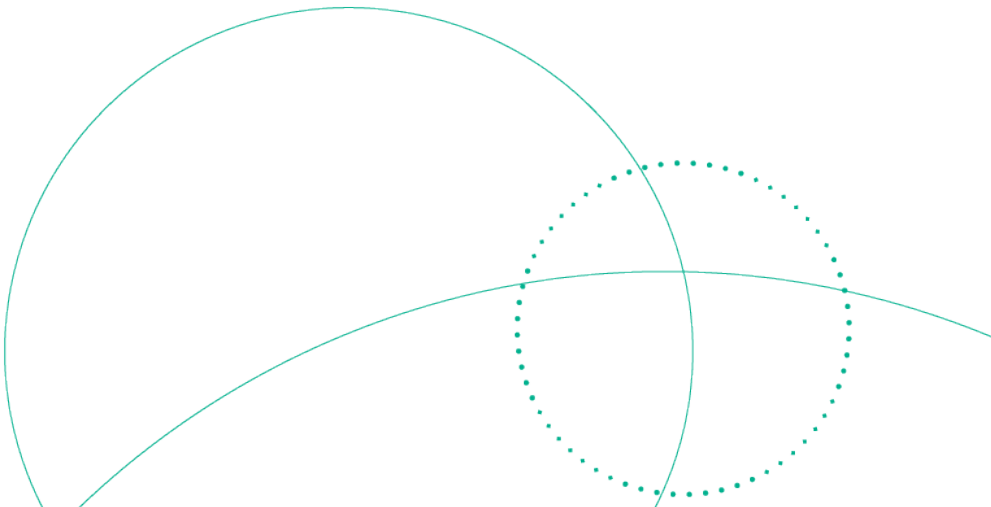
World Health Organization

WHO Prequalification Programme / Vector Control Product Assessment

WHO Public Assessment Report: WHOPAR Part 3

YAHE 4.0
(Fujian Yamei Industry & Trade Co. Ltd)
P-04983

Quality Assessment



Contents

1. Chemical and physical data

1.1 Chemical and physical properties

Data on the chemical and physical properties of the active ingredient and the product YAHE 4.0 were provided. These data were obtained from studies conducted according to established standards and/or Good Laboratory Practices (GLP) and are considered complete. Product specific properties are summarized in Table 1. Numerical results are presented as: mean (range). These summary results are based on the analysis of batches: 082020AR001, 082020AR002, 082020AR003, 2022011004D 2022011105E.

Table 1. Chemical and physical properties for YAHE 4.0 (120D) (Batches 082020AR001, 082020AR002, 082020AR003, 2022011004D 2022011105E)

Identification of Alpha-cypermethrin and Piperonyl butoxide (PBO)	Alpha-cypermethrin CIPAC 454/LN/M/3.2 Piperonyl butoxide CIPAC (N) 33/LN/(M)/3	The active ingredients each comply with an identity test
Alpha-cypermethrin content Accelerated Storage Alpha-cypermethrin content Accelerated Storage Alpha-cypermethrin retention	CIPAC 454/LN/M/3.2	(6.68-6.88 g/kg)* (7.10-7.61 g/kg)** (6.57-6.75 g/kg)* (98.10%-98.50%)*
Piperonyl butoxide content Accelerated storage piperonyl butoxide content Accelerated storage piperonyl butoxide retention	CIPAC/4941, extension of CIPAC 33/LN/M/3	(2.51-2.59 g/kg)* (2.76-3.04 g/kg)** (2.45-2.53 g/kg)* (97.60%-97.70%)*
Wash resistance index (Alpha-cypermethrin) Accelerated storage wash resistance index (Alpha-cypermethrin)	CIPAC MT195	(98.56-99.64%)* (98.27-99.52%)*
Wash resistance index (Piperonyl butoxide) Accelerated storage wash resistance index (Piperonyl butoxide)	CIPAC MT195	(95.68- 96.01%)* (95.59 – 95.47%)*
Mesh size (mean)	See Appendix 2	(19-22 holes/cm^2)*
Fabric weight	ISO 3801/EN 12127	(38.49-40.93 g/m^2)*
Dimensional stability of netting to washing Accelerated storage dimensional stability	ISO 3759; ISO 5077; ISO 6330	Length: (-1.4% to -0.9%)* Width: (+0.9% to +1.1%)* Length: (-1.5% to -1.3%)* Width: (+0.9% to +1.4%)*
Bursting strength (fabric) Bursting strength (inner/outer seam) Accelerated storage bursting strength	ISO 13938-2	(436.9 - 479.5 kPa)* (484.8 – 554.5/ 467.6 – 556.6 kPa)* (430.4 - 452.2 kPa)* (483.7 – 557.1/ 452.0 – 551.6 kPa)*
Flammability	EN 1102	No ignition or propagation. Maximum hole dimension 55-67 mm.

