work?

An insect's cuticle is normally covered by a waterproof layer of wax and oils (lipids), which prevents the loss of water from the insect. DE is very absorptive and absorbs this wax, leaving the cuticle permeable to water. As a result, water is able to evaporate from within the insect through the now permeable cuticle, and so the insect desiccates and dies. For the insect to die, it needs to come into contact with the dust and thus in the application of the product it is important to apply a light coating to the surfaces so that the insect can pick up the dust. If a large amount of DE is placed in an area, insects tend to avoid the area. The process for an insect to desiccate takes time; for example a Bed bug coming into contact with DE will take anything between 3-6 days to die from desiccation.

What can DE be used to control?



Just as with a chemical control, it is important to know what DE will and won't kill. When considering DE as a

pest control product you should know that it can be safely used around all types of animals (including humans) and is only deadly for insect pests. Be aware though it will also kill beneficial insects such as bees, so care should be taken when deciding if and where to use it. DE is effective at all growth stages including larva, pupa and eggs, and can be used on:

- Bed bugs
- Cockroaches
- Ants
- House dust and other mites (widely used for poultry mite control)
- Stored product insects e.g. in grain storage.
- Wasps
- Earwigs
- Fleas and ticks

Where to apply it

DE may be applied in almost any domestic or commercial premises, including kitchens and food preparation/manufacturing areas and hospitals. Apart from its use as a powder, the diluted product can be applied as a surface spray (medium to fine spray) or as a space spray through ULV equipment or a thermal fogging machine suitable for water based products. Dried dust however is much more effective. Published tests generally indicate effective doses of 5-25g/m².

DE is particularly suited to crack and crevice treatments, and can easily be admixed to grain to control SPIs and mites. Control using DE may take several days as the insects die off, but whereas chemical poisons act fast and have a short residual effect, DE while working slower will remain active and nontoxic as long as it remains in the environment. Charles Phillips, Division Director of Barretine Environmental explains, "DE is extremely 'residual', if left in cracks and crevices as its chemical make-up does not alter, the DE is active indefinitely." However, DE deposits will lose activity if they become damp and caked.

It is important to note that DE should be used as part of a control programme – it will not solve issues on its own. For example, it can be applied to wall and floor voids to help control bed bugs, but other methods will be appropriate to remove them from furniture and bedding.

ONLINE
CPD

An online CPD quiz based on this feature is now available on the BPCA website. Each quiz is worth three PROMPT CPD points – register to take part at www.bpca.org.uk/affiliate

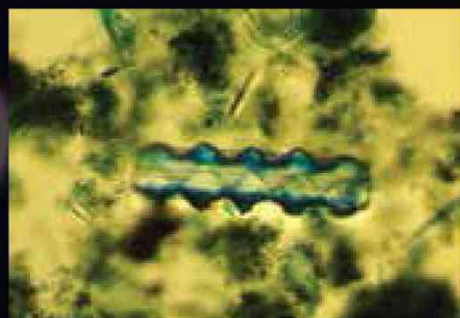
"Diatomaceous earth can be a very useful tool as part of an integrated pest control strategy" comments BPCA Technical Manager Richard Moseley. "In many cases one treatment strategy is not enough to achieve full control of a pest insect infestation, and DE offers the pest controller another non-toxic control option."

Health issues with DE

Though seen as 'green' because of its physical rather than chemical action, DE has safety issues. In health terms, inhalation of crystalline silica is harmful to the lungs, causing silicosis. Amorphous silica is considered to be lower toxicity, but prolonged inhalation can cause changes to the lungs. Luckily, the DE sold for pest control is mostly amorphous silica, but may contain small amounts of crystalline silica. In a study of workers, those exposed to natural DE for over five years had no significant lung changes, while 40% of those exposed to the calcined form had developed pneumoconiosis.

If inhaled, DE can irritate the skin, eyes and in particular the respiratory system (throat and lungs) and may build up over time. If used in a confined space, wear a half mask respirator to EN140 with a particulate filter (A1P2) plus coveralls, goggles and gloves. RPE filters should be changed along manufacturers' instructions. Although considered to be relatively low-risk, pesticides containing diatomaceous earth are not exempt from regulation. DE is itself not classified as hazardous under CHIP Regulation or the CLP Regulation, but occupational exposure limits exist for dust of 1-2mg/m³

When using DE, avoid creating large quantities of dust, and do not use the product in situations where it will be easily or regularly disturbed.



