



Aqua-K-Othrine®

**Leading water-based
space-spray technology
for the control of
mosquitoes and flies**



Aqua-K-Othrine® - the logical choice for space-spray application

- Contains synthetic pyrethroid (2% deltamethrin) in a unique EW formulation
- Primarily based on water with built-in FFAST anti-evaporant technology
- Low environmental impact and high level of safety in use
- Highly effective against flying insects such as mosquitoes and flies
- Very low rates of application
- Biodegradable – no environmental accumulation
- Dilutes with water
- Non-flammable
- Fully WHOPES evaluated and recommended for use as a space spray (For specific details refer: http://whqlibdoc.who.int/hq/2006/WHO_CDS_NTD_WHOPEs_2006.2_eng.pdf)



The importance of space-spray application:

There are a number of methods available to control insects of public health importance and each has its own part to play in an integrated management program. Space-spraying is particularly effective against flying insects (mainly mosquitoes and flies) and is usually the method of choice when a mosquito-borne disease threat is imminent and rapid reduction in insect numbers is required. It can also be a method which is relied upon when resources are limited and other methods are either not practical or have not achieved adequate results.

Space-spraying is routinely carried out in many areas of the world as a crucial means to reduce the incidence of vector borne diseases such as dengue and as an important element in fly management programs.

How does space-spraying work?



Space-spraying relies on the production of a very large number of small insecticidal droplets which are intended to be suspended in the air for a period of time. When these droplets impact on the target insect they deliver a lethal dose of insecticide. There is no residual activity to be expected.



The traditional methods for space-spraying include thermal fogging; whereby a dense cloud of oil-based insecticide droplets is produced (giving the appearance of a thick fog) and Ultra Low Volume (ULV), whereby droplets are produced by a cold mechanical aerosol-generating machine.

Although in essence a very simple technique, space-spraying is built upon some elegant scientific principles. These principles need to be understood in order to maximise the effectiveness of any given product:

- Target insects are usually flying through the spray cloud (or sometimes impacted whilst resting on exposed surfaces). The efficiency of contact between the spray droplets and target insects is therefore crucial.
- This is achieved by ensuring that spray droplets remain airborne for the optimum period of time and that they contain the right dose of insecticide. These two issues are largely addressed through optimising droplet size.
- If droplets are too big they drop to the ground too quickly and don't penetrate vegetation or other obstacles encountered during application (limiting the effective area of application). If one of these big droplets impacts an individual insect then it is also 'overkill' since a high dose will be delivered per individual insect.
- If droplets are too small then they may either not deposit on a target insect (no impaction) due to aerodynamics or they can be carried upwards into the atmosphere by convection currents.
- The optimum size of droplets for space-spray application are droplets with a Volume Median Diameter (VMD) of 10 – 25 microns.



The influence of droplet size can be illustrated in the table below:

Droplet size	10 microns	20 microns	100 microns	200 microns
Time to fall 5 m in still air	34.7 minutes	8.7 minutes	20.8 seconds	5.2 seconds
Number of droplets obtained from 1 mL of diluted spray	1910 million	239 million	1.91 million	0.24 million

Bayer has a long history of industry-leading expertise in space-spraying and is able to offer products such as Aqua-K-Othrine with unique FFAST technology which help to achieve optimum droplet size during application.

