



SUMITOMO CHEMICAL

Olyset[®] Net

GUARANTEED
5
YEARS



Technical Information

Olyset[®] Net is a highly durable long-lasting mosquito bednet containing permethrin.

Extra strong netting incorporating unique slow-release insecticide technology is used to produce a long-lasting net guaranteed to perform for at least 5 years.

In the last decade, nearly 200 million Olyset Nets were distributed to protect people from malaria.



Introduction and Background

Background

Mosquito-borne disease transmission poses one of the greatest threats to the tropical world, and with the advent of global warming is an increasing concern for temperate countries. Of all the mosquito-borne diseases, malaria remains one of the greatest problems in tropical countries, adversely affecting population health and economic development. Malaria kills 1-2 million people every year, with 90% of the deaths occurring in sub-Saharan Africa. The most vulnerable sections of the population are pregnant women and children.

Malaria is both preventable and treatable. Given the cost and logistics of rapid diagnosis and treatment in many African countries, the old saying 'Prevention Is Better Than Cure' remains true. If the infected mosquito can be prevented from biting people, the cycle of disease transmission is broken. This protection can be effected in many ways, from indoor residual spraying of insecticides (IRS) to the use of aerosols and mosquito coils.

Mosquito nets are not new – they have been around for at least 100 years. What was new was the addition of insecticide to those nets: the development of insecticide-treated bednets provided a means to protect people throughout the night and at the same time kill mosquitoes.

The advent of pyrethroid insecticides made a very effective addition, offering rapid action and good kill of insects with low toxicity to people.

The first insecticide formulations marketed for treatment of nets

required manual dilution and dipping of nets. These treatments are depleted after consecutive washings and therefore only last from six months to one year before losing efficacy. The logistics of regular re-dipping of nets, especially in remote villages was so difficult that it was rarely totally successful. It soon became apparent that a long-lasting factory treatment was required so that no re-treatment of the nets would be needed during their subsequent life in the field.

Sumitomo Chemical, with over 2000 employees dedicated to research and development, is a world leader in the discovery of innovative solutions for control of insect pests affecting the health and welfare of mankind, and was the first company to develop a long lasting insecticidal net (LLINs,

Sumitomo Chemical scientists combined their expertise in insecticides and plastics technologies to develop Olyset Net

also referred to as LNs), which changed the face of malaria control programmes. This innovation allowed for nets to be distributed without the need for teams to return regularly to

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re-treat them. LLINs are designed to survive for several years in the field without further maintenance, and to perform for at least 20 washes without losing insecticidal activity.

Sumitomo's focused approach led to the development of Olyset Net—a polyethylene net with the insecticide incorporated within the fibres. Olyset Nets have many advantages over conventional approaches.

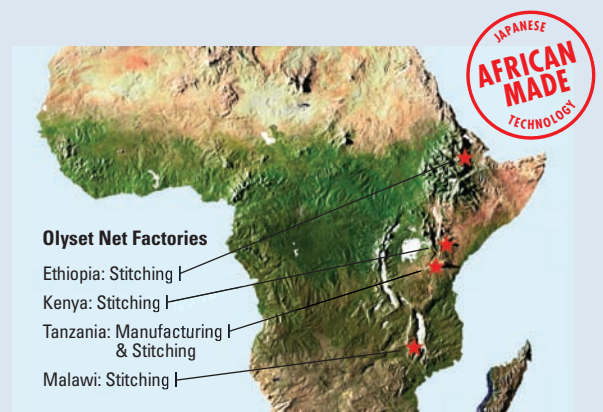
Olyset Net Key Features

- Insecticidal performance that is guaranteed for at least 5 years
- Very strong, doesn't tear easily
- Durable

Manufacturing Process



Olyset Nets start life as a 'master batch' of granules containing permethrin and polyethylene-based formulation technology. (1) This technology, by which the insecticide is included in the polyethylene, is the secret that makes Olyset Net unique. Proprietary formulation components control the rate at which permethrin is released, to ensure replenishment and maintenance of a biologically effective surface dose for at least five years. The master batch is sent to Olyset Net factories in Africa and Asia, where it is melted and extruded into fibres (2, 3, 4, 5). The fibres are subsequently knitted into rolls of net (6, 7). These rolls can then be used on site or distributed to other factories where they are cut and sewn into the final product (8, 9). Finally, they are checked for quality assurance (10).