MYTHS AND LEGENDS

DE ABSORBS WATER, DRYING OUT THE INSECT

DE does not absorb water, it absorbs the insect's wax, allowing water to evaporate. Confusion may have arisen over the little bags of hygroscopic silica gel in electrical equipment which actually absorb water.

ALL INSECTS ARE EQUALLY SUSCEPTIBLE

Smaller invertebrates are more vulnerable to desiccant dusts, because they have a proportionally larger surface area than larger insects, so lose water more rapidly. So, poultry and grain mites, being very small, are relatively susceptible. Arthropods and gastropods (e.g. slugs) die as a result of water pressure deficiency. However, since slugs inhabit humid environments, DE efficacy is very low.

DE IS A 'RESISTANCE BUSTER'

DE is indeed effective against insects such as bed bugs that have become resistant to conventional insecticides such as pyrethroids, because DE has a completely different mode of action (physical not chemical) – one of the major plus points for DE's use. However, in time, some insects may develop resistance to DE itself. There have been studies on storage beetles that have shown a decrease in susceptibility after prolonged selection pressure with DE.

DE IS 'SHARP' AND 'PUNCTURES' THE CUTICLE, LEADING TO LOSS OF WATER

DE and related products do not work in this way. There have been tests of highly abrasive dusts such as carborundum to see if they kill insects, but they do not. Abrasion is not the mode of action.

ALL DE WORKS ON ALL INSECTS

DE is a natural product, originating from different deposits in a number of different countries, and there is variation in the insecticidal activity of DE from these different sources. The effectiveness will also be affected by the production process – products manufactured to give a smaller particle size are more likely to be effective than larger particle sizes. Some published tests have shown that different commercially available DE insecticidal products vary widely in their effectiveness, and some even have very little insecticidal activity. NB in order to be effective as an insecticide, diatomaceous earth must be uncalcinated i.e. not heat-treated before use.

The regulatory situation



In the UK, DE was exempt from the Control of Pesticide Regs 1986 because it had a physical mode

of action. Therefore, DE products did not require approval, so efficacy testing was not required. Consequently there are a lot of unsubstantiated and contradictory claims around. However, recent reviews by the European Food Safety Authority indicate that it is likely that at some point soon DE will require approval under the EU Biocides Regulation. We will of course inform the readers of PPC when we know more.

Summary

While DE remains the friend of the pest controller, it seems the dual spectres of resistance and regulation may restrict its use in future years. Used wisely DE is an effective tool in any PCO's armoury.



Products on the market

Barrettine Environmental Health offers several forms of diatomaceous earth under the Oa2Ki brand. One as a dust in a puffer pack that can be dispersed into cracks and crevices, and another formulated product available in a spray can, allowing DE to be sprayed in a liquid form that rapidly dries on surfaces.

www.barrettine.com

Killgerm sells DE through Killgerid Powder which is available in 3kg tubs.

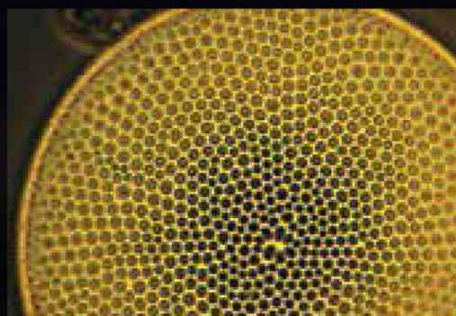
www.killgerm.com

1Env offers Organi-Sect Dust which is diatomaceous earth 100% and is available in 2kg, 6kg or 20kg sacks.

www.1env.co.uk

Pestfix sell Barrettine's OA2KI range and Lodi's Organ-X range.

www.pestfix.co.uk



OUR FLEXIBLE FRIEND

DE is also used in...



Toothpaste as an abrasive



Fire-resistant safes as a thermal barrier



Dynamite as a stabilising agent



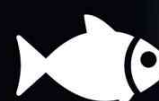
Parasite control for pets and livestock



Cleaning up toxic spills



Cat litter



Swimming pool and fish tank filters

Source: Wikipedia