Spatial application mosquito repellents —
Specification —

Part 4:

Papers
In order to match with technological development and to keep continuous progress in industries, standards are subject to periodic review. Users shall ascertain that they are in possession of the latest edition.
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Foreword

Rwanda Standards are prepared by Technical Committees and approved by Rwanda Standards Board (RSB) Board of Directors in accordance with the procedures of RSB, in compliance with Annex 3 of the WTO/TBT agreement on the preparation, adoption and application of standards.

The main task of technical committees is to prepare national standards. Final Draft Rwanda Standards adopted by Technical committees are ratified by members of RSB Board of Directors for publication and gazettment as Rwanda Standards.

DRS 393-4 was prepared by Technical Committee RSB/TC 015, Pharmaceutical Products.

In the preparation of this standard, reference was made to the following standard:

1) IS 15307, Post card— Specification

The assistance derived from the above source is hereby acknowledged with thanks.

DRS 393 consists of the following parts, under the general title Spatial application mosquito repellents— Specification:

— Part 1: Coils
— Part 2: Spray
— Part 3: Candles
— Part 4: Papers
— Part 5: Liquid vaporizers
— Part 6: Matt vaporizers
— Part 7: Tablets
— Part 8: Liquid detergents

Committee membership

The following organizations were represented on the Technical Committee on Pharmaceutical Products (RSB/TC 015) in the preparation of this standard.

National Industrial Research and Development Agency (NIRDA)
National Pharmacy Council (NPC)
University of Rwanda/College of Sciences and Technology (UR/CST)
Pharmacie NOVA

Rwanda Development Board (RDB)

AGROPY LTD

IKIREZI NATURAL PRODUCTS

HORIZON/SOPYRWA

Rwanda Social Security Board (RSSB)

Pharmavie

University of Rwanda/College of Medicine and Health Sciences (UR/CMHS)

Rwanda Biomedical Center/ Malaria and Other Parasitic Diseases Division (RBC/MOPDD)

Society for Family Health (SFH) – Rwanda

Rwanda Biomedical Center/Medical Procurement and Production Division (RBC/MPPD)

INES - RUHENGERI

Rwanda Standards Board(RSB) – Secretariat
Introduction

Insecticides are used either for killing or controlling harmful insects. The insecticides which are applied for repelling insects are termed as “Repellents”. Mosquito is one of the most harmful insects for mankind. To destroy them, many preparations are available on the market in various recipes like pest killer spray, soap, oil, powder, repellent etc. Out of these, mosquito repellent is the most popular as it has germicidal and disinfectant properties and is able to repel mosquitoes and is convenient to use.

The mosquito repellent is used for warding off mosquitoes which is the most harmful insect. Nowadays, mosquito repellents are used for controlling mosquito and are complimenting other mosquito destroyers gradually. With the rise in the standard of living, increasing urbanization and population, the demand of mosquito repellent mat is constantly increasing particularly in tropical places. It is a convenient method for protection against mosquito, so it has a tremendous market potential. Thus there is a very good scope for development of such units in the country.

Spatial repellent are chemical products designed to be ‘active’ (requiring heat or electricity) or ‘passive’ (requiring no heat or electricity) and release volatile chemicals into the air within the treated space. Product examples that are currently available include mosquito coils, spray, candles, papers, liquid vaporizers, vaporizing mats, tablets and liquid detergents among others. However, many more types of spatial repellent products are waiting to be developed.

Spatial repellents elicit ‘spatial repellency’ which refers to a range of insect behaviours induced by airborne chemicals that result in a reduction in human-mosquito contact. These behaviours include: movement away from a chemical stimulus, attraction-inhibition and/or, and feeding inhibition.
Spatial application mosquito repellents — Specification — Part 4: Papers

1 Scope

This Draft Rwanda Standard prescribes the requirements, sampling and test methods for paper based mosquito repellents formulated and prepared as special paper cards infused with mosquito repellent chemicals that acts on burning the paper.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

RS 191, Refined pyrethrum concentrate — Specification

RS ISO 24153, Random sampling and randomization procedures

AOAC 973.12, d-trans-Allethrin in pesticides formulations

CIPAC 741, Determination of transfluthrin content

CIPAC 743, Determination of prallethrin (etoc) content

CIPAC 993, Determination of Metofluthrin (S1264)

CIPAC 742, Determination of d-allethrin

CIPAC 977, Determination of Meperfluthrin

RS 337-2, Mosquito repellents — Specification — Part 2: Coils containing allethrin

RS 91, Labelling and marking of pharmaceutical products — Specification

RS ISO 287, Paper and board – Determination of moisture content of a lot – Oven drying method

RS ISO 536, Paper and board — Determination of grammage.