Product Concept

Insecticide

Olyset Nets use the insecticide permethrin, which is a second-generation pyrethroid.

The choice of permethrin was made because it has a high margin of safety, exhibiting low mammalian toxicity with high activity on insects. Permethrin has decades of successful use in public health applications, including medically-approved human skin applications such as head lice lotions and shampoos.

Liquid permethrin, along with special release-control agents, is incorporated inside the raw polyethylene matrix. This is then extruded into mono-filament fibres from which the net is subsequently manufactured. The active ingredient is slowly released onto the surface of the fibre over time and the surface concentration reaches equilibrium, so when insecticide is removed from the fibre through washing, the surface concentration is replenished from the reservoir within. The surface concentration is maintained at a level sufficient to provide activity against mosquitoes.

Material

Bednets have a tough life under conditions of everyday use in rural villages, and can easily be damaged or torn. Sumitomo Chemical decided to make a very tough net which could better survive these challenging conditions.

Therefore polyethylene fibres with a thickness of greater than 150



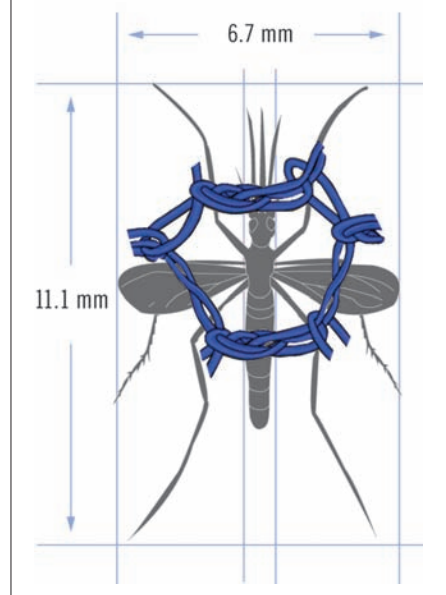
denier were selected — which is thicker and tougher than LLINs using only 75 and 100 denier polyester. This allows Olyset Nets to last longer than polyester LLINs.

If Olyset Net has a wide mesh, do mosquitoes pass through the holes?

Some people avoid sleeping under ordinary bednets because they perceive them to be hot and uncomfortable. The wider mesh of Olyset is a deliberate design feature to improve the airflow and hence comfort, thereby encouraging bednet use.

Even though Olyset has a larger than average mesh size to improve ventilation, field data have shown that penetration of the net by mosquitoes is very rare. Firstly, Olyset Net contains the insecticide permethrin, which is highly repellent to insects. As mosquitoes reach the net, they detect the perme-

Fig. 1 Size of Olyset Net compared with an *Anopheles* mosquito

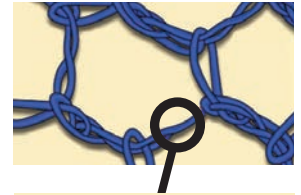
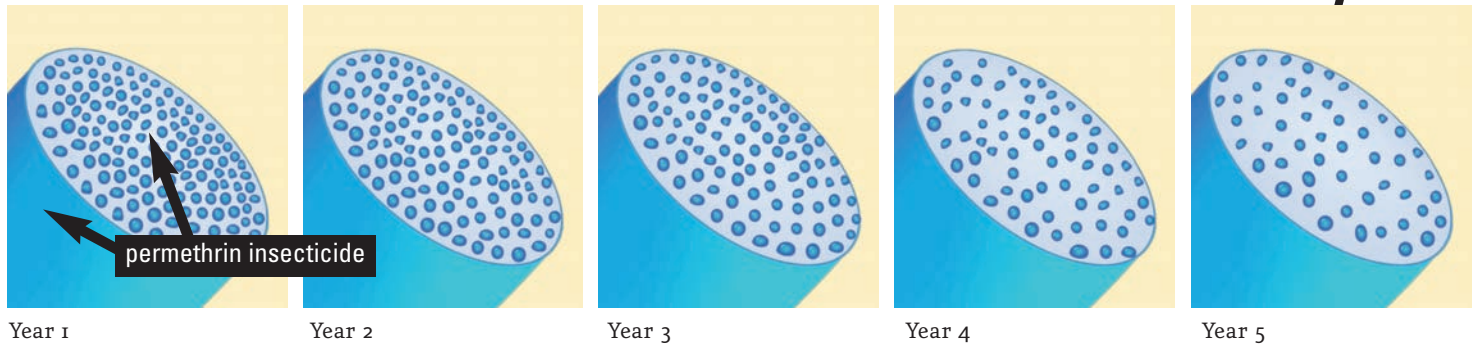