* range of means
** range of individual measurements in samples

No significant differences were recorded among the properties of the product kept at ambient temperature and after accelerated storage stability test conditions.

1.2 Manufacturing, composition and formulant information

Data on the manufacturing process and product composition for YAHE 4.0 have been provided and are adequate. A summary is presented in Table 2. Detailed information on the manufacturing process and product formulation is considered Confidential Business Information (CBI).

Table 2. Manufacturing process and product composition data submitted for YAHE 4.0

Description of Starting Material	The starting material is alpha-cypermethrin active ingredient masterbatch, piperonyl butoxide synergist masterbatch, colour masterbatch, HDPE and LLDPE. The color masterbatch, HDPE and LLDPE are obtained from third-party suppliers. The sources of active ingredients are supported by a current evaluation report confirming compliance of the materials with the established WHO specification.
Declaration of product formulation	Included in the confidential business information.
Production / Formulation Process	The fabric is manufactured by the preparation of the alpha-cypermethrin and piperonyl butoxide masterbatches, the extrusion and warping of the filament, warp knitting, and heat setting. The finished product is manufactured by cutting and sewing of the fabric, addition of label tag, folding prior to packaging, packing, and baling.
Packaging	Nets are packed individually in plastic bags then 50 nets are bound with PET strap and pressed into one bale. The sizes of the bags and bales may depend on the customer requirements.
Discussion of Impurities	There are no relevant impurities of toxicological concern.
Certification of Limits	Alpha-cypermethrin: 6.25 g/kg, acceptable limits 6-6.50 g/kg Piperonyl butoxide: 2.2 g/kg, acceptable limits 1.95-2.45 g/kg

1.3 Enforcement analytical method

Table 3. Details of the analytical method used to determine Alpha-cypermethrin and Piperonyl Butoxide in YAHE 4.0

Quantification of alpha-cypermethrin and piperonyl butoxide	Alpha-cypermethrin: 454/LN/M/3.2, CIPAC Handbook M, p. 41, 2009. Piperonyl butoxide: CIPAC/4941, extension of 33/LN/M/3, CIPAC Handbook N, p.112, 2012.

These methods are appropriate for the determination of the active ingredient content of the product.

2. Chemical and entomological fabric characterisation

Laboratory studies to characterise the availability of the active ingredient and synergist and the insecticidal effect of the fabric of YAHE 4.0 on *Anopheline* mosquito species were submitted to WHO as part of the prequalification dossier. Sampled pieces of ITNs used in the biological laboratory studies were characterised for their alpha-cypermethrin and piperonyl butoxide content using HPLC.

2.1 Laboratory studies

2.1.1 Entomological characterisation

Data on the wash regeneration and wash resistance properties of the YAHE 4.0 product were provided. These data were obtained from studies conducted according to established standards and/or Good Laboratory Practices (GLP). These summary results are based on ITNs drawn from batch numbers 082020AR001 and 082020AR002.

