DRAFT TANZANIA STANDARD

Textile – Specification for mosquito nets: Part 2: Nets made from 100 % Polyethylene yarn
Foreword

The consumers everywhere are interested in the information pertaining to various requirements of textiles such as blend composition, length, width, mass (g/m²), colour fastness, fire resistance, shrinkage and care labelling instructions for their subsequent use so that they can make optimum use of the textile and get the full value of the price paid by them.

It is therefore; very important that information pertaining to these as well as other essential requirements are labelled and marked on the consumer textiles so that the interests of the consumers are fully safeguarded. This will also help in curbing the malpractice in the textile trade regarding spurious markings which mislead the consumers,

In addition, certain safety and environment friendly requirements of textiles are essential to provide safety to the user and prevent environmental pollution after their final disposal. Keeping in view the health and safety of the consumers of textiles, many countries of the world have brought out regulation which will also help a long way in minimizing of dumping and import of cheap and hazardous textiles in Tanzania.

In the preparation of this Draft Tanzania Standard, assistance was derived from:


Textiles – General labelling of all products manufactured from textiles

1 SCOPE

This Draft Tanzania Standard specifies basic labelling, marking and sapling plan requirements for all ready-made garments, woven and knitted fabrics and other products manufactured from textiles.

2 NORMATIVE REFERENCES

For the purpose of this Draft Tanzania Standard, the following references shall apply:

- TZS 4: Rounding off numerical values
- TZS 22: Textiles — Woven fabrics — Determination of breaking load and extension
- TZS 23: Method for determination of colour fastness of textiles material to artificial light (xenon arc lamp)
- TZS 41: Method for evaluating change in colour
- TZS 42: Method for evaluating straining
- TZS 40: Method for determination of colour fastness of textiles material to day light
- TZS 137: Textiles — Determination of dimensional changes of woven and knitted fabrics and garments, Machine method
- TZS 44: Textiles — Woven or knitted fabrics — Determination of length and width
- TZS 43: Textiles — Tests for colour fastness — Colour fastness to washing: Test 1
- TZS 138: Textiles — Method for determination of colour fastness of textiles material to rubbing
- TZS 327: Textiles – Binary fibre mixtures – quantitative chemical analysis.
- TZS 691:2001, The General Labelling of all products manufactured from textiles

3 REQUIREMENTS

All textile fabrics (woven or knitted) shall be labelled and marked with and shall satisfy the following requirements.

3.1 Length—The length of fabric when measured as per method given in TZS 44 shall be as declared by the manufacturer subject to a tolerance of 5 percent.
3.2 Width—The width of fabric when measured as per method given in TZS 44 shall be as declared by the manufacturer. However, this shall be subject to following tolerances:
   a) Woven fabrics: +2/-1 cm
   b) Knitted fabrics: ± 2 cm

3.3 Mass per unit area, g/m²)—The mass per unit area of the fabric when measured as per TZS 21 shall be as declared by the manufacturer. However, a tolerance of +5/-2.5 percent shall be permitted on the declared value. For cotton denim the tolerance on mass shall be ±5 percent.

3.4 Blend Composition
3.4.1 Silk Textile Fabrics — Textile materials containing silk shall be marked as given below on the basis of content of silk in Basel ground fabric only when tested as per TZS 327.
   a) Pure silk — A textile material shall be marked ‘PURE SILK’ if the material comprises of silk only subject to manufacturing tolerance up to 5 percent of foreign matter including metallic and weighting materials.
   b) Blended silk — The textile material shall be marked ‘BLENDED SILK’ if it contains not less than 50 percent of silk fibres. However, a tolerance of ±3 percent units shall be permitted on the declared silk content in the textile material.
   c) Part silk — The textile material shall be marked ‘PART SILK’ if it contains not less than 20 percent of silk. However, a tolerance of ±3 percent units shall be permitted on the declared silk content in the textile material.

NOTES
1 All reference to percentage contents mean percentages by mass calculated from the mass of materials when in standard condition, namely, their oven dry mass plus the appropriate regain.

2 In all cases the more detailed description of the contents of the material shall be given by indicating the percentages of silk and other fibres in descending order used in the manufacture of textile material. However, such a description should not be misleading.