thrin and are repelled (see page 4 for modes of action). Secondly, it is impossible for mosquitoes to pass through the mesh without touching the net (Fig. 1). In doing so, they receive a lethal dose of insecticide which prevents biting and leads to rapid knockdown and kill.

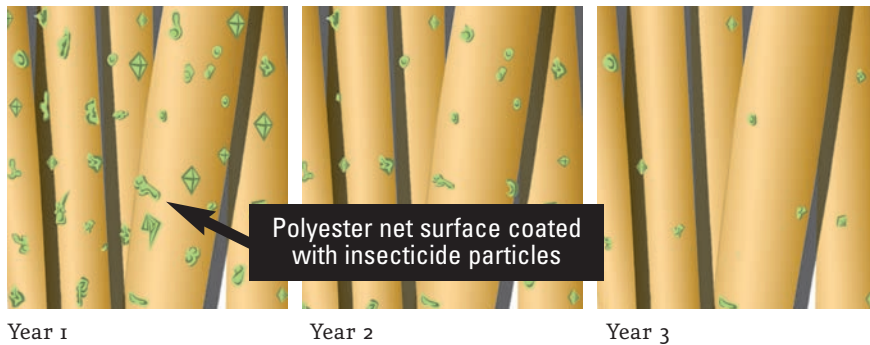
Controlled Release Technology

Net ageing 1-5 years: Olyset Net vs. Coated Polyester LLIN

Olyset Net



Coated Polyester LLIN



Above: For Olyset Net, permethrin migrates to the surface of the net over a five-year period, maintaining an effective surface concentration. This enables Sumitomo Chemical to guarantee Olyset's insecticidal performance for five years.

Left: For coated polyester LLINs, surface concentration of insecticide declines over a three-year period.

How Does Olyset Net Work?

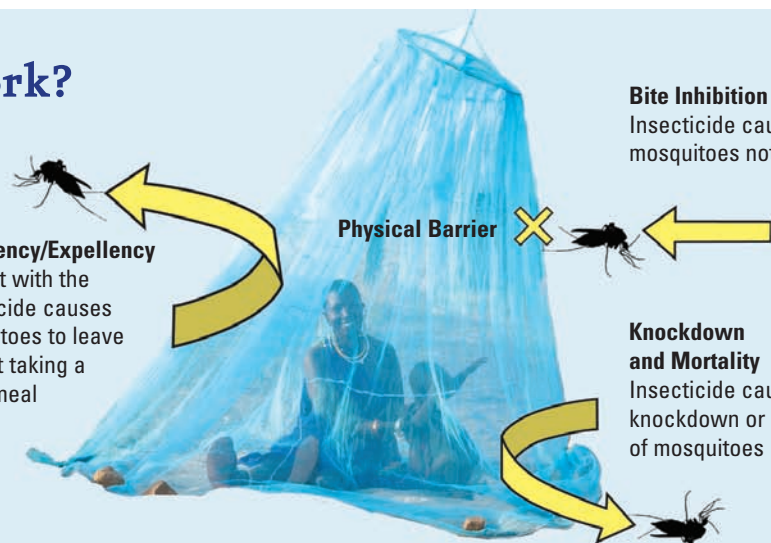
Olyset Net has a four-fold insecticidal action against mosquitoes—bite inhibition, repellency, knockdown and mortality—all of which contribute to protect people sleeping under Olyset Nets. Additionally, nets provide a substantial physical barrier.

