DE – Delta Electricity or Diatomaceous Earth?

The DE discussed here is not a new energy company, as first pops up on a web search, but an age old natural resource – DIATOMACEOUS EARTH. Known for its already proven results in filtration, animal health and agriculture, and as an abrasive, a thermal barrier, and filler, it is still being investigated for its further potential uses. With its unique qualities, DE already has many applications, with an incredible future potential for agriculture and food production as it replaces expensive and often toxic residual chemical treatments.

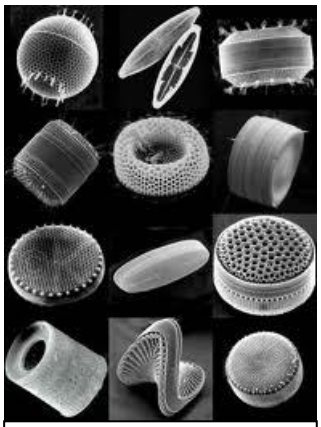
History

First identified in 1836 in Europe, it has since found many uses including as a base material for making dynamite, a filtering agent for disease management (helping immensely during the Cholera Epidemic in 1892) as well as being extensively used in water filtration such as in *swimming pools. DE has been and is still being used as an abrasive, absorbent, in thermal control situations, as a natural pest control agent and in agriculture. It is the agricultural applications of naturally occurring amorphous (not heat treated crystalline) DE that will be discussed here in more detail.

* The DE used in water filtering has been heat treated resulting in a crystalline DE immediately hazardous when inhaled or ingested. Untreated DE is amorphous silica which, even though it can congest the lungs, does not hold the same hazardous risks to permanent organ damage as crystalline silica. With either material, precautions must be taken to remove exposure to skin and prevent inhalation or ingestion by using the appropriate personal protective apparel such as face masks, glasses and gloves.

Composition

DE comprises the fossilised remains of diatoms, a microscopic single-celled algae, embedded in lacustrine (fresh water lake) or marine sediments. Though quality varies considerably based on its source, DE generally consists of 80 to 90% silica, with 2 to 4% aluminium (attributed mostly to clay minerals) and 0.5 to 2% iron oxides. The higher quality material is inevitably sourced from fresh water sediments where the consistency and structural makeup are more reliably homogenous and therefore better matched to fit for purpose. The shape of the diatoms can be remarkably different between deposits and will determine their efficacy in certain applications. As an example, spiny, razor-sharp diatoms from lacustrine deposits range in size from 1µm to 1 mm (typically 10-200µm), and will more effectively injure insects as their outer shell is lacerated to cause dehydration and eventual death.



Microscopic view of diatomite

Uses in Agriculture

DE is used as an anti-caking and drying agent in stock feed mixes and deep litter management, as a growing medium in hydroponics (similar to perlite, vermiculate and zeolite) and as a means of reducing manure odours whilst it keeps fly populations down by keeping fly larvae from developing.

DE is great for internal worm and parasite control in humans, livestock (ruminants, mono-gastrics and birds) as well as external pest control of weavils, cockroaches, fleas, mites, flies where up to 75% are killed within 72 hours of contacting it. This makes it a frontrunner for non-chemical weavil control in grain storages, and as a means of managing livestock parasites likely to develop resistance to commercial drenches or other chemical treatments. It also creates minimum disturbance or damage in biologically driven growing systems and readily qualifies for organic farming use.

Some nutritional benefits will also be derived from the use of DE as a range of trace elements and minerals are ingested and used by the animal. An analysis of your source of DE will be useful in confirming the nutritional value of this supplement.

Modes of Action

DE, diatomaceous earth or diatomite is used by way of several actions to manage a range of pests, insects and parasites without the need to resort to chemical use. The modes of actions include:

- Lipid absorption from the waxy outer layer of insect exo-skeletons
- Sorptive properties to physically dehydrate the insect, or dry the surrounding area
- Physical laceration of the skeleton of insects, digestive tract of parasites and foot of gastropods (snails and slugs)
- Storage of nutrients for buffering in hydroponic growing media or deep litter/compost

Whether to use or apply 'once off' in response to identified infestations or as an ongoing preventative will depend on your particular circumstances, but usually prevention is better than cure!

Specific Applications

There are an increasing number of users of DE as the efficacy and the non-residual nature of this control agent are discovered by innovative farmers. **Piglets** are rolled in it for **mite control**, **turkeys** and **other poultry** are given access to it in a **dust bath** to offend **lice and mites** and various other insects such as **brown beetle** hiding under troughs or in nesting boxes. It can be scheduled into the building program of **houses** to provide long term **control** of **white ants**, **millipedes** and **earwigs**, etc. Provided it remains relatively dry (<12% moisture), it will cause grief to **snails** and **slugs**, but should be reapplied after rains or irrigation.