RS ISO 535, Paper and board – Determination of water absorptiveness – Cobb method

RS ISO 534, Paper and board — Determination of thickness, density and specific volume

3 Terms and definitions

For the purposes of this standard, the following terms and definitions apply.

3.1 mosquito

any of numerous arthropod animals of the class mosquito, having an adult stage characterized by three pairs of legs and a body segmented into head, thorax, and abdomen and usually having one or two pairs of wings.

3.2 mosquito repellent

substance applied to skin, clothing or other surfaces which discourages mosquito (and arthropods in general) from landing or climbing on that surface.

3.3 paper

material manufactured in thin sheets from the pulp of wood or other fibrous substances, used for writing, drawing, or printing on, or as wrapping material.

3.4 natural repellents/biopesticides

repellents that contain natural, plant-based active ingredients

3.5 synthetic repellents

conventional repellents containing synthetic chemical active ingredients and carrier synthetic chemical compounds as approved by a competent authority.

3.6 Transfluthrin
(1R,3S)-3-(2,2-Dichlorovinyl)-2,2-dimethyl-1-cyclopropanecarboxylic acid (2,3,5,6-tetrafluorophenyl)methyl ester

3.7

Etoc

Prallethrin. (S)-2-methyl-4-oxo-3-prop-2-ynylcyclopent-2-enyl(1R)-cis, trans-2,2-dimethyl-3-(2-methylprop-1-enyl) cyclopropanecarboxylate

3.7

Metofluthrin

C_{18}H_{20}F_{4}O_{3}, 2,3,5,6-Tetrafluoro-4-(methoxymethyl)benzyl 2,2-dimethyl-3-(prop-1-en-1-yl) cyclopropanecarboxylate

3.8

d-Alethrin

(RS)-3-allyl-2-methyl-4-oxocyclopent-2-enyl (1R)-cis, trans-chrysanthemate

3.9

Meperfluthrin

C_{17}H_{16}Cl_{2}F_{4}O_{3}, [2,3,5,6-tetrafluoro-4-(methoxymethyl)phenyl)methyl (1R,3S)-3-(2,2-dichloroethyl)-2,2-dimethylcyclopropane-1-carboxylate

3.10

PBO

Piperonyl butoxide

3.11

MGK 264

N-octyl Bicycloheptene Dicarboximide
4 Requirements

4.1 General requirements

4.1.1 The paper shall consist of active ingredient(s) together with organic fillers capable of smouldering well, a binder and additives such as synergists and dye and fungicide, formulated in the form of a postcard.

4.1.2 The paper shall be free from loose fibres, bits of loose paper, dust, wood splinters, dirt, creases and any other defects that shall impair its use.

4.1.3 The paper shall be white or coloured by light tints or half tones.

4.1.4 The paper shall burn without producing any flame except at the beginning, and shall be readily extinguishable after ignition. Upon ignition, the product shall produce smoke that is capable of repelling insects.

4.2 Active ingredients

4.2.1 Natural repellents

4.2.1.1 Active ingredients used in natural repellents shall be natural plant based compounds such as essential oils or any other plant extract approved as mosquito repellents.

4.2.1.3 The manufacturer shall provide adequate data on the repellence/efficacy of such ingredients/products.

4.2.1.4 The manufacturer shall have adequate data justifying the proportion of ingredient(s) for which claims are made, used in the product.

4.2.1.5 The essential oils and plant extracts used in natural repellents shall be, but not limited to:

a) Cedarwood oil;

b) Tea tree oil;

c) Geranium oil;

d) Rosemary oil;

e) Lemongrass oil;

f) Citronella oil;

g) Soybean oil;

h) Eucalyptus oil; and
i) Cinnamon oil.

4.1.2.6 The proportion of single or blended essential oil in natural repellent shall be set by the manufacturer in accordance with specific standard (s) of the essential oil used and records shall be availed.

4.1.2.7 Pyrethrum extracts such as pyrethrins shall be considered in natural repellents. The limits of pyrethrins in natural repellents shall not be less than 0.5 % and the extract used shall meet the requirements of RS 191.

4.2 Synthetic repellents

4.2.2.1 Synthetic repellents shall contain synthetic chemical compounds which are able to discourage mosquitoes and send them flying or crawling away.

