8.23 LONG-LASTING TREATED STORAGE BAGS (LB)

**Introduction**

For the purposes of this guideline, a “long-lasting treated storage bag” is a woven polymer fibre bag with a pesticide active ingredient incorporated into the fibre or coated on the surface of the fibre. The storage bag is intended for postharvest storage of commodities including cereal grains, pulses and seeds and provides control of pests before they can infest the stored commodities. The pesticide is released to the surface of the material in a sustained manner so that the commodities stored in the bags are continuously protected against pest infestation over a certain time period (at least 2 years, over multiple seasons).

To evaluate the migration of the active ingredient the proposed methodology lends itself from the CIPAC method MT195 (Wash resistance index of long-lasting nets). Whilst it is understood that the bags are unlikely to be washed, it provides a validated method for release and migration properties of the active ingredient to the surface of the polymer material.

Accelerated storage clauses were divided into two sub sections as sampling and sub sampling for chemical and physical tests require different schemes (5.1 & 5.2).

In case the fibre material is a polyolefin (HDPE, PP), an anti-slip weave in the weaving pattern is recommended. Storage bags made of e.g. polypropylene tend to slip when stacked and therefore present a hazard. The anti-slip weave increases the frictional force between stacked bags and reduces the hazard of falling bags. The presence of an anti-slip weave may be checked by a visual inspection counting ends versus picks and comparison with known anti-slip weaving patterns. The anti-slip weave should be noted on the label of the storage bag.

**Food contact material**

The polymer material used to produce the yarn must be virgin (non-recycled) polymer and comply with international regulations concerning food contact material.

These are:

* **Migration of polyolefins**. If the polymer is a polyolefin (HDPE, PP) migration of polyolefin shall be tested as per US FDA 21 CFR Part 177-1520 or EU Directive 10/2011 for food contact substances.
* **Migration of heavy metals.** Migration of heavy metals shall be tested as per BS EN 1186:2002 or TIS-656-2529 (1986) or other suitable ASTM method wherein the sum concentration levels of lead, cadmium, mercury and hexavalent chromium shall not exceed 100 ppm.
* **Residues of pesticide on the stored commodity**. The residues of the pesticide(s) incorporated or coated in the bag on the stored commodity should be determined and should comply with the CODEX Alimentarius Maximum Residue Levels (MRLs) for the pesticide and commodity combinations.

These parameters are not part of the specification, but should be covered in the supporting documentation of the proposer for establishment of a LB specification.

**Distribution of the active ingredient over the bag material**

Manufacturers should control and minimize the within-product heterogeneity of active ingredient and provide a sub-sampling scheme to represent the active ingredient of the product unit. The example sampling scheme given in this specification is a suggested method.

**Physical properties**

The ISO standard 23560:2015 (Woven polypropylene sacks for bulk packaging of foodstuffs) describes “the construction of the sacks, their dimensions, and test methods suitable for ensuring the long-term storage and transportation of foodstuffs in the sacks” (end of quote). The properties and testing of long-lasting treated storage bags in this LB guideline are harmonized with the requirements in this standard. In particular, the average breaking strength and elongation at break (clause 4.1), the breaking strength of bottom seam (clause 4.2) before and after accelerated storage test and resistance to UV and weathering (clause 6) are adopted from that ISO standard. Table 1 in ISO 23560:2015 (Required construction parameters of fabric and sacks) summarizes parameters and requirements with tolerances together with test methods to be used.

**Storage stability**

Empty or full storage bags may or may not be protected from sunlight. An additional storage stability clause for UV stability of the fabric has therefore been introduced. If a claim for UV stability is made then the clause for UV stability must be included (clause 6).

 Note for preparation of draft specifications. Do not omit clauses or insert additional clauses, nor insert limits that are more lax than those than given in the guidelines, without referring to Section 4. From the “Notes” provided at the end of this guideline, incorporate only those which are applicable to the particular specification.

….. [ISO common name] (INCORPORATED/COATED ONTO FILAMENT) LONG-LASTING STORAGE BAG

[CIPAC number]/LB (month & year of publication)

8.23.1 **Description** (Note 1)

 The product shall be formed from (or in the form of) a storage bag suitable for agricultural commodities, consisting of mono-/poly-filament, [polymer type] fibres, having a width of ….. mm, woven/non-woven coating/incorporating technical/formulated ….. [ISO common name] complying with the requirements of FAO specification ….. [CIPAC number/technical or formulation code (date)], together with any other necessary formulants, if required. The product shall appear clean and shall be free from visible extraneous matter, visible damage (such as splitting or tearing) and visible manufacturing defects (such as poorly made seams or a weave that is either not uniform or too loose to remain uniform in use) (Note 2), and shall be suitable for use as storage bag with long-lasting activity and with/without UV resistance (Notes 3 & 4).

8.23**.**2 **Active ingredient**

 8.23.2.1 **Identity tests** (Note 5)

 The active ingredient shall comply with an identity test and, where the identity remains in doubt, shall comply with at least one additional test.

 8.23.2.2 **….. [ISO common name of active ingredient] content** (Notes 5 & 6)

 The ….. [ISO common name] content shall be declared (….. g/kg) and, when determined, the average measured content shall not differ from that declared by more than the appropriate tolerance, Section 4.3.2.

8.23.2.3 **….. [ISO common name of active ingredient] isomer ratio** (Note 7), if required

 The ratio of ….. [ISO common name of active ingredient] isomers shall be in the range ….. to …..