One laboratory study was submitted to characterize the YAHE 4.0 fabric. Bioavailability was evaluated in wash regeneration and wash resistance studies. The endpoints used to evaluate bioavailability were knockdown at 60-minutes post-exposure, 24-hour mortality (M24) and blood feeding inhibition. Demonstration of bioavailability post-wash using an insecticide susceptible test system was used to determine the wash interval that was selected for use in the wash resistance study. Thresholds of ≥95% knockdown and/or ≥80% mortality in WHO cone tests and ≥80% mortality or ≥90% blood-feeding inhibition in tunnel tests were used to determine wash resistance. Results from pyrethroid susceptible mosquitoes were used to determine the wash interval and to evaluate the wash resistance.

The bioavailability of alpha-cypermethrin and piperonyl butoxide on the surface of the ITN fabric was characterized using the insecticide susceptible test systems *Anopheles stephensi* in the wash regeneration study. In the wash resistance studies, insecticide susceptible and pyrethroid resistant *Anopheles stephensi* test systems were used for bioavailability characterization. Bioassays to determine the mortality of mosquito strains against the diagnostic dose of the active ingredient, including in response to pre-exposure with PBO, were not conducted.

The wash interval was determined to be one day. The wash resistance study using a 1-day wash interval and insecticide resistant mosquitoes test system does not demonstrate consistency in the entomological response over the 20-wash series. Tunnel tests conducted using 20 washed netting samples did not meet the threshold for blood feeding inhibition.

These results are summarized in Tables 4-6.

Table 4. Wash regeneration study results for Yahe 4.0 using the insecticide susceptible *An. stephensi* test system in WHO cone tests to characterize the bioavailability of alpha-cypermethrin and PBO

Days post-wash	*An. stephensi* (insecticide susceptible)		
	n	%KD (95% CI)	%M24 (95% CI)
UW	200	100	97
1	200	100	100
2	200	100	100
3	200	100	100
5	200	100	100
7	200	100	100

Table 5. Wash resistance study results for Yahe 4.0 using insecticide susceptible and pyrethroid resistant *An. stephensi* test systems in WHO cone tests to characterize the bioavailability of alpha-cypermethrin and PBO

Wash No.	*An. stephensi* (susceptible)			*An. stephensi* (resistant)		
	n	%KD (SE)	%M24 (SE)	n	%KD (SE)	%M24 (SE)
0	200	100	97 (0.58)	200	100	89.5 (0.96)
1	200	100	100	200	82.5 (1.26)	76.0 (1.41)
3	200	100	100	200	72.5 (1.26)	65.5 (1.50)
5	200	100	98 (0.82)	200	69.0 (1.29)	53.0 (0.58)
10	200	100	93 (1.29)	200	78 (1.41)	59.5 (1.50)
15	200	98.0 (0.82)	89 (1.29)	200	70.5 (0.96)	65.0 (1.91)
20	200	96.0 (0.82)	85 (1.29)	200	67.5 (0.96)	51.5 (1.50)
25	200	98 (0.82)	83 (1.29)	200	62.0 (0.82)	48.5 (0.50)

Table 6. Wash resistance study results for Yahe 4.0 using a pyrethroid resistant *An. stephensi* test system in a tunnel test to characterize the bioavailability of alpha-cypermethrin and PBO

Wash No.	*An. stephensi* (resistant)		
	n	%M24 (SE)	%BFI (SE)
20	100	87.64 (0.74)	65.82 (2.26)

Chemical characterization of samples

Data on the alpha-cypermethrin and piperonyl butoxide content of sampled pieces of the YAHE 4.0 product used in the entomological laboratory wash resistance study were provided. These data were obtained from studies conducted according to established standards and/or Good Laboratory Practices (GLP). These summary results are based on ITNs drawn from batches 082020AR001 and 082020AR002. The results are summarized in Table 7.