3.4.2 Woollen/Worsted Fabrics—Textile fabrics shall be marked as given below on the basis of content of wool fibres when tested by the test method given in TZS 327.
   a) All wool— A textile fabric shall be marked ‘All wool’, if the material comprises of pure new wool fibres only subject to the tolerances given below:
      1) Manufacturing tolerance up to 3 percent of inadvertent impurities, and
      2) An allowance up to 5 percent of material other than wool fibres used to provide a decorative or ornamentation effect.
   b) Blended wool— The textile fabric shall be marked ‘BLENDED WOOL’, if it contains not less than 50 percent of wool fibres. However, a manufacturing tolerance up to ±3 percent units on wool contents shall be permitted.
   c) Part wool— The textile material shall be marked ‘PART WOOL’, if it contains not less than 20 percent wool fibres. However, a manufacturing tolerance up to ±3 percent units on wool contents shall be permitted.

NOTES
1 All reference to the percentage contents mean percentages by mass calculated from the mass of materials when in standard condition, namely, their oven dry mass plus the appropriate regain.

2 In all cases the more detailed description of the contents of the material shall be given by indicating the percentages of the wool and other fibres in descending order used in the manufacture of the textile material. However, such a description should not be misleading.
3 The above classification pertains to the use of pure new wool fibres only. In case the used wool/shoddy wool fibres are used for manufacture of fabrics, the material shall also be clearly marked as ‘made from shoddy/reused wool’ in addition to above markings.

3.4.3 Textile Fabrics Other Than Wool and Silk Fabrics – Textile fabrics other than wool and silk fabrics, shall satisfy the blend composition as declared by the manufacturer with a tolerance of ±3 percent units when tested by methods specified in TZS 327.

3.5 Shrink Resistance – The dimensional changes in both directions on washing of woven fabrics shall not exceed 2 percent except for cotton denim for which it shall not exceed 3 percent. For knitted fabrics, the dimensional changes on washing shall not exceed 5 percent. The dimensional change shall be tested by the method prescribed in TZS 137 for woven and knitted cotton textiles. However, if the textile fabric is declared as Shrink resistant (or Pre-shrunk), it shall have dimensional stability of ±1 percent except for cotton denim for which the tolerance shall be ±3 percent in warp way and weft way when tested as per test method specified in above mentioned.

3.6 Colour Fastness Ratings – The fabric shall conform to the colour fastness ratings to all the agencies as specified in Table 1 of TZS 23, TZS 40, TZS 43, and TZS 138 and shall be marked ‘FAST COLOUR’.

4 MARKING

4.1 Marking of Fabrics

The marking shall be done by stencilling/labelling at both the free ends of the cloth and shall contain the following information:

a) Name of material and its blend composition, for example, polyester blended shirting fabric (67 percent Polyester and 33 percent Viscose);
b) All wool or Blended wool or Part wool in case of woollen worsted fabrics and also ‘Made from shoddy wool/reused wool’, if applicable;
c) Pure silk or Blended silk or Part silk and/or Pure Zari silk as applicable in case of silk fabrics;
d) Mass per unit area in (g/m²);
e) Size and fibre content:
a) Width and length;
b) Colour fastness rating;
c) Care Labelling Instructions using symbols;
d) Shrinkage percentage, maximum or ‘Pre-shrunk’ or ‘Shrink resistant’, if applicable;
e) Fire resistant, if applicable;
f) ECO-Mark, if applicable;
g) Manufacturer’s name, initials or trade-mark, if any;
h) Month and year of manufacture;
i) Country of origin; and
j) Any other information as required by law in force.

4.2 Marking of Ready-Made Garments

A suitable label, woven or printed, shall be fastened to garment at a conspicuous position underside of the garment on which the control dimensions of garments along with information as given in 4.1 as applicable (except 4.1 (e)) shall be provided.

4.2.1 The label shall be permanent and non-detachable such that colour from the label does not bleed into the fabric or ready-made garment.
4.2.2 The marking of the labels/stencils shall be clearly readable. The height of letters on labels shall be minimum 5 mm for the markings given in 4.1 (b), (c), (f), (j), and (k) and for all other letters, the minimum height shall be 2 mm. For stencils, the height of letters shall be minimum 10 mm for the marking given in 4.1 (b), (c), (f), (j), and (k) and for all other markings, the minimum height shall be 5 mm.

