PermaNet® 2.0

Long-lasting Insecticidal Net

Fully recommended by the WHO

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The PermaNet® Concept

The World Health Organization (WHO) estimates an annual occurrence of 300-500 million cases of malaria worldwide. The toll is the highest in developing countries where at least one million people die from the disease. Young children account for most of these deaths.

Moreover, malaria is a great drain on many national economies. Many economists believe that malaria is responsible for a 'growth penalty' of up to 1.3% per year in some countries. It exacts a high social and economic toll on the affected populations causing physical incapacitation that limits school attendance and impairs work productivity. Since the disease is widely prevalent in the less developed countries, this leads to a vicious cycle of disease and poverty.

The PermaNet® technology, developed by Vestergaard Frandsen, combats malaria with the use of insecticidal bednets. This superior technology controls the slow release and migration of the WHO-approved insecticide in the yarn to the surface of the netting, resulting in long-lasting efficacy even after multiple washes.

The need for long-lasting insecticidal nets (LNs) for the prevention of vector-borne diseases arose as the majority of net owners did not re-treat their nets after the stipulated period of time, thus rendering the tool ineffective in repelling and killing mosquitoes, and subsequently increasing the risk of the user contracting malaria.

The PermaNet® technology is unique as it enables one to wash the nets without any loss in the effectiveness in killing mosquitoes and without requiring re-treatment during its specified lifetime.

PermaNet® long-lasting insecticidal nets are recommended by the WHO for the prevention and control of malaria.

Product Overview

PermaNet® 2.0 long-lasting insecticidal net...

- Is a ready-to-use bednet pre-treated with deltamethrin.
- Has a long-lasting killing effect on malaria mosquitoes, as well as other disease-transmitting susceptible vectors.
- Prevents and controls malaria as well as other vector-borne diseases.
- Is made of 100% polyester, which is the preferred material by end-users.
- Requires no re-treatment or dipping; thereby decreasing the need for repeat intervention.
- Is based on a superior technology of impregnation, where the bioavailability of active ingredient is controlled through a slow release process.
- Does not allow mosquitoes to penetrate the net due to the optimum mesh size.
- Is available in various colours, shapes and sizes to accommodate local preferences.
- Is safe to use for all, including pregnant women and young children.
- Is produced in a large-scale, professional production facility under strict quality measures.
- Is the most widely tested bednet in both the laboratory and field.

WHOPES Recommendation

PermaNet®2.0 was submitted for WHO Pesticide Evaluation Scheme (WHOPES) in 2003 and was given a full recommendation for malaria prevention and control in 2008.

PermaNet®2.0 satisfies the WHO specification 333/LN.

User Acceptability

Millions of nets are distributed every year for the prevention and control of malaria. The uptake of these nets is a critical success factor for any malaria programme to achieve its desired health impact.

Programme implementers desire a tool that is available in various colours, shapes and sizes so that user preference can be considered.

Our focus is to develop long-lasting tools that are designed to meet the needs of the end-users. Therefore, PermaNet® 2.0 bednet is made of 100 percent polyester, which is the preferred material of end users due to its soft texture. PermaNet® 2.0 is also offered in a wide assortment of shapes, sizes and colours to ensure customer satisfaction.

Available Shapes and Sizes

Shape : Circular

Sizes	Small	Medium	Large
Circumference	850 cm	1050 cm	1250 cm
Height	220 cm	220 cm	250 cm
Roof	56 cm	56 cm	65 cm
Area	13.0 m^2	17.5 m^2	22.2 m^2

Shape : Rectangular

Sizes	X-Small	Small	Medium	Large	X-Large
Width	70 cm	100 cm	130 cm	160 cm	190 cm
Length	180 cm	180 cm	180 cm	180 cm	180 cm
Height	150 cm	150 cm	150 cm	150 cm	150 cm
Area	8.76 m^2	10.20 m^2	11.64 m^2	13.08 m^2	14.52 m^2

Shape : Hammock

Sizes	Standard
Length	240 cm
Depth	65 cm
Flap	120 cm

Alternate sizes can be offered as per the specific requirements of customers.
PermaNet® bednet is also available in Dumuria fabric. Details available on request.