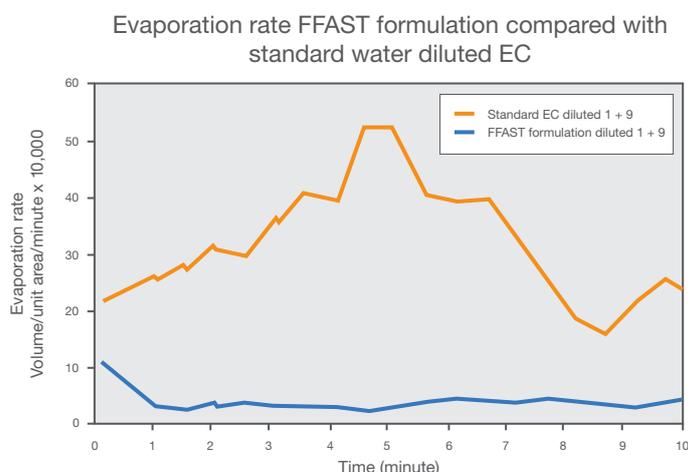
The Aqua-K-Othrine advantage - FFAST

Aqua-K-Othrine represents the latest development in formulation technology for space-spray use in Australia. It is intended for dilution in water but is novel in that it is also primarily water-based, with a greatly reduced hydrocarbon solvent content. Since many solvents are potential environmental pollutants themselves, this provides an improved environmental profile. The table below illustrates the solvent contents of some commonly available space-spray products.

Product	Hydrocarbon solvent content
Other typical competitor (EC) formulations	689 g/L to 760 g/L
Reslin®	370 g/L
Aqua-K-Othrine	250 g/L

Aqua-K-Othrine is an emulsion in water (EW) formulation which in addition contains an anti-evaporant to protect the water-based spray droplets from evaporative water loss. This anti-evaporant technology is referred to as FFAST (or Film Forming Aqueous Spray Technology).

As the spray droplets are formed, the anti-evaporant agent comes out of the solution and forms a protective skin around the droplets. This process (which is completed in less than a second) ensures that the droplets maintain their size and therefore impaction efficiency for much longer than water-diluted emulsifiable concentrates (or even standard EW formulations). They are comparable in efficacy to the oil-based and oil-diluted products, but with the added benefit of economy in use, which result from the use of water as a diluent and reduced environmental contamination compared to an oil-based spray.



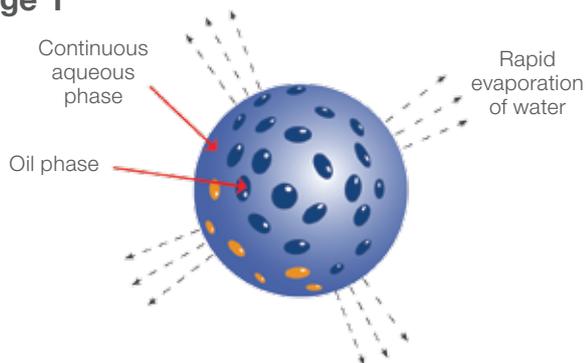
Many hydrocarbon solvents are now regarded as potential or probable carcinogens so any reduction of their use in public areas is also a desirable goal.

A comparison between different types of products is illustrated in the table below:

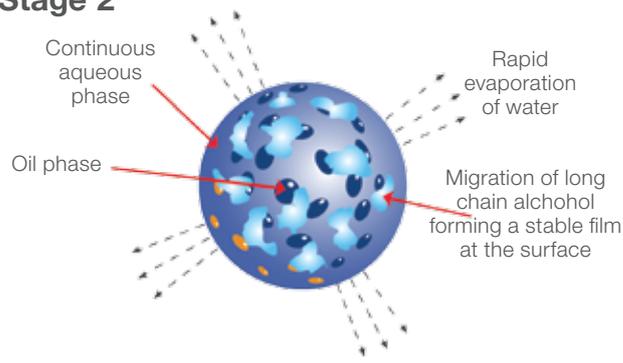
Product type	Formulation solvent content	Reliance on hydrocarbon solvents	Evaporation rate from spray droplets	Flammability (of formulation)	Environmental profile
Oil-based and oil-diluted	High	Highest	Slow	High	Worst
Oil-based and water-diluted	High	Medium	High	High	Middle
Aqua-K-Othrine with FFAST	Low	Lowest	Slow	Low	Best

The stages in formation of a FFAST droplet are illustrated in the diagrams below.