Repellency/Expellency
Contact with the insecticide causes mosquitoes to leave without taking a blood meal

Physical Barrier X

Bite Inhibition
Insecticide causes the mosquitoes not to bite

Knockdown and Mortality
Insecticide causes knockdown or death of mosquitoes



Do the Math

Choosing an Olyset Net allows malaria campaign managers to get the most out of bednet program distribution expenditures. Because Olyset Nets are guaranteed for five years, they do not need to be replaced as frequently. An additional advantage is that using Olyset Nets means administering (and paying for) only one distribution every five years, instead of replacing polyester nets every three years.

Over the five year life of an intervention, an Olyset-based distribution program costs less. Do the calculation yourself to determine the real cost advantage of choosing Olyset Net.

The Olyset Savings

Coated Polyester LLIN

Cost per net	<input type="text"/>
+ Distribution cost per net	<input type="text"/>
Total	<input type="text"/>
÷ 3 =	<input type="text"/> (X)

Olyset Net

Cost per net	<input type="text"/>
+ Distribution cost per net	<input type="text"/>
Total	<input type="text"/>
÷ 5 =	<input type="text"/> (Y)

The Olyset Savings

(X)	-	(Y)	=	<input type="text"/>	per year
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To use the online **Olyset Savings Calculator**, please link to: www.olyset.net/calculator

Cost Efficacy

The comparative cost of Olyset Nets with IRS and even other polyester bednets is a very important consideration. When calculating costs, the price of the insecticide is only part of the picture. The cost of application, equipment required, frequency of re-application, and distribution costs must all be included to understand the whole cost. With LLINs, the cost per year is based on the number of people sleeping under the net and the life of the net in years. As Olyset Nets last at least five years, costs are very favourable over time.

Intervention/Insecticide	Programme Cost per person/year
IRS/Carbamate	\$4.80
IRS/DDT	\$2.77
IRS/Pyrethroid	\$2.16
LLIN/Polyester	\$1.00
LLIN/Olyset	\$0.68

From: WHO Global Malaria Programme Strategic Technical Advisory Group Meeting, May 2006

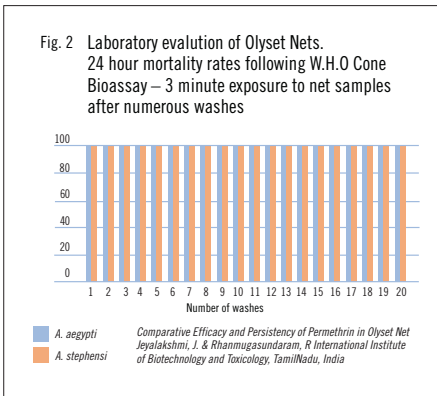
Using the data reported by C.Lengeler and published in the Cochrane Review (2007), the value in additional lives saved by Olyset Nets can also be calculated. Lengeler states that 5.5 child deaths are prevented for every 1000 children who are protected by a net for 1 year. Because an Olyset Net lasts for at least five years compared to a maximum of three years for a coated polyester LLIN, and assuming two children sleep under each net, an additional 22 lives would be saved per 1000 Olyset Nets used.



Biological Testing

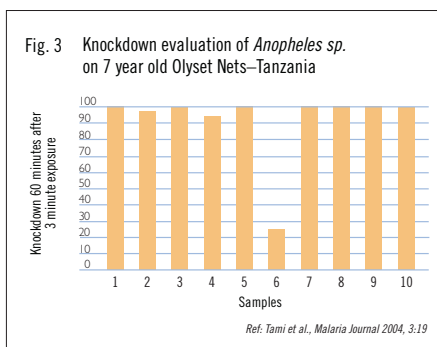
Wash Proof Tests on Olyset Nets

Olyset Nets have passed the >20 washes test required by the World Health Organization to be designated an LLIN (Fig. 2).