Available Colours

WH WHITE

DC1 DARK BLUE

LC1 YELLOW

DC2 DARK GREEN

LC2 PINK

DC3 DARK GREEN

LC3 KHAKI

DC4 GREEN
MADAGASCAR

LC4 BLUE

DC5 LIGHT BROWN

The above colours are available in all shapes and sizes. Colours shown are only indicative and may slightly vary.
WH= White; LC= Light colour; DC= Dark colour

Summary of Field Trials Focusing on Efficacy and Wash Resistance

Study Title	**Long-term field performance of a polyester-based long-lasting insecticidal mosquito net in Uganda.**
Author/ Year/ Reference	Kilian *et al* (2008). *Malaria Journal* 7: 49
Objective	To evaluate first and second generation PermaNet® to investigate if the product meets the criteria for LN field performance (Phase III) set out by the WHO Pesticide Evaluation Scheme.
Key Findings	Baseline concentration of deltamethrin was within targets for all net types. PermaNet® 2.0 retained insecticide well, with 41.5% of baseline dose in PermaNet® 2.0 after 36 months. Bioavailability with PermaNet® 2.0 remained high after 36 months, with 90.0% of PermaNet® 2.0 having a knockdown rate $\geq$ 95% or mortality rate $\geq$ 80%. Loss of insecticide on PermaNet® under field conditions was far more influenced by factors associated with handling (75.6% loss) rather than washing (24.4% loss).
Conclusions	PermaNet® 2.0 showed excellent results after three years of field use and fulfilled the WHOPES criteria for long-lasting nets. The high presence of polyester nets even after 5 years showed good retention and long-term utilization.

Study Title	**Personal protection of long-lasting insecticide-treated nets in areas of *An. gambiae s.s* resistance to pyrethroids.**
Author/ Year/ Reference	Dabire *et al* (2006). *Malaria Journal* 5: 12
Objective	To compare wide (Olyset®) and small (Permanet®) mesh LNs in field conditions, using entomological parameters.
Key Findings	The efficacy of the two LNs were comparable, killing significantly more mosquitoes and significantly reducing the blood feeding rate compared to control houses. The results also showed that the LNs provided a fairly strong deterrent effect, which enhanced their prevention capacity. The proportion of dead mosquitoes collected above the net was significantly higher on PermaNet® than on Olyset® (37.1% vs 17.9% respectively); 15.6% of dead mosquitoes were recorded inside Olyset® while no mosquitoes were found inside PermaNet®. Of the 21 mosquitoes collected inside Olyset®, 15 were analyzed; 3 had fed on humans and 12 had fed on cattle. It is likely that the human-fed mosquitoes had managed to cross the mesh and feed on the humans inside the net.
Conclusions	In this area of South Western Burkina Faso, where there was moderate *kdr* resistance present, PermaNet® and Olyset® showed a similar level of efficacy over the two month study period, with a significant level of mortality observed with both LNs compared to the control.

Study Title	**Evaluation of long-lasting insecticidal nets after 2 years of household use.**
Author/ Year/ Reference	Lindblade *et al* (2005). *Tropical Medicine & International Health*, 11: 1141-1150
Objective	To compare time to net failure of conventionally treated polyester bednets with two LNs (Olyset®; PermaNet®) and two candidate LNs (Insector, Athanor, France; and Dawa®, Siamdutch Mosquito Netting Co., Thailand).
Key Findings	Baseline mortality rates did not differ by net type but mortality throughout the study was highest for PermaNet® 1.0 (>70% in all surveys) and lowest for Insector (<50% in all surveys after baseline). Only 10.8% of households reported any possible side effects during the first 3 months, with no difference by net type. After 2 years of normal household use, 82% of PermaNet®, 41% of Dawa®, 36% of permethrin-cyclodextrin treated nets, 20% of Olyset®, 14% of conventional nets and 0% of Insector remained effective. The risk of failure compared to conventional nets was lowest for PermaNet® 1.0, highest for Insector, and equal for all other nets tested.
Conclusions	PermaNet® showed significantly better insecticide bioavailability than a conventional net, and performed the best out of all the nets tested. PermaNet® should be recommended to malaria control programs.

Study Title	**Efficacy of PermaNet® 2.0 against *Anopheles culicifacies* and *Anopheles stephensi,* malaria vectors in India.**
Author/ Year/ Reference	Sreehari *et al* (2007). J *Am Mosq Control Assoc* 23(2): 220-3.
Objective	To evaluate the efficacy of PermaNet® against two major malaria vectors in India, India- *Anopheles culicifacies Giles* and *An. stephensi Liston* in both the laboratory and field.
Key Findings	Impact of washing on the efficacy of PermaNet® was tested after each wash up to 20 washes; the washed nets were dried under sunlight for 5-6 h during daytime, which is a general practice in India. After 20 washes, mortality in both *An. culicifacies* and *An. stephensi* remained high (>80%). Furthermore, there was no significant difference between the mortalities of the 2 species ($P > 0.05$). PermaNet®s were distributed in Nawada village, and untreated nets were distributed in Durgawali village. Harampur village was left as a control village where nets were not used. After the distribution of nets, the densities reduced gradually in the PermaNet® village, as measured in person-hours using a fortnightly collection of indoor resting mosquitoes. Although there was also a reduction in the village using untreated nets, the impact was less pronounced than that observed in the PermaNet® village.
Conclusions	The results of the study showed high efficacy of PermaNet® 2.0 even after 20 washes in the laboratory and after several months under field conditions.