Table 7. AI content and retention of sampled pieces of YAHE 4.0 used in the entomological wash resistance study (batch numbers 082020AR001 and 082020AR002)

Wash No.	Mean alpha-cypermethrin content (g/kg)	RSD (%)	Alpha-cypermethrin retention	Alpha-cypermethrin retention per wash	Mean PBO content (g/kg)	RSD (%)	PBO retention	PBO retention per wash
0	6.72 (6.68-6.75)	0.74	-	-	2.70 (2.65-2.73)	2.10	-	-
1	6.63 (6.61-6.64)	0.32	98.66	98.66	2.66 (2.62-2.69)	1.86	98.52	98.52
3	6.56 (6.54-6.57)	0.32	97.62	99.20	2.59 (2.57-2.61)	1.09	95.93	98.62
5	6.46 (6.43-6.48)	0.55	96.13	99.21	2.45 (2.42-2.49)	2.02	90.74	98.08
10	6.24 (6.22-6.26)	0.45	92.86	99.26	2.34 (2.30-2.40)	3.01	86.67	98.58
15	6.11 (6.09-6.13)	0.46	90.92	99.37	2.26 (2.22-2.29)	2.20	83.70	98.82
20	6.02 (6.00-6.05)	0.59	89.58	99.45	2.14 (2.10-2.19)	2.97	79.26	98.84
25	5.93 (5.90-5.96)	0.72	88.24	99.50	2.06 (2.03-2.09)	2.06	76.30	98.92

The mean AI content presented in Table 7 was determined based on 4 net samples belonging to 2 batches, indicating ranges to the AI content in parenthesis.

AI retention per wash in Table 7 is calculated as:

- AI retention per wash = 100 x $\sqrt[n]{(t_n/t_0)}$ where:
  - t_n = total active ingredient content after n washing cycles
  - t_0 = total active ingredient content before washing
  - n = number of washes.

2.2 Chemical and entomological fabric characterisation conclusions

The submitted laboratory studies characterize the fabric of YAHE 4.0 against four strains of *An. gambiae* complex mosquitoes. Following three washes intended to deplete the surface of the fabric of bioavailable insecticide, the laboratory results demonstrate that sufficient bioavailable insecticide to induce mortality in insecticide susceptible test systems was present one day after washing.

Wash resistance to 20 washes using standardised washing methods was demonstrated against two *An. gambiae* complex insecticide susceptible test systems. Based on the submitted studies, YAHE 4.0 does not demonstrate consistency in entomological response over 20 washes when a one-day wash interval is used against insecticide resistant *An. stephensi* test system.

3. Overall quality conclusions

Based on the studies and information provided, all data requirements for the prequalification assessment of product quality have been satisfied. These data have been relied upon to assess the formulation, manufacturing process, physical/chemical characteristics, biological regeneration time, and bioavailability using products prepared with a defined wash interval of the proposed product for the purpose of establishing the identity of the product and assuring that the product can be produced consistently.

The methods for assessing the physical/chemical properties of the product were CIPAC methods and/or validated methods.

The quality component of the dossier is considered complete, and the assessment of the submitted information on quality supports prequalification of the product.

Table 9. List of studies related to chemistry submitted to WHO as part of the prequalification dossier

Studies that were relied upon for decision making	
Study number	Study title
20258	YAHE 4.0 LLIN - Alpha-cypermethrin 250 mg/m2 ± 25% + Piperonyl butoxide 90 mg/m2 ± 25% incorporated into polyethylene filaments: Physical and Chemical Analysis
22066	Physical and Chemical Analysis of Yahe 4.0 LLIN -Alpha-cypermethrin 250 mg/m2 ± 25% + Piperonyl butoxide 90 mg/m2 ± 25% incorporated into polyethylene filaments (Including Accelerated Storage Stability and all the parameters as per FAO/WHO, within Net and in between net of two batches)
20261	YAHE 4.0 LLIN - Alpha-cypermethrin 250mg/m2 ± 25% + Piperonyl butoxide 90mg/m2 ± 25% incorporated in polyethylene filaments: Regeneration, Wash Resistance and Efficacy against Susceptible and Pyrethroid-Resistant Mosquito Strains of *Anopheles stephensi*
20256	YAHE 4.0 LLIN - Alpha-cypermethrin 250 mg/m2 ± 25(¼, + Piperonyl butoxide 90 mg/m2 ± 25% Incorporated into polyethylene filaments: Chemical analysis of nets before and after subjecting to lab bioassay
Studies that were not used to inform decision making	
Report No. W24013633-1	Colour fastness to domestic and commercial laundering