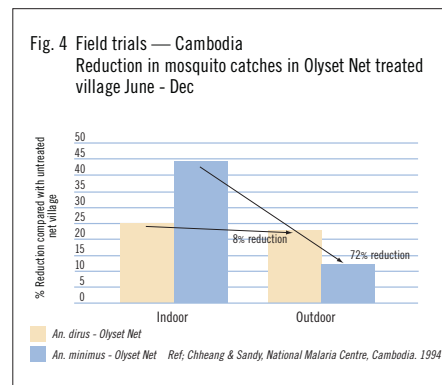
Biological Tests on Olyset Nets

Olyset Nets are guaranteed for five years, and field tests have shown that this is a conservative estimate of their effective life. In Tanzania, field trials showed that when nets from the field were tested after seven years of normal use they still contained significant levels of permethrin, and in contact tests were still effective, causing an average of 92% mosquito knockdown (Fig. 3).

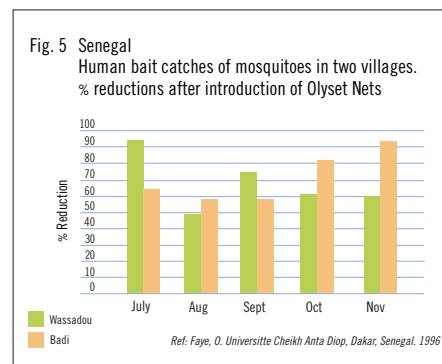


Impact of Olyset Nets on Vectors

Olyset Nets act to reduce the numbers of mosquitoes both indoors and outdoors. A field trial in a Cambodian village compared their impact on anopheline mosquitoes with a control village provided with standard untreated nets. The results presented below show the % reductions from June to December in comparison to the control village data (Fig. 4).

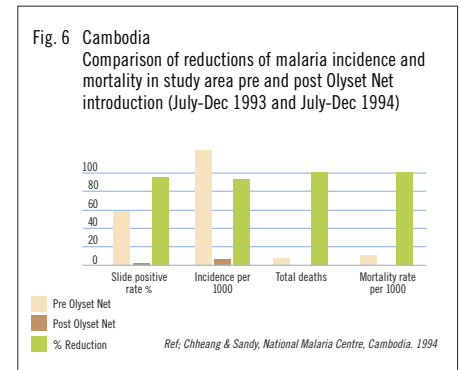


Human bait catches of mosquitoes over five months in two villages that had Olyset Nets showed dramatic reductions in the numbers of mosquitoes caught (Fig. 5).

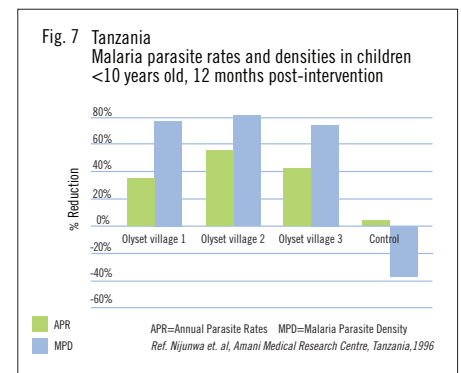


Impact of Olyset Net on disease

In the same trial in Cambodia as Fig. 6, there was a follow up on the impact on malaria Slide Positivity Rate (SPR), incidence per 1000 population and mortality comparing two similar six-month periods. There were enormous reductions in all three measures of malaria, as illustrated below (Fig. 6).



In Tanzania, a trial was conducted comparing one year pre-intervention and one year post-intervention using Olyset Nets in three villages (Fig. 7).

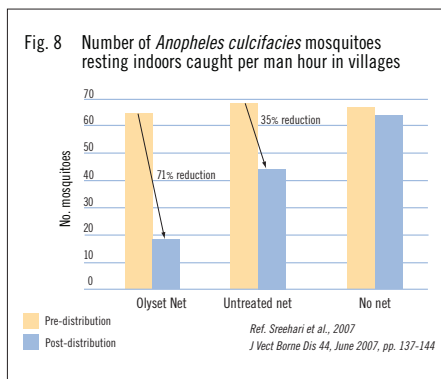


Blood samples were taken from children (aged 0-9 years) pre-intervention and at 12 months post-intervention. There were ~80% and ~40% reductions in malaria parasite rates (APR) and parasite densities (MPD)

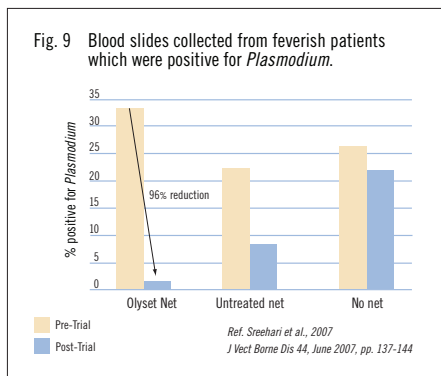
respectively, whereas in the control area there was no significant change in APR and an increase in MPD was observed.