4.2.2.2 If the synthetic chemical compound is blended with other active ingredient (s), either natural or synthetic, the proportion shall be set by the manufacturer based on scientific research and records shall be availed.

4.2.2.3 Active ingredients and their content in synthetic repellents shall meet the requirements prescribed in table 1.

Table 1 — Active ingredients content for synthetic repellents

<table>
<thead>
<tr>
<th>S/N</th>
<th>Active ingredient</th>
<th>Limits (% w/w)</th>
<th>Identification method</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Picaridin</td>
<td>0.2 – 5</td>
<td>CIPAC 740</td>
</tr>
<tr>
<td>3</td>
<td>DEET</td>
<td>5 – 50</td>
<td>Annex A</td>
</tr>
<tr>
<td>4</td>
<td>Permethrin, max</td>
<td>13</td>
<td>Annex B</td>
</tr>
<tr>
<td>5</td>
<td>Transfluthrin, max</td>
<td>1</td>
<td>CIPAC 741</td>
</tr>
<tr>
<td>6</td>
<td>Etoc</td>
<td>0.5 – 1.5</td>
<td>CIPAC 743</td>
</tr>
<tr>
<td>7</td>
<td>Metofluthrin (S1264), max</td>
<td>1.82</td>
<td>CIPAC 993</td>
</tr>
<tr>
<td>8</td>
<td>d-Alethrin (Pynamin Forte), max</td>
<td>0.5</td>
<td>CIPAC 742</td>
</tr>
<tr>
<td>9</td>
<td>Meperfluthrin</td>
<td>0.05 – 0.1</td>
<td>CIPAC 977</td>
</tr>
</tbody>
</table>

4.2.2.4 Synthetic repellents and their active ingredients shall be approved and registered by competent authority before being released to the market.

4.3 Specific requirements

The product shall comply with the specific requirements given in table 2 when tested according to the methods described therein.

Table 2 — Specific requirements for paper repellent

<table>
<thead>
<tr>
<th>S/N</th>
<th>Parameter</th>
<th>Requirements</th>
<th>Test method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Moisture content</td>
<td>120</td>
<td>RS ISO 287</td>
</tr>
<tr>
<td>2</td>
<td>Density, gsm</td>
<td>140 – 500</td>
<td>RS ISO 534</td>
</tr>
<tr>
<td>3</td>
<td>Thickness, mm</td>
<td>0.22 – 0.25</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Burning time</td>
<td>1 h</td>
<td>RS 337-2</td>
</tr>
</tbody>
</table>
5. Nominal grammage, g/m² | 205 | RS ISO 536
6. Smoothness (bendtsen), ml/min, for both sides | 50 – 120 | RS ISO8791-1
7. One minute cob value, max (for both top and wire side) | 20 | RS ISO 535
   | 15º across the grain | 20 – 40 |
9. Tear index (MD), mN m²/g, min. | 4 | RS ISO 1974
10. Porosity (Gurley), 100 ml/s, min. | 50 | RS ISO5636-3

4.4 Biological efficacy

When tested in accordance with DRS 394-2, the product shall have repelled 100 % of the mosquitoes available in space, within protection time indicated by the manufacturer.

5  Packaging and labelling

5.1 Packaging

The product shall be packaged in a container which offers protection from breakage and maintains the integrity of the product.

5.2 Labelling

The containers shall be securely closed and in addition to the labelling requirements of RS 91, the following information shall be legibly and indelibly labeled on the container:

a) name of the product;

b) name and full address of the manufacture;

c) batch number;

d) date of manufacture and expiry;

e) size of the paper;

f) nominal grammage;

g) total number of papers in the box;

h) active ingredient content;
i) protection time;

j) net mass of the product;

k) directions for use;

l) safety caution;

m) special people whose exposure is prohibited (children and pregnant women);

o) storage conditions.

6 Sampling

Random samples of the papers shall be drawn for test in accordance with RS ISO 24153 from the market, factory or anywhere else.
Annex A  
(normative)

Determination of DEET content

A.1 General

The sample is dissolved in carbon disulfide and the difference in absorbance at 14.18 µm and at 14.48 µm is determined. The quantity of meta-isomer is obtained from this value by means of a calibration curve prepared by the use of a reference standard.

A.2 Apparatus

F.2.1 Double-beam infrared spectrophotometer. Perkin-Elmer model 21 or equivalent.