4. Manufacturing release specifications

4.1 Summary of manufacturing release specifications

Table 10. Summary of manufacturing release specifications

Description: The material shall be in the form of netting, consisting of 120 denier* monofilament polyethylene yarn, treated with technical alpha-cypermethrin complying with the requirements of WHO specification 454/TC (current version) and with technical piperonyl butoxide (synergist) complying with the requirements of WHO specification 33/TC (current version) together with any necessary other formulants. The product shall appear clean and shall be suitable for use as an insecticidal net.

ID	Property	Method	Declared value
1*	Sampling Plan	See Appendix 2	
2	Alpha-cypermethrin content	454/LN/M/3.2, CIPAC Handbook M, p. 41, 2009	6.25 g/kg ± 25%
3	Piperonyl butoxide content	CIPAC/4941, extension of 33/LN/M/3 33/LN/M/3, CIPAC Handbook N, p.111, 2012	2.2 g/kg ± 25%
4*	Alpha-cypermethrin wash resistance index	MT195, CIPAC Handbook O, p. 205, 2017	Within the range 95% to 100%
5*	Piperonyl butoxide wash resistance index	MT195, CIPAC Handbook O, p. 205, 2017	Within the range 92% to 100%
6	Fabric weight	ISO 3801 / EN 12127	38 g/m^2 ± 10%
7*	Bursting strength – fabric and seams	ISO 13938:2	Min 350 kPa in both fabric and seams
8*	Netting mesh size	See Appendix 2	The average number of complete holes shall not be less than 18 holes / cm^2 and the lowest value shall be not less than 16 holes / cm^2

*Indicates that additional information is available in Appendix 2.

Manufacturers are expected to rely on the information above as part of a QC management plan and for validation of product quality when released. To the extent required, Certificates of Analysis to support the release of products should present results for the attributes identified in the above table.

4.2 Storage

Accelerated storage stability data were generated as per CIPAC MT 46.3. Test samples were stored for 14 days at 54°C. No significant differences were recorded among the properties of the product kept at ambient temperature and after accelerated storage stability test conditions.

Products should be stored and transported in appropriate conditions in accordance with the recommendations of the manufacturer.

Where products have been subjected to prolonged storage or adverse conditions during storage, analysis and testing are recommended to assess changes in characteristics and their suitability for use.

Appendix 1. Summary of available data considered in Module 3

Batches used to generate the physical/chemical data

Batch number	Date	Formulation	Uses
082020AR001	05/05/2020	White	Storage stability, in-use stability (laboratory)
082020AR002	25/05/2020	White	Storage stability, in-use stability (laboratory)
082020AR003	05/05/2020	White	Storage stability
2022011004D	11/01/2022	White	Storage stability
2022011105E	10/01/2022	White	Storage stability

Product characteristics

Studies 20258, 22066

Study 20258:

Property	Batch ID	Test Method	Results
Alpha-cypermethrin content (mean of 5 samples)	082020AR001 082020AR002 082020AR003	CIPAC 454/LN/M/3.2	6.83 g/kg (RSD 0.67%) 6.88 g/kg (RSD 0.32%) 6.86 g/kg (RSD 0.44%)
Alpha-cypermethrin distribution (range for 5 samples)	082020AR001 082020AR002 082020AR003		6.78-6.89 g/kg (108.5-110.2%) 6.85-6.91 g/kg (109.6-110.6%) 6.82-6.90 g/kg (109.1-110.4%)
PBO content (mean of 5 samples)	082020AR001 082020AR002 082020AR003	CIPAC 33/LN/M/3	2.54 g/kg (RSD 1.37%) 2.56 g/kg (RSD 1.33%) 2.51 g/kg (RSD 1.04%)
PBO distribution (range for 5 samples)	082020AR001 082020AR002 082020AR003		2.50-2.59 g/kg (111.1-115.1%) 2.52-2.60 g/kg (112.0-115.6%) 2.47-2.54 g/kg (109.8-112.9%)
Alpha-cypermethrin wash resistance index	082020AR001	CIPAC MT 195	99.64%
PBO wash resistance index	082020AR001	CIPAC MT 195	95.96%
Fabric weight	082020AR001	ISO 3801	38.49 g/m^2
Mesh size	082020AR001	ISO 139	19-20 holes/cm^2
Dimensional stability	082020AR001	ISO 3759(2011), ISO 6330(2012), ISO 5077(2007)	-1.4%, +1.1%
Bursting strength (fabric)	082020AR001	ISO 13938-2:1999	436.9 kPa
Bursting strength (inner/outer seam)	082020AR001		484.8/467.6 kPa
Flammability	082020AR001	EN 1102	No ignition or propagation. Maximum hole dimension 55 mm.

Study 22066:

Property	Batch ID	Test Method	Results
Alpha-cypermethrin content (mean of 5 samples)	2022011004D 2022011105E	CIPAC 454/LN/M/3.2	6.79 g/kg (RSD 1.05%) 6.68 g/kg (RSD 0.68%)
Alpha-cypermethrin distribution (range for 5 samples)	2022011004D 2022011105E		6.70-6.89 g/kg (107.2-110.2%) 6.64-6.75 g/kg (106.2-108.0%)
PBO content (mean of 5 samples)	2022011004D 2022011105E	CIPAC 33/LN/M/3	2.59 g/kg (RSD 1.62%) 2.56 g/kg (RSD 1.02%)
PBO distribution (range for 5 samples)	2022011004D 2022011105E		2.54-2.64 g/kg (112.9-117.3%) 2.52-2.59 g/kg (112.0-115.1%)
Alpha-cypermethrin wash resistance index	082020AR002 082020AR003 2022011004D 2022011105E	CIPAC MT 195	98.60% 98.74% 98.68% 98.56%
PBO wash resistance index	082020AR002 082020AR003 2022011004D 2022011105E	CIPAC MT 195	95.68% 95.97% 95.92% 96.01%
Fabric weight	082020AR002 082020AR003 2022011004D 2022011105E	ISO 3801	40.40 g/m2 39.86 g/m2 40.93 g/m2 40.51 g/m2
Mesh size	082020AR002 082020AR003 2022011004D 2022011105E	ISO 139	20-22 holes/cm2 20-22 holes/cm2 20-22 holes/cm2 19-21 holes/cm2
Dimensional stability	082020AR002 082020AR003 2022011004D 2022011105E	ISO 3759(2011), ISO 6330(2012), ISO 5077(2007)	-1.4%, +1.1% -1.2%, +1.1% -0.9%, +1.1% -1.2%, +0.9%
Bursting strength (fabric)	082020AR002 082020AR003 2022011004D 2022011105E	ISO 13938-2:1999	443.0 kPa 452.1 kPa 462.0 kPa 479.5 kPa
Bursting strength (inner/outer seam)	082020AR002 082020AR003 2022011004D 2022011105E		530.7/542.8 kPa 542.9/549.0 kPa 554.5/556.6 kPa 552.5/545.5 kPa
Flammability	082020AR002 082020AR003 2022011004D 2022011105E	EN 1102	No ignition or propagation. Maximum hole dimension 63-67 mm.