Trials of Olyset Nets on Malaria Transmission in India

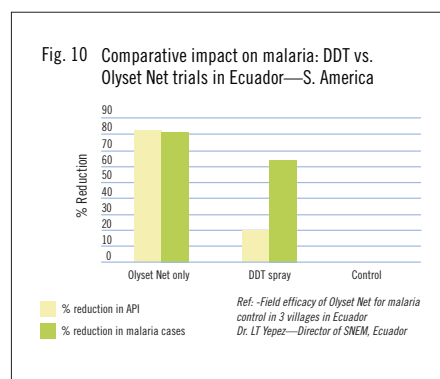
A recent trial in India showed a huge impact on the major malaria vector *An. culicifacies* with a reduction of 71% of mosquitoes found indoors compared to only 35% reduction with untreated nets and no impact without a net (Fig. 8).



The resulting impact on people in these villages is shown in Fig. 9 where there was a 96% reduction in feverish patients showing positive for malaria.



The other main intervention against malaria is indoor residual spraying (IRS). DDT is one of the recommended materials. In this trial conducted in Ecuador, Olyset Net was more effective than DDT residual spray in preventing malaria. LLINs and/or IRS may be prescribed depending upon local circumstances, including malaria prevalence. Generally, IRS programs are more costly than bednet placement because IRS requires each house to be sprayed every 6-12 months by trained spray teams, with associated logistical costs and challenges (Fig. 10).



World Health Organization Pesticide Evaluation Scheme (WHOPES)

Olyset Net was the first LLIN to be submitted to WHOPES for evaluation, and was also the first LLIN to be fully recommended, passing all four stages of the evaluation process confirming efficacy and longevity. The complete report can be read in WHO/CDS/WHOPES/2001.4. (http://whqlibdoc.who.int/hq/2001/WHO_CDS_WHOPES_2001.4.pdf). Additional information on permethrin specifications and evaluation are located at (http://www.who.int/whopes/quality/en/Permethrin_specs_eval_WHO_March_2009.pdf)

Usage and Care of Olyset Net

Nets are ready to use. Just unpack and hang over the bed, using the suspension points to attach string or cord and suspend from the roof (there is no need to air it for 24 hours before use like some other nets). Ensure the net hangs over the bed with sufficient netting hanging below the mattress or mat to tuck under at night.

The net is factory treated with insecticide and never needs re-treatment during its anticipated minimum five-year life.

Olyset Nets may be washed using soap and water to remove dirt. Gentle washing (with no bleach) is recommended to avoid damaging the net. After washing, the net should be dried in the shade before re-hanging over the bed. Once washed, Olyset Net regenerates insecticide to the surface of the fibre to replace any lost through washing.

Safety

Permethrin is a pyrethroid insecticide with low mammalian toxicity. The majority of the permethrin is contained within the fibre matrix. Sufficient insecticide is available on net surface fibres to provide for biological performance. The risks from handling the net are therefore negligible. Permethrin is virtually non-irritant, so no adverse effects should occur from contact or sleeping under the net.

Technical Specifications

Specification WHO/IS/NI/331/LN July 2006.