F.2.2 Two equivalent infrared absorption cells, with sodium chloride windows and a path length of approximately 0.4 mm.

A.3 Preparation of calibration curve

F.3.1 Weigh (to the nearest 0.1 mg) into four volumetric flasks sufficient amounts of the reference DEET standard of known purity to give concentrations of approximately 20, 40, 60 and 80 g/L when dissolved in carbon disulfide.

F.3.2 Fill the reference cell with carbon disulfide and the sample cell with each of the standard solutions in turn, and record the spectra. The spectrum may be scanned rapidly, except for the region 12 – 15 µm, where a normal speed should be used. Carry out a blank measurement with carbon disulfide to correct for any inequality in the paired cells and to determine whether a cell correction is required.

F.3.3 Measure the absorbance at 14.18 µm and at 14.48 µm and calculate the difference between these values, ΔA, for each of the solutions. Plot the values of ΔA against the concentration (g/l) of the meta-isomer.

F.3.4 If a cell correction is required, the value of ΔA is determined from the formula:

\[ \Delta A = [A_{14.18} - A_{14.48}]_{\text{ref.}} - [A_{14.48}]_{\text{blank}} \]

Where ref. = determination with reference standard  
blank = determination on CS$_2$ blank

A.4 Procedure

Weigh (to the nearest 0.1 mg) about 0.5 g of the sample, transfer quantitatively to a 10 mL volumetric flask, and make up to the mark with carbon disulfide. Measure the infrared absorption at 14.18 µm and 14.48 µm using the same conditions as described in section A.3. Determine the concentration of meta-isomer by comparing this value with the calibration curve. A standard sample should be run each day to check the calibration of the instrument.
A.5 Calculation

DEET content (g/kg) = \( \frac{C_1 \times P}{C_2} \)

Where,

\( C_1 \) = concentration (g/L) of standard DEET found from calibration curve

\( C_2 \) = concentration (g/L) of sample taken

\( P \) = purity (g/kg) of the reference standard.
Annex B  
(normative)

Determination of permethrin

Permethrin as one of the active ingredients in this product may be determined using HPLC by injecting a solution of analyte into a chromatograph, followed by separation and comparison of peak areas of the analyte in the sample with that of an external standard.

B.1 Reagents

Cis – Permethrin, 99%

Trans - Permethrin, 99%

Methanol HPLC grade

Water, HPLC grade

B.2 Apparatus

An HPLC equipped with an auto sampler, a variable wavelength detector (or equivalent) and a column (phenomena x, 250 x 4.6mm Luna Phenyl 5μ Reverse phase (or equivalent)

B.3 Operating conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow rate</td>
<td>1.0mL/min</td>
</tr>
<tr>
<td>Solvent composition</td>
<td>60% : 40% (Methanol: Water)</td>
</tr>
<tr>
<td>Elution</td>
<td>Isocratic</td>
</tr>
<tr>
<td>Column temperature</td>
<td>40°C</td>
</tr>
<tr>
<td>Wavelength</td>
<td>240nm</td>
</tr>
<tr>
<td>Injection volume</td>
<td>25 μL</td>
</tr>
<tr>
<td>Stop time</td>
<td>50 minutes</td>
</tr>
<tr>
<td>Post time</td>
<td>2 minutes</td>
</tr>
</tbody>
</table>

B.4 Procedure

B.4.1 Preparation of standard solution

Weigh about 0.001g (to the nearest 0.0001g) Permethrin standard in beaker, use methanol-dissolved and transfer them into a separate volumetric flasks (50 ml), dilute to the mark and mix well.
B.4.2 Preparation of Solution

Weigh about 0.02 g (to the nearest 0.0001g) Permethrin test sample into beaker, use methanol dissolved and transfer them into a separate volumetric flasks (50 ml), dilute to the mark and mix well.

B.4.3 Determination

After the chromatograph is stable, make a minimum of three injections of the standard as well as for the sample and average the area counts. The relative standard deviation between injections should be within 2%.

B.5 Calculation

The % of either cis or trans isomers is calculated as follows;

\[
\%\text{cis or transpermethrin} = \frac{\text{Averagesamplearea} \times \text{weight of std} \times \text{purity (in%)}\}}{\text{Average std area} \times \text{weight of sample}}
\]

Report the concentration of permethrin as the total of Cis and Trans.
Bibliography


[3] IS 1060-1, Methods of sampling and testing for paper and allied products: Part I


[5] IS 1060-3, Methods of sampling and test for paper and allied products, Part III