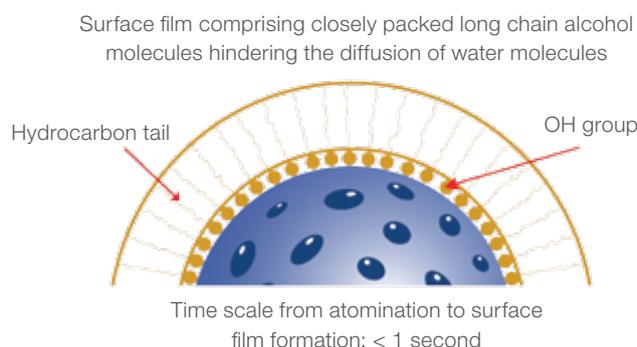
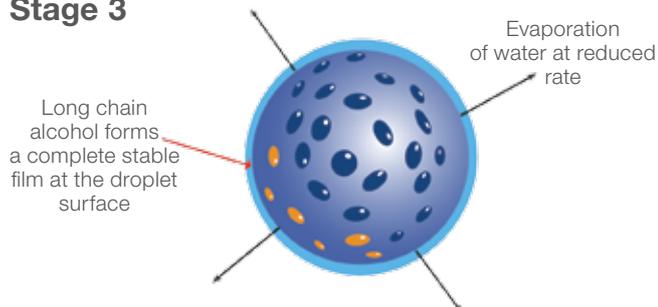
Stage 1



Stage 2



Stage 3



Equipment Flexibility

Aqua-K-Othrine can be applied by means of appropriate specialist equipment capable of producing and distributing droplets of a volume mean diameter (VMD) value below 50 µm (optimum droplet size 10 - 25 µm). This equipment may be thermal fogging equipment, cold aerosol generating ULV equipment and hand-held or knapsack sprayers which are designed for space-spraying.

Motorised knapsack/backpack sprayers or mist blowers produce a mist with a droplet size spectrum of 0 to 200 µm with Volume Median Diameters greater than 50 µm. These larger droplets are less efficient for flying insect control.

It has primarily been designed for ULV application, it is also ideal for use through thermal foggers. Worldwide use has demonstrated a high level of efficacy through both types of application.

Note that generally speaking, due to the lower viscosity of water-based and water-diluted formulations, smaller nozzle sizes should be adopted, otherwise droplet sizes may be too large and this can lead to precipitation (or 'spitting') from the application equipment.

Summary of label directions

The directions for use and associated general instructions which appear on the label are included below:

Situation	Pest	Rate	Critical comments
Outdoor and indoor situations where flies and/or mosquitoes are a problem (including but not limited to abattoirs, refuse tips, picnic areas, sports grounds, recreation areas, factories, industrial buildings, domestic residences and areas associated with animal production).	Adult flies and mosquitoes	Outdoors 50 mL/ha Indoors 2.5 mL/1000 m ³	Dilute with a suitable volume of water (further details provided in the next table) and apply using equipment capable of generating a mist or thermal or cold fog. Avoid application outdoors if wind speed is in excess of 10 km/h as spray will be dispersed too quickly.

Application method	Situation	Dilution rate	Application rate of dilution
ULV (Cold fogging)	Indoors	1 – 2 mL + 50 mL water	50 mL/1000 m ³
	Outdoors	50 mL + 450 mL water	500 mL/ha
Thermal Fogging	Indoors	1 – 2 mL/500 mL water	100 – 200 mL/house or 500 mL/1000 m ³
	Outdoors	50 mL + 4950 mL water	5 L / Ha

Biological activity

Aqua-K-Othrine is currently registered and in use in more than 25 countries around the world. It has been fully assessed under the World Health Organisation Pesticides Evaluation Scheme (WHOPES) and is recommended for use as a mosquito space spray. (The WHOPES evaluation process assesses human health and environmental risk as well as biological efficacy).

A summary of results from a trial carried out in 2005 (Penang, Malaysia) after outdoor ULV application is provided in the table below. The product was applied at label rate (dilution of 1:9 in water). Caged adult mosquitoes of three species were assessed for knockdown and mortality at distances of 50 m and 100 m from point of application.