5 PACKAGING

5.1 Garments

Garment packages shall be so designed as to ensure that the garments reach the consumer in satisfactory condition without any damage. Packaging of garments shall be done in a secured way either in bales or in cases or shall be as agreed upon between the buyer and the seller.

5.2 Fabrics

The fabrics shall be packed in a secured way or as agreed upon between the buyer and the seller.

6 PACKING

6.1 Fabrics

The fabric shall be well packed in roll or piece form wrapped in polyethylene film of not less than 40 microns’ thickness in clean and dry state free from stains, grease etc.

6.2 Garments

The garment shall be packed in polyethylene or polypropylene bags and sealed and then kept in box, as required by the buyer. However, each box shall also be marked with the information required at 4.2.

7 SAMPLING AND CRITERIA FOR CONFORMITY

7.1 Lot

The number of pieces of the same type and composition of fabric or ready-made garment delivered to a buyer against one dispatch note shall constitute a lot.

7.2 The number of pieces to be selected at random shall be according to col. 2 and 3 of Table 1.
Table 1 Sample Size
(Clauses 3.4.2, 3.4.3.1 and 3.4.3.2)

<table>
<thead>
<tr>
<th>S/N</th>
<th>Lot size</th>
<th>Sample size</th>
<th>Permissible number of Non-conforming pieces</th>
<th>Sub-sample size</th>
<th>Sub-sub sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Up to 50</td>
<td>5</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>51 - 150</td>
<td>8</td>
<td>0</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>151 - 300</td>
<td>13</td>
<td>1</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>301 - 500</td>
<td>20</td>
<td>1</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>501 - 1000</td>
<td>48</td>
<td>3</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>6</td>
<td>1001 and above</td>
<td>50</td>
<td>3</td>
<td>10</td>
<td>7</td>
</tr>
</tbody>
</table>

7.3 Number of Tests and Criteria for Conformity

7.3.1 The number of pieces to be selected for care labelling symbols, length, width, mass and control dimensions (in case of garments) shall be in accordance with col. 3 of Table 1. For shrinkage resistance, colour fastness and blend composition, the number of pieces selected shall be in accordance with col. 5 of Table 1. For all other requirements specified in this Draft Tanzania Standard, the number of pieces selected shall be as given in col. 6 of Table 1.

7.3.2 All the pieces selected from the lot shall be tested for all requirements as specified in 3 or 4. A piece shall be declared defective, if it does not meet any of the requirement specified in 3 and 4. The lot shall be declared conforming to the requirements of this Draft Tanzania Standard if the total number of defective pieces does not exceed the value given in col. 4 of Table 1.
Foreword

This Draft Tanzania Standard specifies the requirements of two types of mosquito nets made out of 100% polyethylene yarn incorporated with permethrin insecticide.

Mosquito nets can be categorized according to their sizes and design. In determining the quality of this item, more emphasis should be given not only to the netting fabric and stitching quality, but also to the active ingredient of insecticide incorporated in the fibre structure of the net during the manufacturing process. In that case shape, size, dimensions and active ingredient loading are very important. This Draft Tanzania Standard which outlines requirements for manufacture and workmanship of mosquito nets will guide the manufacturer and protect the buyer.

In the preparation of this Draft Tanzania Standard the valuable assistance derived from the following organizations are gratefully acknowledged.

- WHO approved specifications, published by World Health Organization
- Sumitomo Chemicals, manufacturers of long lasting Olyset Net brands
- IS 9886:1981, Specification for mosquito nets, published by the Bureau of Indian Standards
- Company standards from local manufacturers
1. **SCOPE**

This Draft Tanzania Standard prescribes the requirements of two types of mosquito nets namely rectangular mosquito nets and circular or conical shaped mosquito nets. These may be bleached or dyed as specified in the contract or order.

2. **NORMATIVE REFERENCES**

The following referenced documents are indispensable for the application of this Draft Tanzania Standard.

