The residual carbamate insecticide for vector control

**Ficam® VC**

Ficam® VC, a WP80% formulation based on bendiocarb, is the unique tool in Insecticide Resistance Management (IRM).

- Ficam® VC can be used in Resistance Management strategies since bendiocarb shows no cross-resistance to other insecticides in field populations of malaria vectors.
- Ficam® VC is highly effective against mosquitoes with excellent residual efficacy on wall materials.
- Ficam® VC is highly acceptable to householders since it is odorless and non-staining.
- Ficam® VC causes minimal sprayer nozzle erosion and does not corrode or damage spray equipment.
- Bendiocarb is rapidly metabolized, excreted from the body and it is not persistent in the environment.
- Bendiocarb is fully documented by the World Health Organization, WHO (WHO/SIF/41.R2).
Ficam® VC

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WHO Policies against development of Resistance

Among the Policies for Protection against the development of Resistance, WHO recently recommended to rotate the different insecticides used, either changing insecticide when resistance is detected or implement a pre-planned rotation scheme. (Nejera J.A., Zaim M., 2001)

Ficam® VC as the Resistance Management Tool

The value of Resistance Management has been studied in Mexico through a joint collaboration of School of Biosciences, University of Wales, Cardiff, the Liverpool School of Tropical Medicine and the Centro D’Investigacion de Paludismo, Tapachula, Chiapas and Mexico. This study has been funded by the Insecticide Resistance Action Committee (IRAC) of CropLife International. This is the first and only study to determine whether the development of insecticide resistance in malaria vectors can be delayed and whether existing levels of resistance in vector species decreases with different strategies.

Insecticides of different classes, pyrethroid, organophosphate and carbamate, were used in rotation.

Results over a three-year period show that resistance develops more rapidly with continuous insecticide use but, when unrelated insecticides were used in rotation, resistance to the compound previously used reverts after the next insecticide came into use. Resistance levels decreasing after 3 years use.

Bendiocarb, the active ingredient of Ficam® VC, as a carbamate, is the ideal insecticide to use in rotational resistance management programs with a pyrethroid for example, such as K-Othrine® or Softac®. It has similar residual efficacy to pyrethroids but unlike other non-pyrethroids, is well accepted by householders because it is odorless and non-staining.

Since much resistance in vector species occurs through the use of insecticides in agriculture, bendiocarb has the unique advantage of not being used in agriculture and is registered as a public health insecticide only.

WHOPES evaluated

This product has been successfully evaluated by the World Health Organization (WHO) Pesticide Evaluation Scheme (WHOPES) for Indoor Residual Spraying for Malaria Vector control.

This product is manufactured in accordance with the WHO specifications WHO/SIP/41_R2.

Mode of Action to the nervous system

The main resistance mechanisms are targeting the stimulus transmission at the nerve. Carbamates are inhibiting the enzyme Acetylcholine Esterase at the synapses level, while Pyrethroids and DDT are impacting different or the same enzymes at the Sodium Channel along the nerve axis. Therefore, Pyrethroids and DDT can be cross-resistant, but not Pyrethroids and/or DDT with Carbamates, such as Bendiocarb.
Selective application of Ficam® VC in the Philippines and in Mexico

In the Philippines, Ficam® VC reduced the rate of mosquito, An. flavirostris landing on man indoor, for at least 6 months after application. Mosquito longevity was similarly reduced and there was a dramatic fall in the number of malaria cases.

An. flavirostris rests predominantly on walls less than 2.1 m above the floor and treatment only of these areas, together with areas around windows, resulted in a level of control equivalent to total coverage.

In Mexico, An. albimanus rests preferentially on walls between 0.7 m and 1.75 m from the floor and on the lower area of roofs. Application of Ficam® VC only to these areas gave control equivalent to total coverage and costs were reduced by 67%.

Studies in both countries confirmed that selective application of Ficam® VC gives considerable benefits in terms of quantity of insecticide used number of houses sprayed per man per day.

Impact of Bendiocarb against resistant malaria vector in India

Ficam® VC spray was carried out in the District of Ghaziabad, with the dose rate of 200 and 400 mg a.i./m² during the years 1999, 2000 and 2001. The spraying resulted in considerable reduction in malaria vector density of Anopheles culicifacies (resistant to DDT and HCH), MRC, New Delhi.