Mosquito species	Check point distance	Knock-down % at time intervals (minutes) post-application					Mortality (24 hours)
		10	20	30	40	50	
<i>Aedes aegypti</i>	50 m	3.3	45	96.7	96.7	96.7	96.7
	100 m	13.3	35	61.7	76.7	83.3	85
<i>Aedes albopictus</i>	50 m	1.7	25	86.7	88.3	93.3	96.7
	100 m	16.7	35	41.7	66.7	76.7	71.7
<i>Culex quinquefasciatus</i>	50 m	6.7	41.7	98.3	98.3	100	86.7
	100 m	8.3	23.3	46.7	73.3	75	65

NOTE: Knockdown/mortality for the control of mosquitoes was less than 10%.

Results from a similar trial against *Aedes aegypti* only in the Philippines (Bayer Internal report) are provided below. This illustrates knockdown and adult mortality as assessed at various distances and time points after application.

Check point distance	Knock-down % at time intervals (minutes) post-application					Mortality (24 hours)
	10	20	30	40	60	
10 m	100	100	100	100	100	100
25 m	100	100	100	100	100	100
50 m	98.3	100	98.3	100	100	100
75 m	100	100	100	100	100	100
100 m	96.6	100	100	100	100	100

Product Safety

With extremely low rates of use (the lowest application rate of any other space-spray in Australia), Aqua-K-Othrine has a very high level of safety. The active ingredient, deltamethrin, has a very good safety profile which is reinforced by the range of use patterns which it is approved for globally. In the field of mosquito management it is also used for impregnation of mosquito bednets and indoor residual spraying. For fly control it is approved for use as a topical treatment to livestock. The technical knowledge which Bayer has on deltamethrin is second to none and the full WHOPEs evaluation and recommendation for use of Aqua-K-Othrine is an additional re-assurance of the level of safety associated with the product.

Environmental Profile

The application of Aqua-K-Othrine according to the registered label results in no long term environmental contamination. Generally speaking, space-spray applications result in minimal deposition on surfaces; the same applies for Aqua-K-Othrine. Add to this the very low application rate and this results in no potential for bioaccumulation. The active ingredient in any spray droplets which do impact onto a surface is rapidly degraded at the very low rates applied.

Environmental Risk Assessments are extremely favourable when used according to the registered label.

Insecticide Resistance Management

The use of space sprays can be generally regarded as having little contribution to the generation of insecticide resistance development. Usually space-spray adulticides are only applied in situations where there is an immediate disease threat.

As such, an insect population is only exposed to the selection pressure over a very short space of time. Since there are no residual deposits, the selection pressure does not remain after application has ended. It would also be highly unusual for a space-spray to result in exposure to an entire population of mosquitoes or flies and as such there are always susceptible individuals that help to ensure dilution of the gene pool.

The dose of insecticide received by a target insect within a properly applied space-spray is also reasonably fixed, with very little potential for sub-lethal doses which might otherwise help to select out resistant genes. (This is in contrast to residual surface treatments over wide areas which provide an ongoing selection mechanism over a range of different dose exposures).



Summary

Aqua-K-Othrine is a unique formulation which, through the benefit of FFAST, can result in optimum droplet sizes being maintained for longer periods of time in all climatic conditions and is as effective as oil/diesel diluted space-spray concentrates. Aqua-K-Othrine is an easy-to-use, user-friendly concentrate producing a space-spray that minimises flammability, smell, staining, paintwork damage, toxicological risk and pollution.

Bayer Environmental Science is committed to sustainable development

Aqua-K-Othrine presents an opportunity to reduce the reliance on hydrocarbon solvents (traditionally a significant proportion of formulations and diluents) and thus the potential for environmental contamination. Aqua-K-Othrine has one of the lowest application rates of any mosquito adulticide currently available and this enables more compact packaging to be utilised which reduces packaging waste. This information sheet is printed on 100% recycled paper using a waterless printing process.



Aqua-K-Othrine® - the logical choice for space-spray application



ALWAYS READ AND FOLLOW THE REGISTERED PRODUCT LABEL PRIOR TO USE.

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