- TZS 4, *Rounding off numerical values*
- TZS 21, *Textiles – Determination of mass per unit length and per unit area of knitted or woven fabric*
- TZS 26, *Textiles – Determination of conductivity, pH, water soluble matter, chloride and sulphate in aqueous extracts*
- TZS 40, *Textiles – Determination of colour fastness – colour fastness to daylight*
- TZS 44, *Textiles – Determination of length and width of fabrics*
- TZS 139, *Textiles – Determination of linear density of yarn removed from fabric free from added matter*
- TZS 167, *Textiles – Determination of colour fastness – colour fastness to washing – Test 3*
- TZS 265, *Test method for testing strength of yarn from packages*

3. **REQUIREMENTS**

3.1 **Manufacture**

3.1.1 Netting Fabric

The fabric used for the manufacture of mosquito nets shall conform to constructional and performance requirements prescribed in Table 1.

3.2 **Defects**

The mosquito nets shall be free from defective holes having diameter more than the normal hole size of the netting), stitching defects, stains and observable defects.

3.3 **The colour**

The fabric shall be in white or any colour which is agreeable between the purchaser and supplier.
3.4 Sizes and dimensions
The mosquito net shall be of any of the following sizes and dimensions as described in Table 2 and shall be tested in accordance TZS 44.

3.5 Colour fastness
The colour fastness of mosquito netting and attachments shall conform to the requirements given in Table 3.

3.6 pH value
The pH value of mosquito netting shall be as described in Table 1.

3.7 Active ingredient
The active ingredient shall be as described in Table 1.

3.8 Dimensional change
The dimensional change of mosquito net shall be as described in Table 1.

3.9 Workmanship
The mosquito net shall be rectangular or conical in shape unless otherwise agreed between the manufacturer and the purchaser. The body of the mosquito net shall be made of not less than two pieces assembled together to obtain the required shape of the mosquito net.

3.10 Mosquito Net attachment
The net shall be provided with suitable number of suspension points to attach string or cord, of which the width is not less than 10 mm fixed at the top at 6 places equally spaced to tie the net to the hanging frame for a rectangular net or a center loop with an insertion for the cord to hold a ring for a conical net.

3.10.1 The top support ring shall be of any suitable material e.g. rust proof wire which has sufficient strength to withhold the net when it is hung at the required position.

3.10.2 A suspension ring made out of any suitable material and fixed to the upper centre of the top or any other suitable measures shall be provided to hang the net during its usage.
Table 1 Requirements for high density polyethylene (monofilament fibre) Rectangular or conical mosquito netting

<table>
<thead>
<tr>
<th>S/NO.</th>
<th>Characteristic</th>
<th>Requirement</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Material</td>
<td>100 % high density polyethylene (monofilament fibre) yarn.</td>
<td>TZS 327</td>
</tr>
<tr>
<td>2.</td>
<td>Linear density (den) min</td>
<td>150 denier.</td>
<td>TZS 139</td>
</tr>
<tr>
<td>3.</td>
<td>Hole number (scale, physical counting), min.</td>
<td>8 holes/cm²</td>
<td>Manual</td>
</tr>
<tr>
<td>4.</td>
<td>Mass per unit area, g/m², min.</td>
<td>43±5</td>
<td>TZS 21</td>
</tr>
<tr>
<td>5.</td>
<td>Bursting strength, kPa (min)</td>
<td>350 (see figure 1)</td>
<td>See Appendix A</td>
</tr>
<tr>
<td>6.</td>
<td>pH</td>
<td>6.0 - 8.5</td>
<td>TZS 26</td>
</tr>
<tr>
<td>7.</td>
<td>Dimensional change to washing: (Length and width)</td>
<td>±10 %</td>
<td>TZS 137</td>
</tr>
<tr>
<td>8.</td>
<td>Active ingredient: Permethrin</td>
<td>1.8 - 2.2 (w/w%)</td>
<td>See appendix B</td>
</tr>
</tbody>
</table>