Storage stability

Study 22066:

Property	Batch ID	Before	After	Change
Alpha-cypermethrin content (mean)	082020AR001 082020AR002 082020AR003 2022011004D 2022011105E	6.83 g/kg 6.88 g/kg 6.86 g/kg 6.79 g/kg 6.68 g/kg	6.70 g/kg 6.75 g/kg 6.73 g/kg 6.70 g/kg 6.57 g/kg	-0.13 g/kg (-1.9%) -0.13 g/kg (-1.9%) -0.13 g/kg (-1.9%) -0.09 g/kg (-1.3%) -0.11 g/kg (-1.6%)
PBO content (mean)	082020AR001 082020AR002 082020AR003 2022011004D 2022011105E	2.54 g/kg 2.56 g/kg 2.51 g/kg 2.59 g/kg 2.56 g/kg	2.48 g/kg 2.50 g/kg 2.45 g/kg 2.53 g/kg 2.51 g/kg	-0.06 g/kg (-2.4%) -0.06 g/kg (-2.3%) -0.06 g/kg (-2.4%) -0.06 g/kg (-2.3%) -0.05 g/kg (-2.0%)
Alpha-cypermethrin wash resistance index	082020AR001 082020AR002 082020AR003 2022011004D 2022011105E	99.64% 98.60% 98.74% 98.68% 98.56%	99.52% 98.30% 98.27% 98.25% 98.27%	-0.12% -0.30% -0.47% -0.43% -0.29%
PBO wash resistance index	082020AR001 082020AR002 082020AR003 2022011004D 2022011105E	95.96% 95.68% 95.97% 95.92% 96.01%	95.64% 95.59% 95.84% 95.79% 95.74%	-0.32% -0.09% -0.13% -0.13% -0.26%
Dimensional stability	082020AR001 082020AR002 082020AR003 2022011004D 2022011105E	-1.3%, -1.2% -0.5%, -0.4%	-1.3%, -1.2% -0.4%, -0.3%	
Bursting strength (fabric)	082020AR001 082020AR002 082020AR003 2022011004D 2022011105E	417.5 kPa	412.2 kPa	-
Bursting strength (seam)	082020AR001 082020AR002 082020AR003 2022011004D 2022011105E	523.6 / 543.8 kPa	519.4 / 542.7 kPa	-

Appendix 2. Manufacturing release specifications: Methods and notes

Description

The linear density (denier) of the yarn cannot be measured in the netting or the manufactured bed net but it should be identified on the packaging.

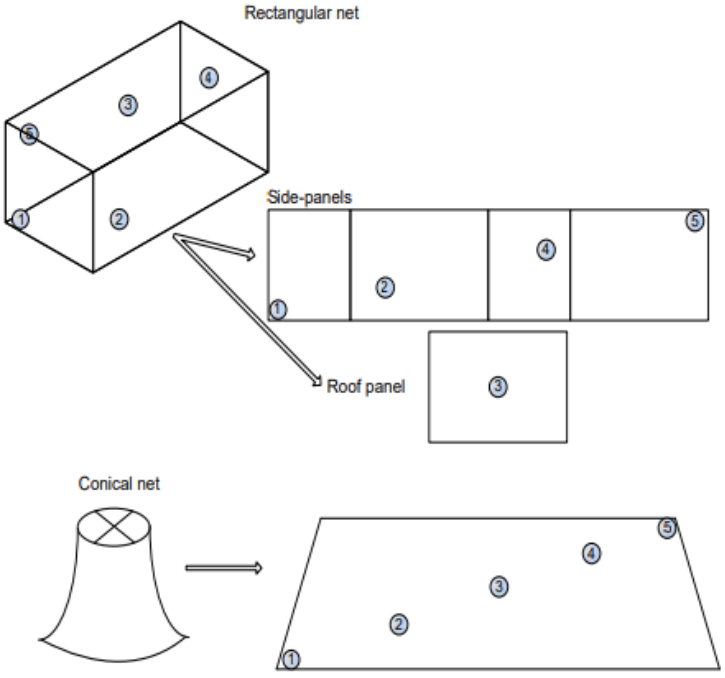
Sampling Plan

Applicable to all attributes for which samples are to be taken from various parts of the constructed ITN

- Sampling should be noted as Figure 1.