8.23.2.4 **….. [ISO common name of active ingredient] wash resistance index** (MT 195) (Note 8)

The wash resistance index of ….. [ISO common name of active ingredient] from the bag material, when determined, shall be within the range ….. to …..%.

8.23.3 **Relevant impurities**

 8.22.3.1 **By-products of manufacture or storage** (Note 9), if required

Maximum: …..% of the ….. [ISO common name of active ingredient] content found under 2.2.

8.23.4 **Physical properties**

 8.23.4.1 **Average breaking strength and elongation at break** (ISO 23560:2015, Table 1)

 The average breaking strength lengthwise and width wise shall not be less than 918 N for a 50 kg bag and 816 N for a 25 kg bag, respectively. The elongation at break of fabric lengthwise and width wise should comply with ISO 23560:2015, as per Table 1.

8.23.4.2 **Breaking strength of bottom seam** (ISO 23560:2015, Table 1)

 The minimum average breaking strength of the bottom seam of the bag shall not be less than 377 N for a 50 kg bag and 337 N for a 25 kg bag, respectively.

8.23.5 **Storage stability**

 8.23.5.1 **Chemical** **stability at elevated temperature** (CIPAC MT 46.3.4) (Note 10)

 After storage at 54 ± 2 °C for 2 weeks (Note 11), the determined active ingredient content shall not be lower than 95%, relative to the determined average content found before storage (Note 12) and the product shall continue to comply with the clauses for:

 - Isomer ratio (8.22.2.3), if required,

 - Wash resistance index (8.22.2.4),

 - Relevant impurities (8.22.3.1), if required.

8.23.5.2 **Physical stability of bags at elevated temperature** (MT 46.3) (Note 13)

 After storage at 54 ± 2 °C for 2 weeks, the product shall continue to comply with the clauses for physical properties:

- Average breaking strength and elongation at break(8.22.4.1),

- Breaking strength of bottom seam(8.22.4.2),

8.22.6 **UV Resistance** (ISO 4892-3:2008, Table 4, Method A, Cycle No.1)
(Note 14), if required

Bags shall retain at least …..% of active ingredient when tested after exposure to UV radiation and weathering for 144 h and the breaking strength of bottom seam shall not be lower than 50% of the original measure without UV exposure.

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Note 1 The specification may apply to bags in bulk or made up bags which may be of different capacity made up of woven crushed tapes or non-woven. The bags must be made up of virgin polymer e.g. polypropylene or HDPE and may be white or coloured. These bags are expected to last in the warehouse for at least 2 years.

Note 2 Occasional short lengths of loose yarns present in made up bags are not considered to be extraneous matter.

Note 3 Long-lasting pesticide treated storage bags are expected to retain their biological activity and tensile strength during the lifespan and through an exposure to UV over a specified number of hours when tested as per Note 14.

Note 4 Flammability of the product is not part of the specification but it should be measured by the manufacturer, according to 16 CFR Part 1610, and the result presented on the package.

Note 5 Methods for identification and determination of the active ingredient content must be CIPAC, AOAC or equivalent. If the methods have not yet been published then full details, with appropriate method validation data, must be submitted to FAO/WHO by the proposer. The sampling scheme should consider the within-product variation. For active ingredient content, homogenization of sample before taking portions before and after storage and keeping the sample in a capped bottle are recommended.

Note 6 A recommended sampling scheme is presented in Figure 1. Samples must be sufficiently large to conduct all tests required and representative of the fabric. Except where seams are to be tested, do not test material within 10 cm of seams or selvedge.

 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 analysed/tested with minimum delay. Representative portions (sub-samples) for testing should be taken as described in each test method.

Note 7 Methods for determination of isomer ratio must be peer validated.

Note 8 The CIPAC method MT 195 for determination of wash resistance index of LN was adopted as full CIPAC method in 2013, but the method is not yet published in a Handbook. Prior to publication in a Handbook, copies of the method may be obtained through the CIPAC website, <http://www.cipac.org/index.php/methods-publications/pre-published-methods>. The CIPAC method was developed for LN formulations, but is considered to be applicable to similar textile based slow release formulations as storage bags as well.

Note 9 Methods for determination of relevant impurities must be peer validated, as a minimum. If it is not published, full details of the method and the peer-validation data must be provided.

Note 10 The CIPAC method MT 46.3.4 for accelerated storage of LN samples was adopted as full CIPAC method in 2015, but the method is not yet published in a Handbook. Prior to publication of the Handbook, copies of the method may be obtained through the CIPAC website, <http://www.cipac.org/index.php/methods-publications/pre-published-methods>. The CIPAC method was developed for LN formulations, but is considered to be applicable to similar textile based slow release formulations as storage bags as well.

Note 11 Unless other temperatures and times are specified. Refer to Section 4.6.2 for alternative storage conditions.

Note 12 Samples of the bag material before and after the storage stability test may be analyzed concurrently (i.e. after storage) in order to reduce the analytical error. The manufacturer shall demonstrate the sub-sampling design provides homogenized analytical portions for before and after storage stability test.

Note 13 The CIPAC method MT 46.3.2 is used where the entire bag is stored at 54 ± 2°C for 2 weeks in order to test the physical properties and appropriate samples are taken after the storage from the bag.

Note 14 UV radiation and weathering test to be conducted as per procedure given in ISO 4892-3:2006, Table 4, Method A, Cycle No.1

Figure 1 Recommended 6 positions, 3 from each side, cut along the diagonal with at least 10 cm from any edge to make up a representative sample for a product unit.

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