Table 2 – Sizes and dimensions of mosquito nets:

a) Rectangular

<table>
<thead>
<tr>
<th>Description</th>
<th>Width</th>
<th>Length</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>100 cm</td>
<td>180 cm</td>
<td>210 cm</td>
</tr>
<tr>
<td>Medium</td>
<td>130 cm</td>
<td>180 cm</td>
<td>210 cm</td>
</tr>
<tr>
<td>Large</td>
<td>160 cm</td>
<td>180 cm</td>
<td>210 cm</td>
</tr>
<tr>
<td>Extra large</td>
<td>190 cm</td>
<td>180 cm</td>
<td>210 cm</td>
</tr>
</tbody>
</table>

b) Conical

<table>
<thead>
<tr>
<th>Description</th>
<th>Circumference</th>
<th>Height</th>
<th>Top (diameter)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>850 cm</td>
<td>220 cm</td>
<td>56 cm</td>
</tr>
<tr>
<td>Medium</td>
<td>1050 cm</td>
<td>220 cm</td>
<td>56 cm</td>
</tr>
<tr>
<td>Large</td>
<td>1250 cm</td>
<td>250 cm</td>
<td>65 cm</td>
</tr>
</tbody>
</table>

Note – The sizes and dimensions mentioned above are for guidance purposes only. They should not be considered as prime requirement of this specification.

Table 3 – Requirements for colour fastness

<table>
<thead>
<tr>
<th>S/N</th>
<th>Colour fastness to:</th>
<th>Minimum Rating</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>a) daylight</td>
<td>4</td>
<td>TZS 40:1979</td>
</tr>
<tr>
<td>2.</td>
<td>b) washing</td>
<td>4</td>
<td>TZS 167:1979</td>
</tr>
</tbody>
</table>
4. PACKING AND MARKING

4.1 Packing
Each mosquito net shall be packed in a polythene bag

4.2 Marking
The following information shall be marked or labelled legibly and indelibly on each individual package:
   a) Name of the product
   b) Size of the net
   c) Name and address of the manufacturer
   d) Brand name if any
   e) Batch identification mark.
   f) Country of origin

5. SAMPLING

5.1 Lot
In any consignment all the pieces of mosquito netting belonging to one batch of manufacture or supply shall constitute a lot.

5.2 Scale of sampling

5.2.1 Samples shall be tested from each lot for ascertaining its uniformity to the requirements of this specification.

5.2.2 The number of pieces to be selected from a lot shall be in accordance with Table 4.

Table 4 – Scale of sampling

<table>
<thead>
<tr>
<th>No. of pieces in the lot</th>
<th>No. of pieces to be selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 8</td>
<td>2</td>
</tr>
<tr>
<td>9 to 15</td>
<td>3</td>
</tr>
<tr>
<td>16 to 25</td>
<td>4</td>
</tr>
<tr>
<td>26 to 50</td>
<td>5</td>
</tr>
<tr>
<td>51 and above</td>
<td>7</td>
</tr>
</tbody>
</table>

5.2.3 To test the bursting strength of seams (Table 1), up to 5 seams may be tested, avoiding intersections, to provide a total of 5 measurements.
Figure 1: Sampling rectangular and conical nets for bursting test;
Annex B

Test method for active ingredient

PERMETHRIN
331

ISO common name  Permethrin

Chemical name  3-Phenoxybenzyl (1RS)-cis,trans-3-(2,2-dichlorovinyl)
-2,2-dimethylcyclopropanecarboxylate (IUPAC);
(3-Phenoxyphenyl)methyl 3-(2,2-dichloroethenyl)-2,2
-dimethylcyclopropanecarboxylate (CA)

CAS No.  52645-53-1

Empirical formula  C₂₁H₂₉Cl₂O₃

RMM  391.29

v.p.  2.06 x 10⁻⁷ Pa (20°C),••6.82 x 10⁻⁷ Pa (25°C),
2.24 x 10⁻⁵ Pa (30°C),••6.87 x 10⁻⁵ Pa (35°C),
1.93 x 10⁻⁵ Pa (40°C)••

Solubility  In water: 11.11 g/l (20±0.5°C/pH7.0-9.3);
soluble in organic solvents

Description  Yellow to yellowish brown oil and solidifies on lowering
temperature
1 Sampling. Take at least 100 g.

2 Identity tests
2.1 GLC. Use the GLC method below. The retention time of permethrin for the sample solution should not deviate by more than 1% from that for the permethrin working standard solution and intensities of the permethrin isomers should give the same pattern as in the working standard solution.