Insecticide Resistance Management - Mexico IRAC Trial

A 3 year evaluation of rotation spraying of insecticides, as resistance strategy, was completed. When unrelated insecticides were used in rotation, resistance to the compound previously used reverted after the next insecticide came into use (Américo D. Rodríguez, Patricia Penilla, Janet Hemingway, et al.).

Impact of Bendiocarb against resistant malaria vector in India

Bendiocarb 80% WP spraying was carried out in Orissa, Malkangiri district, at 200 mg a.i./m² in 23 villages, and at 400 mg a.i./m² in 23 villages. Malaria incidence showed a decline of 30% and 35% in both areas. VCRC, Pundicherry 2002.

% Reduction in the relative abundance of malaria vectors after each round of Bendiocarb spray

<table>
<thead>
<tr>
<th>Rounds of spray</th>
<th>0.2 g (a.i.)/m²</th>
<th>0.4 g (a.i.)/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>30.3</td>
<td>57.0</td>
</tr>
<tr>
<td>Second</td>
<td>89.0</td>
<td>80.7</td>
</tr>
<tr>
<td>Third</td>
<td>76.8</td>
<td>82.3</td>
</tr>
<tr>
<td>Fourth</td>
<td>87.1</td>
<td>89.8</td>
</tr>
<tr>
<td>Fifth</td>
<td>74.0</td>
<td>82.6</td>
</tr>
<tr>
<td>Overall</td>
<td>79.3</td>
<td>82.6</td>
</tr>
</tbody>
</table>

Instructions for use

- Read product label carefully before using Ficam® VC.
- Effective training is key to successful malaria control with residual insecticides. The general principles of organising house spraying programmes, and particularly the training of spray operators, are described by WHO/CDS/HOPS/GCDPD/2000.3.
- Bayer Environmental Science Technical staff are available to advise and assist with training programmes.
Safety Precautions

- Wear clean protective clothing (face mask, gloves, overalls, hat and shoes).
- If contaminated remove and wash affected clothing.
- Wash contaminated skin thoroughly with soap and water.
- Wash with soap and water after preparing each pump charge, before eating, drinking or smoking and at the end of work each day.
- Do not work in spray mist.
- Keep product out of reach of children and animals.
- Keep product away from human and animal foodstuffs and food and water containers.
- Toxic to fish, do not contaminate waterways.
- Report any feeling of sickness to supervisor immediately.
- Pets, with a special attention for ducks and ducklings, should preferably be caged/penned to prevent them coming accidentally into contact with spray.
- Avoid secondary poisoning by collecting all dead insects after treatment and dispose of safely.

Spraying Practice

- Compression sprayers to WHO specification should be used, fitted with No. 8002 nozzles checked to discharge 760 ml spray per minute.
- Spray tip should be maintained 45 cm from the surface, to give a spray swath 65-70 cm wide.
- An area of 19 m² should be covered in 1 minute, giving a target application rate of 25 m² per litre.
- Ensure that spray machine is working properly and is not leaking.
- Ensure that houses are properly prepared for spraying, i.e. that foodstuffs and cooking utensils etc. are removed.
- Ensure that occupants are outside during spraying and do not re-enter until spray deposit is dry.
- Do not spray rooms with sick or bed-ridden occupants.
- Dispose of empty containers and dead insects by burning or burying.

Recommendations for use of Ficam® VC

<table>
<thead>
<tr>
<th>Target</th>
<th>Sites of Application</th>
<th>Dilution Rate</th>
<th>Application Rate</th>
<th>Nominal deposit level of active ingredient (mg/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mosquitoes and crawling insects</td>
<td>Surfaces (e.g. wood, concrete, mud)</td>
<td>1 x 125 g sachet</td>
<td>1 litre of diluted insecticide per 25 m²</td>
<td>400 mg a.i./m²</td>
</tr>
</tbody>
</table>

First Aid

- If Ficam® VC is swallowed, induce vomiting unless the patient is unconscious.
- If eye contamination occurs, wash thoroughly with water.
- Keep patient at rest and obtain medical attention without delay.

Advice for Medical Practitioners

- Ficam® VC contains anti-cholinesterase carbamate insecticide.
- Treat symptomatically.
- Atropine sulphate is the recommended antidote with adult dose of 2 mg preferably by intravenous injection (intramuscular injection being also possible). Depending on the symptoms, keep administrating injections of Atropine every 15 mm. Watch for symptoms of over dosage: dilated pupils, tachycardia, reddening of the face and dry mouth.
- Do not use Pralidoxime or any other oximes.
- Diazepam may be useful to control convulsions.

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