Where it is finding a popularity never seen before is in **parasite** and **worm control** of **farm animals**. Not using costly drenches that often end up ineffective with **parasite** or **worm resistance,** and with the knowledge that some drenches adversely affect dung beetles is giving DE the impetus for broader usage. **Sheep, cattle and other livestock worming** methods include adding DE to dried molasses or with salt as in lick blocks, or as a component in the free choice selection of minerals and health supplements. DE also mixes with oral drenching liquids such as the trio of MinKel, Cod Liver Oil and Apple Cider Vinegar but must be immediately used after mixing. If left for a time, the DE will absorb the liquids into its microscopically abrasive and aggresive structure and become very much less effective. Another important practical application for DE is in controlling **weavils** of various types in **silos** and **bulk storage** of grains. As long as the DE is evenly distributed throughout the grain, it can offer residual control for a year or more even in unsealed silos. A mechanical applicator may be required for effective coverage, but in any case research has shown that the residual DE on the grain does not affect its qualities in flour or other downstream uses. It may even provide a level of human intestinal parasite control!

Amounts to use

The quantity of DE used depends on the mode of action that is expected to provide the end result. Measures such as surface area, volume, moisture levels, density of infestation will each create circumstances where regular monitoring will eventually determine the amount to use.

To begin with, a one-off application could suffice if the timing is such that it enters the parasite's life cycle at the appropriate time and cuts the cycle short. If parasites and worms are endemic and have a history of persistence, ongoing daily administration of DE may be necessary for up to 90 days. Other management actions such as weaning, joining, introduction of new stock, grazing rotations and water supply must be included for ongoing control, with the application of DE only taking the pressure off the immediate worm burden by dealing with the situation at the time of administration.

Parasite and Worming: Amounts to use vary, but rule of thumb is 2% of total daily dry matter feed intake which for a sheep equates to about 10gm of DE and for weaning cattle of 200-300kg, a dose of 50gm is suggested. Larger and smaller quantities are used in response to body size, severity of infestation, whether regularly administered, the actual end result after initial treatment and whether the conditions (humidity, timing, etc) are favourable or not to the mode of action. Repeated dosing or free choice availability may be needed until faecal egg counts or a change in the animal's condition confirm that control has taken place.

The following recommended amounts are for:
Kittens - 1/2 to 1 teaspoon
Cats - 2 teaspoons twice/day
Puppies less than 5kg. - 1/2 to 1 teaspoon
Puppies 5-10kg . - 2 teaspoons
Dogs 10kg+ 1-2 tablespoons
Cattle, Dairy Cows, & Pigs - 2% of dry feed ration & Free Choice
Chickens and Poultry - 5% in feed & Free Choice
Goats & Sheep - 2-3 tbsps. per 100kg's of body weight & Free Choice
Horses - 1 to 2 cups in daily ration & Free Choice

Weavil control in grain storage: As little as 1kg is sufficient to cover 1 tonne of large grain against insect attack. Because of the different types of insects and the variations in their waxy outter cuticles, and the vast differences in the physical properties of DE, the target insect must be matched to the most suitable DE to give optimum results. Some trials may be necessary to establish whether the DE you source and the amounts effectively deal with the pests that need to be controlled. Apart from the type of DE, the grain size and coverage will determine the amount applied and the end result. Results can usually be found within 72 hours of application as the weavils become dessicated, dehydrate and die. When the grain is ready to be milled or processed, it is not necessary to remove the DE. There is no difference in taste or in cooking quality compared with raw untreated grains – and there is no other potential toxic residual to be concerned about!

As a guide, the amounts to use in grain or seed storage:

- 1 cup (250ml) of **DE** will protect 25kg of small grain
- 3.5kg of **DE** will protect up to 1000kg of small grains or seed eg. Grass seeds, Canola, Linseed, Buckwheat, Wheat, Oats, Barley
- 1-2kg of **DE** will protect up to 1000kg of larger grain or seed eg. Peas, Beans, Corn

Flystrike, lice and mites: To effectively control these pests, a review of the nutritional plane of the animal should take place while dust baths and topical treatment methods are adapted. As with grain weavil control, a thorough coverage of the animal should be performed by either providing a facility for it to take a dust bath, or to physically apply it to the animal ensuring the DE contacts all the folds of skin under any fur or feathers and thorough coverage is achieved.

Cost of product

The amount paid for DE will vary depending upon the quality and quantity purchased. Prices as at September 2011 can range from <$4/kg to as much as $12/kg or more. Again, make sure that you match the DE quality to the purpose so that you get the desired end result. Some trials may be necessary to ensure the prevailing conditions in your situation do not impact the effectiveness of DE application.

Cautions: Use Of Personal Protective Apparel Highly Advised.

Possible effects of a single overexposure - acute accidental exposure effects would be non-specific. **Total dust:** nuisance dust but inhalation symptoms might include coughing, wheezing, difficult breathing and upper respiratory tract irritation. **Skin contact:** no known concern. **Eye contact:** may cause temporary discomfort and irritation. **Ingestion**: no known hazard. **Health:** no known reactions. **Flammability:** 0**. Reactivity:** 0. **Environmental:** do not use near aquariums or waterways as it may kill fish.

This summary has been compiled by Gerhard Grasser, AgriSolutions 2011 as an introduction to using Diatomaceous Earth in Agriculture and Food Storage. No responsibility will be accepted for losses due to the application of these guidelines as the practical circumstances vary beyond the author's control.

FOR FURTHER INFORMATION CONTACT

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