2.2 Infrared. Prepare a film between NaCl plates and scan from 4000 to 400 cm⁻¹. The spectrum produced from the sample should not differ significantly from that of the standard.

3 Permethrin
OUTLINE OF METHOD The content of permethrin in the test samples are determined by capillary GC using flame ionisation detection and triphenyl phosphate as internal standard, and the trans-isomer ratio is calculated from the chromatogram obtained.
The content of permethrin is the total content of cis- and trans-isomers.

REAGENTS
Acetone analytical grade
Permethrin working standard technical product of certified purity. Store refrigerated.
Triphenyl phosphate internal standard. Must not show peaks with the same retention times as cis-permethrin and trans-permethrin.
Internal standard solution. Dissolve triphenyl phosphate (1.0 g) in acetone (100 ml). Ensure that a sufficient quantity of this solution is prepared for all samples and calibration standards to be analysed.
Calibration solution. Homogenise the permethrin working standard. When the permethrin working standard is waxy solid or partly waxy solid homogenise it by warming it to melting and by stirring. Prepare calibration solutions in duplicate. Weigh (to the nearest 0.1 mg) 90 to 110 mg (s mg) of permethrin working standard into a vial or stoppered flask (100 ml). Add by pipette internal standard solution (5 ml) and dissolve completely. Add by measuring cylinder acetone (45 ml) and mix well (Solutions C_A and C_B).

APPARATUS
Gas chromatograph equipped with a split/splitless injection and a flame ionisation detector.
Capillary column fused silica, 30 m x 0.25 (i.d.) mm, film thickness: 0.25 μm, coated with crosslinked dimethyl polysiloxane (DB-1 or equivalent)
Electric integrator or data system
PERMETHRIN TECHNICAL
331/TC/m/-

1 Sampling. Take at least 100 g.

2 Identity tests
2.1 GLC. Use the GLC method below. The retention time of permethrin for the sample solution should not deviate by more than 1% from that for the permethrin working standard solution and intensities of the permethrin isomers should give the same pattern as in the working standard solution.
2.2 Infrared. Prepare a film between NaCl plates and scan from 4000 to 400 cm⁻¹. The spectrum produced from the sample should not differ significantly from that of the standard.

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Internal standard solution. Dissolve triphenyl phosphate (1.0 g) in acetone (100 ml). Ensure that a sufficient quantity of this solution is prepared for all samples and calibration standards to be analysed.
Calibration solution. Homogenise the permethrin working standard. When the permethrin working standard is waxy solid or partly waxy solid homogenise it by warming it to melting and by stirring. Prepare calibration solutions in duplicate. Weigh (to the nearest 0.1 mg) 90 to 110 mg (s mg) of permethrin working standard into a vial or stoppered flask (100 ml). Add by pipette internal standard solution (5 ml) and dissolve completely. Add by measuring cylinder acetone (45 ml) and mix well (Solutions C_A and C_B).

APPARATUS
Gas chromatograph equipped with a split/splitless injection and a flame ionisation detector.
Capillary column fused silica, 30 m x 0.25 (i.d.) mm, film thickness: 0.25 μm, coated with crosslinked dimethyl polysiloxane (DB-1 or equivalent)
Electric integrator or data system
PERMETHRIN TECHNICAL
331/TC/m/-

1 Sampling. Take at least 100 g.

2 Identity tests
2.1 GLC. Use the GLC method below. The retention time of permethrin for the sample solution should not deviate by more than 1% from that for the permethrin working standard solution and intensities of the permethrin isomers should give the same pattern as in the working standard solution.
2.2 Infrared. Prepare a film between NaCl plates and scan from 4000 to 400 cm⁻¹. The spectrum produced from the sample should not differ significantly from that of the standard.

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Acetone analytical grade
Permethrin working standard technical product of certified purity. Store refrigerated.
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Internal standard solution. Dissolve triphenyl phosphate (1.0 g) in acetone (100 ml). Ensure that a sufficient quantity of this solution is prepared for all samples and calibration standards to be analysed.
Calibration solution. Homogenise the permethrin working standard. When the permethrin working standard is waxy solid or partly waxy solid homogenise it by warming it to melting and by stirring. Prepare calibration solutions in duplicate. Weigh (to the nearest 0.1 mg) 90 to 110 mg (s mg) of permethrin working standard into a vial or stoppered flask (100 ml). Add by pipette internal standard solution (5 ml) and dissolve completely. Add by measuring cylinder acetone (45 ml) and mix well (Solutions C_A and C_B).

