

VAPORMATE™: A NICHE METHYL BROMIDE ALTERNATIVE.

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Introduction:

Ethyl Formate [HCOOC_2H_5] a volatile highly flammable liquid is a historical fumigant of dried fruit and a rapid acting, GRAS registered food additive. EtF's advantage include: natural occurrence in food; rapid kill of insects (2-4 hours); fast breakdown of residues to natural products; low human toxicity. With a low boiling point (54.1°C) the volatile ethyl formate has a wide flammability in air (2.8-16.5 vol% or 90-540 g/m³). Mixing with carbon dioxide [VAPORMATE] enhances EtF toxicity and eliminates the flammability hazard of ethyl formate. Ethyl formate is diluted 6 times in liquid carbon dioxide (CO_2) to formulate the non-flammable VAPORMATE [16.7wt% ethyl formate in liquid CO_2 = 11vol% ethyl formate in gaseous CO_2]. VAPORMATE is a patented post harvest fumigant which controls insects in stored grains, fresh produce & food processing equipment. VAPORMATE is dispensed as a fog (particle size ~5-10 microns) or vaporised to a gas/vapour mixture to assist uniform distribution and optimise efficacy. VAPORMATE has been registered as a pesticide in Australia and New Zealand. Registration applications have been submitted in the Philippines, Turkey, South Africa and are being prepared for Asia – Pacific countries.

VAPORMATE [“No Withholding Period” status] applications include:

- Niche alternative for methyl bromide (eg fresh produce, grain, dried fruit, nuts etc);
- Rapid treatment: eg 50-tonne silo of grain: 12 minutes to apply, three hours to fumigate and two hours to air out with no withholding period.
- Disinfestation of food processing equipment containing food residues.
- Modified Atmosphere Package [MAP] treatment for packaged food.

VAPORMATE dispensing innovations include:

- spraying product via a manual hand gun to treat food processing equipment as the resultant "fog" permeated the spaces quickly being propelled by the high cylinder pressure [50 bar = 800psi]. This application is assisted having the VAPORMATE piped to a number of locations throughout the food plant.
- VAPORMATE is vaporised as a hot gas and dispensed using aeration fans in grain storages (product is dispensed during one air change).
- VAPORMATE is vaporised as a hot gas and dispensed using novel mixing devices based on pressure equalisation or venturi principles to dilute the hot gaseous mixture with atmospheric air to optimise use.

Successful Fumigation of Quarantine Insects in Export Bananas:

BOC recently conducted trials in the Philippines to test the effectiveness of VAPORMATE controlling pests such as mites and mealybugs in bananas and pineapples. The trials were conducted in conjunction with DOLE Food Company, Inc., one of the world's leading producers of fresh fruits and vegetables.

Novel technique used a blend of warm gaseous VAPORMATE & Air treating bananas in evacuated plastic bags and achieving efficacy while avoiding phytotoxicity.

Disinfesting Food Processing Equipment:

The cleaning of the intricate internals of food storage & processing equipment is not always perfect and pockets of food dust are frequently left behind. This residual food is an attractive breeding place for stored product insects. Pest Control of internal spaces is difficult as treatment with conventional liquid pesticides is not acceptable because of high pesticide residuals levels in food dusts or on the internal surfaces. VAPORMATE having no residue issues makes possible the disinfestation of enclosed food equipment spaces. Successful trials were conducted at SUNRICE Rice Mill, Deniliquin & Arnott's Biscuit Plant, Huntingwood. VAPORMATE was sprayed in the processing equipment for the calculated time and the resultant "fog" quickly permeated the spaces being propelled by the high cylinder pressure [50 bar].

Proposed new VAPORMATE label rates:

Insect tested by Haritos et al. (2004) included highly phosphine resistant field strain of the grain borer, *Rhyzopertha dominica*; laboratory strains of the flour beetle, *Tribolium castaneum* and the rice weevil, *Sitophilus oryzae*. A single dose of 450 g/m³ is sufficient to obtain high level control (> 99%) of all stage of *T. castaneum* and *R. dominica* when the grain is held for 24 hours and moderate control (86%) of *S. oryzae*. In the presence of light infestation of *S. oryzae* the lower rate of application would be sufficient to greatly reduce the insect load in the grain.

Field trial by Haritos et al (2006) showed VAPORMATE is a fast and safe treatment for stored grain. From this work the following recommendations were made:

Complete control of all stages of lesser grain borer [*Rhyzopertha dominica*], flour beetle [*Tribolium castaneum*], Psocids - table will include storage moths [*Esphestia spp.*, *Plodia spp.*] *Trogoderma variable*, *Orysoeophilus spp.*, *Collosobruchus spp.*, *Bructus pisorum*: in cereal grain and oilseeds:

Dose: 660g/m³ held for 4hours or 420g/m³ held for 24 hours.

Complete control of all stages of Rice weevil (*Sitophilus oryzae*) in cereal grains and oilseeds:

Dose: 940g/m³ held for 72 hours."

Effect on Barley Germination

VAPORMATE is seen as an ideal fumigant for malt & malting barley. Barley germination test were conducted at 5x the maximum label dose to determine any germination issues. The preliminary results suggest VAPORMATE is suitable on malting barley as reported by Ralph Nischwitz (2006) "Although the control results produced better germination after 72 hours of testing the results do not appear to indicate a significant difference in germination energy"

Keywords:

Gaseous fumigant; methyl bromide alternative; fresh produce pests; stored product pests; pest-free & residue-free grain; malting barley; commodity fumigation.