Figure 1 General method for sampling rectangular and conical nets

Recommended positions from which 5 pieces of netting should be taken from a made up bed net and combined to form a representative sample.



Samples should be taken according to Figure 1 or on a convenient diagonal across the width of bulk material. Samples must be sufficiently large to conduct all tests required and representative of the net or netting. Except where seams are to be tested, do not test material within 10 cm of seams or selvedges. Where a final product is made from more than one type of netting, each type of netting should be sampled and tested separately.

Use sharp scissors, or equivalent, to minimize damage to the fibres and fabric and thus avoid any consequential bias in the results of certain tests. Roll up the strips or squares and place them in labelled,

new, clean aluminium foil prior to analysis. Samples should be kept cool, avoiding heat sources (including direct sunlight) or freezing, and analyzed/tested with minimum delay. Representative portions (sub-samples) for testing should be taken as described in each test method.

For the purposes of chemical analysis, the analytical method and the number and size of test portions analyzed should be designed to provide results with a relative standard deviation (RSD) ≤ 5% or as applicable in certain justifiable cases. Test portion and replication requirements for physical test methods are defined in the methods or Notes referenced.

Attributes 4 and 5: Alpha-cypermethrin and piperonyl butoxide wash resistance index

The content of alpha-cypermethrin in the net pieces before and after washing should be determined by the method 454/LN/M/3.2, CIPAC Handbook M, p. 41, 2009. The content of piperonyl butoxide in the net pieces before and after washing should be determined by the method CIPAC/4941, extension of CIPAC method 33/LN/(M)/3.

Attribute 7: Bursting strength – fabric and seams

Test method: ISO 13938 part 2 with conditioning of the fabric as specified in the ISO standard. The declared bursting strength, and testing for compliance with it, should be based on tests of 7.3 cm2 areas of fabric. Proposed specifications based on tests of 50 cm2 area must be supported by data showing the suitability of the proposed value and its relationship to minimum of 250 kPa (which is based on 7.3 cm2 area). Five replicate tests should be conducted on samples taken at approximately equal distances on a diagonal across the netting, taking no sample within 10 cm of a border or seam. In made up rectangular nets, the “diagonal” may correspond to figure 1. The average of the 5 measurements is calculated.

The method to test seam bursting strength is identical to that used to test the fabric, except that 5 replicate tests should be made, with the seam centred on the test head. Up to 5 seams may be tested but, if there are <5 seams, replicate measurements should be made on 1 or more seams, to provide a total of 5 measurements.

Attribute 8: Mesh size

In the absence of a simple or standard method to determine the size of holes, which may have complex shapes, in highly flexible fabrics, mesh size is determined by counting the number of holes in a square of the fabric. Counting may be done directly on the fabric or indirectly by taking a picture/photocopy of the fabric. Indirect methods may ease counting and provide a permanent record. The number of holes per measured area is converted in holes/cm^2. Before counting, the fabric should be conditioned according to ISO 139 (4 h, 20ºC, 65% relative humidity).

Use a template to define the square of netting, taking care not to stretch or distort the fabric. The template should be a 1-2 mm thick rigid sheet, in/on which an accurately calibrated (±1% in each dimension) square (e.g., 1 x 1 in or 5 x 5 cm) has been cut/marked. If a template is not available and a ruler must be used, great care is required to ensure that the area counted is square. Where practicable, one edge of the square to be counted should be aligned with a row of complete holes in the fabric. Incomplete holes ≥ ½ are

counted as complete holes, whereas those < ½ are not counted. Count 5 replicate squares selected according to the sampling plan, calculate the average and note the lowest value.

Another suitable method is the use of a stereomicroscope with an image analyser software, where the number of holes in a defined area is counted. In case of discrepancy between the netting mesh size using stereomicroscopic method and direct or indirect counting method, the stereomicroscopic method shall be the referee method.