APPARATUS
Gas chromatograph equipped with a split/splitless injection and a flame ionisation detector.
Capillary column fused silica, 30 m x 0.25 (i.d.) mm, film thickness: 0.25 μm, coated with crosslinked dimethyl polysiloxane (DB-1 or equivalent)
Electric integrator or data system
PROCEDURE

(a) Gas chromatographic conditions (typical):
- **Column**: fused silica, 30 m x 0.25 (i.d.) mm, film thickness: 0.25 µm, coated with crosslinked dimethyl polysiloxane (DB-1 or equivalent)
- **Injection system**
  - **Injector**: split injection
  - **Split flow**: approximately 100 ml/min
  - **Injection volume**: 1 µl
- **Detector**: flame ionisation
- **Temperatures**
  - **Column oven**: 240°C
  - **Injection port**: 265°C
  - **Detector**: 265°C
- **Carrier gas**: helium, 30 cm/sec
- **Retention times**
  - triphenyl phosphate: about 6.5 min
  - permethrin:
    - cis-permethrin: about 12.4 min
    - trans-permethrin: about 12.9 min

(b) Linearity check. Check the linearity of the detector response by injecting 1 µl of solutions with permethrin concentrations 0.5, 1 and 2 times that of the calibration solution before conducting analysis.

(c) System equilibration. Prepare two calibration solutions. Inject 1 µl portions of the first one until the response factors obtained for two consecutive injections differ by less than 1.0%. Then inject a 1 µl portion of the second solution. The response factor for this solution should not deviate by more than 1.0% from that for the first calibration solution, otherwise prepare new calibration solutions.

(d) Preparation of sample solution. Homogenise the sample. When the sample is waxy solid or partly waxy solid homogenise it by warming it to melting and by stirring. Prepare sample solutions in duplicate for each sample. Weigh (to the nearest 0.1 mg) 90 to 110 mg (w/mg) of permethrin into a vial or stoppered flask (100 ml). Add by pipette internal standard solution (5 ml) and dissolve completely. Add by measuring cylinder acetone (45 ml) and mix well (Solutions S_A and S_B).

(e) Determination. Inject in duplicate 1 µl portions of each sample solution bracketing them by injections of the calibration solutions as follows: calibration solution C_A, sample solution S_A, sample solution S_A, calibration solution C_B, sample solution S_B, sample solution S_B, calibration solution C_A, and so on. Measure the relevant peak areas.

(f) Calculation of permethrin content. Calculate the mean value of each pair of response factors bracketing the two injections of a sample and use this value for calculating the permethrin contents of the bracketed sample injections.
\[ f_i = \frac{lr \times s \times P}{Hs} \]

Content of permethrin = \( \frac{f \times Hw}{lq \times w} \) g/kg

where:
- \( f_i \) = individual response factor
- \( f \) = mean response factor
- \( Hs \) = total peak area of permethrin (cis-permethrin + trans-permethrin) in the calibration solution
- \( Hw \) = total peak area of permethrin (cis-permethrin + trans-permethrin) in the sample solution
- \( lr \) = peak area of the internal standard in the calibration solution
- \( lq \) = peak area of the internal standard in the sample solution
- \( s \) = mass of permethrin working standard in the calibration solution (mg)
- \( w \) = mass of sample taken (mg)
- \( P \) = purity of permethrin working standard (g/kg)

Repeatability \( r \) = 9 g/kg at 953 g/kg active ingredient content
Repeatability \( R \) = 9 g/kg at 951 g/kg active ingredient content

(g) Calculation of trans-isomer ratio.

\[ \text{trans-Isomer ratio} = \frac{Hwt}{Hwc + Hwt} \times 100\% \]

where:
- \( Hwt \) = peak area of trans-permethrin in the sample solution
- \( Hwc \) = peak area of cis-permethrin in the sample solution