Category	Data
Odour	Odourless
Colour	Blue (Approximate Pantone Ref: 298), white or green
Shape	Rectangular or Conical
Dimensional Stability to washing (ISO 5077)	±10% of initial dimension (length and width)
Net attachment	Rectangular – A minimum of 6 suspension rings (one at each of the four corners of the top panel and one equidistant at each of the sides) attached by fabric loops. Conical – single suspension point
Active Ingredient	Permethrin
Active Ingredient Content	2% w/w
Impregnation Technology	Treated with Permethrin, incorporated into the polyethylene fibres during the manufacturing process
Insecticide location	Incorporated in a reservoir inside the net during manufacture
Storage Stability	In storage stability tests, net material contains >95% of the original a.i. content after 2 weeks at 54°C
Duration of Insecticide Efficacy from first use	5 years (minimum)
Fire Safety Classification 16CFR 1610	Class 1: (Textiles - acceptable for use in clothing)
Yarn	>150 denier High density polyethylene monofilament fibre
Mesh Size (holes/inch ²)	56 (minimum)
Weave Type	Raschel
Bursting Strength ISO 13938-1-1999	350 KPa (minimum)
Ease of tearing	High tear resistance
Fabrication ISO 8388	Warp Knitted
Manufacturing sites	China, Vietnam, Tanzania
Stitching Facilities	Kenya, Malawi, Ethiopia

Sizes Available (cm)

Rectangular Nets

Description	Length	Width	Height
Double	180	100	150
Family	180	130	150
Large Family/High	180/180	160/160	150/210
Extra Family/High	190/190	180/180	150/210

Conical Nets

Description	Circumference	Height	Roof (diameter)
Small	850	220	56
Medium	1050	220	56
Large	1250	250	65

For latest product information refer to www.Olyset.net

Insecticidal Content of Olyset Net

The following information refers to permethrin, the active ingredient in Olyset Net. Permethrin has been used for public health and agricultural insect control for over 30 years and has an excellent track record. Registered uses of permethrin include human skin applications for lice and mite control.

Permethrin (Ref VBC/DS/84.51)

SYNOPSIS: Permethrin is a broad spectrum, non-cumulative synthetic pyrethroid; and is a fast acting neurotoxin with good contact, limited stomach and no fumigant action. It is moderately stable in the environment and has good residual action on inert surfaces. Permethrin is non systemic in plants; of low mammalian toxicity, and is readily metabolized with immediate loss of toxicity.

Common Name: Permethrin (ISO, BSI, ANSI)

Identity:

IUPAC: 3-Phenoxybenzyl (1RS, 3RS; 1RS, 3SR)-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate

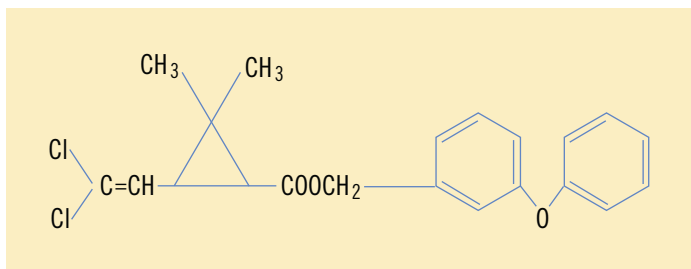
CA: (3-Phenoxyphenyl)methy 3-(2,2-dichloroethenyl)-2,2-dimethylcyclopropanecarboxylate

CAS Reg. No.: 52645-53-1

Molecular formula: C₂₁H₂₀Cl₂O₃

Molecular weight: 391.3

Structural formula:



Permethrin Content

Declared content is 20g/kg (+/-3g/kg), 2%w/w (1.7 – 2.3% limits). Cis/trans isomer ratio: 50/50 to 30/70.

Ecotoxicology

Exposure of non-target organisms to permethrin in Olyset Nets is unlikely when used in accordance with label instructions. Permethrin is toxic to fish under laboratory conditions, so contamination of fish-bearing water should be avoided. Nets should be gently washed in containers using a mild soap as necessary, and not in natural water sources such as streams, rivers, ponds and lakes.

Disposal Considerations

The net should be changed when biological performance declines. Normally this will occur after approximately five years. Disposal should conform to recommendations of International organizations and should comply with all federal, state and local regulations.

Transport Information

Hazard class: Not classified as a hazardous material

UN Number: Not applicable

Packaging

The nets are packed in sealed polypropylene bags with full instructions for usage. Bags are normally packed in bales for convenient transport. Typically 40 nets are contained in a bale.

Storage

Store in a cool, well-ventilated place away from sources of ignition and direct sunlight.

Analytical

Full analytical methodology is available in CIPAC/4503/m Permethrin (June 2006).



Find out more at:
www.Olyset.net

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