Bioassay laboratory

Quality Control

Vestergaard Frandsen maintains quality control standards necessary to meet WHOPES specifications. We are the only LN manufacturer with our own internal bioassay laboratory complying with WHO protocol. This ensures real time monitoring of quality. The bioassay lab, which is located in Vietnam, raises its own mosquitoes and performs cone and tunnel tests in order to test the knock-down effect of PermaNet®.

The chemical laboratories in Vietnam and Thailand measure the chemical dosage on the net, while the textile laboratories in Vietnam and Thailand focus on the intricate details such as width, mesh and weight control, bursting strength of the netting material and dimensional stability in washing and drying.

Chemical laboratory

Certificate of Quality

Each shipment of PermaNet® 2.0 is accompanied with a Certificate of Quality (COQ).

COQ summarises Quality Control testing data, including physical properties, chemical properties, dimension check, visual check, marking and packing for every batch or shipment. It is sent to the customer for their information.

A sample of the COQ can be seen on www.permanet.com/COQ.htm

Textile laboratory

Member of ILAC/ APLAC MRA

VILAS 393

Quality Control at Every Stage of Production

- ☐ Deltamethrin purity and QC test
- ☐ Yarn property testing
- ☐ Accessories check

Yarn Incoming

- ☐ Workshop floor supervision
- ☐ Defect count and marching
- ☐ Defect classification

Warping/Knitting

Production supervision in warping workshop

- ☐ Workshop floor supervision
- ☐ Colour shade match test
- ☐ Colour fastness to washing
- ☐ Azo-free dyed stuff confirmation

Dyeing (if any)

Quality check of just-dyed coloured nets

- ☐ Workshop floor supervision
- ☐ Physical property test (width, weight, dimension stability, bursting strength and mesh count)

Heat Setting

Bursting strength for netting physical property control

- ☐ Workshop floor supervision
- ☐ Active ingredient content (every lot of c.a. 1 ton)
- ☐ Wash resistance as per WHOPES 1

Impregnation

HPLC for deltamethrin content quality control

- ☐ In line cut and sew inspection
- ☐ Visual inspection of finished net before packing

Cutting/Sewing/ Packing

Visual inspection of PermaNet®

- ☐ Internal quality verification
- ☐ External inspection (SGS, ITS)

Finishing Process

Bale size verification of PermaNet®

Certificate of Quality

Service Package

After a certain period of use, your PermaNet® may be tested at the Vestergaard Frandsen Hanoi laboratories to ascertain a full sample history:

- Chemical analysis as per SOP.C.01
- Bioassay as per SOP.B.02
- Bursting strength as per SOP.T.02

In addition, we have the possibility to evaluate whether the loss of deltamethrin in the field is caused by normal use or by extreme conditions, which is primarily sunlight. If PermaNet® is exposed to extreme conditions, deltamethrin is not removed but is instead decomposed. The decomposed insecticide can be detected.

This analysis is offered as a service and for this we need to receive complete nets with the original labels showing a legible production code. The results of the analysis will be available within three weeks from the date of submission of the net to the nearest Vestergaard Frandsen office or laboratory.

Since the lifetime of PermaNet® largely depends on usage, the analysis will enable the national malaria programme or implementing partner in the field to more accurately estimate when to start a new procurement round of new long-lasting nets.

Vestergaard Frandsen does not stand liable for differences in the lifetime of PermaNet® 2.0 between laboratory and field use, due to potentially harsh washing conditions, exposure to UV rays, soiling etc. under field conditions.

Flexibility

The global focus on the fight against malaria has never been greater. Considerable resources are being mobilised and the demand for preventive tools is on the rise.

With Vestergaard Frandsen's current monthly production exceeding five million long-lasting insecticidal nets (LNs) and with our existing substantial infrastructure in the realms of sales, marketing, and product development, we have the capacity to scale up further if and when it is needed. With our reputation of being at the technological forefront in this field, we can do this without loosing the strong and important focus on quality control throughout the production process.

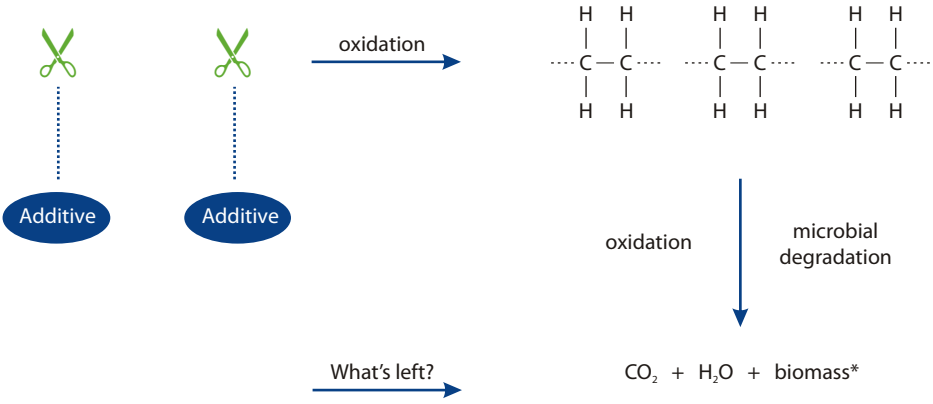
While focusing on meeting the rising market demand, we must also not forget the needs and preferences of the end users, which ultimately impact the efficacy of the tools on the ground. Alongside our implementing partners, we have always strived to adapt the preventative tools we offer to the needs of the target population, rather than demanding adaptation to our tools. Offering flexibility in the manufacturing of all insecticidal products, we can be counted on to provide unique product specifications on an as-needed basis for all settings and programs.

PermaNet® Oxo-biodegradable Plastic Bag

Long-lasting insecticidal nets save numerous lives every year from malaria. However, most of these nets are packaged in plastic bags that are left scattered after large-scale bednet distributions, resulting in clogged landfills and choked rivers. Pollution from plastic packaging is a major environmental issue in developed and developing countries alike. Vestergaard Frandsen is sensitive to this and has therefore introduced an eco-friendly packaging solution—PermaNet® oxo-biodegradable plastic bags.

PermaNet® oxo-biodegradable plastic bags are 100% degradable and non-toxic. Before degrading they are totally recyclable. The bags contain a unique additive that enables them to oxo-biodegrade after disposal. The additive loosens the carbon-carbon bonds of the plastic, allowing it to breakdown easily. Oxygen is the initiator of the degradation process, which occurs naturally in the same way as a leaf or plant material degrades. Prior to degradation, PermaNet® oxo-biodegradable plastic bags look and perform in exactly the same way as regular plastic.

Chemistry of the degradation process



*Biomass can be defined as dead biological material. Eventually, this will completely degrade as well.

Global Logistical Support

Vestergaard Frandsen works with a multitude of local partners to provide the exceptional service of delivering products to in-country destinations rather than simply shipping them to the container port, as is the case with most other suppliers. We have developed a distribution network across the African continent, establishing delivery channels for deeper penetration inland and ensuring a seamless delivery to the end destination.

Our global logistical efforts are far from offering just a delivery platform. We have moved beyond shipping in plain purchased containers to branded ones, which have multiple uses such as a service platform for various products or as a self-equipped laboratory in the field in the remotest parts of the world.

For Vestergaard Frandsen, logistics is not just an operational task that needs to be fulfilled but a strategic choice we consider as important as our lifesaving products. We do whatever we can to ensure the same high quality in our logistics as in all other parts of our business.

Vestergaard Frandsen also has warehouse facilities in the remotest parts of the world, allowing the company to help programme implementers distribute PermaNet® long-lasting insecticidal nets affordably and efficiently.

This unique profile makes Vestergaard Frandsen the optimal partner for disease-control needs.


Malaria Elimination!
"YES WE CAN"
Protect Yourself, Sleep Under An Insecticide-treated Net
PermaNet 2.0
Long-lasting Insecticidal Net
Ministry of Health, Swaziland
National Malaria Control Program
PermaNet 2.0
KICK MALARIA OUT
Protect Yourself, Sleep Under An Insecticide-treated Net
Ministry of Health, Swaziland
National Malaria Control Program
PermaNet 2.0 Long-lasting Insecticidal Net - Fully recommended by the WHO


PermaNet®

Customer Support

With 10 regional offices across Europe, Africa, Asia and the Americas, Vestergaard Frandsen provides an exceptional local and international customer service. Being close to the market is an unequivocal benefit for our customers and partners, allowing rapid and proactive service and market intelligence.

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DISEASE CONTROL TEXTILES

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