



Food and Agriculture Organization
of the United Nations

AGP: CP/58

**FAO SPECIFICATIONS
FAO PLANT PROTECTION PRODUCTS**

SULPHUR

**FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 1973**

DISCLAIMER¹

FAO specifications are developed with the basic objective of promoting, as far as practicable, the manufacture, distribution and use of pesticides that meet basic quality requirements.

Compliance with the specifications does not constitute an endorsement or warranty of the fitness of a particular pesticide for a particular purpose, including its suitability for the control of any given pest, or its suitability for use in a particular area. Owing to the complexity of the problems involved, the suitability of pesticides for a particular purpose and the content of the labelling instructions must be decided at the national or provincial level.

Furthermore, pesticides which are manufactured to comply with these specifications are not exempted from any safety regulation or other legal or administrative provision applicable to their manufacture, sale, transportation, storage, handling, preparation and/or use.

FAO disclaims any and all liability for any injury, death, loss, damage or other prejudice of any kind that may arise as a result of, or in connection with, the manufacture, sale, transportation, storage, handling, preparation and/or use of pesticides which are found, or are claimed, to have been manufactured to comply with these specifications.

Additionally, FAO wishes to alert users to the fact that improper storage, handling, preparation and/or use of pesticides can result in either a lowering or complete loss of safety and/or efficacy.

FAO is not responsible, and does not accept any liability, for the testing of pesticides for compliance with the specifications, nor for any methods recommended and/or used for testing compliance. As a result, FAO does not in any way warrant or represent that any pesticide claimed to comply with a FAO specification actually does so.

¹ This disclaimer applies to all specifications published by FAO.

INTRODUCTION TO FAO SPECIFICATIONS DEVELOPED UNDER THE OLD PROCEDURE

Between 1973 and 2000, FAO published booklets of specifications for technical materials and related formulations of plant protection products. Revisions of, and additions to, already published specifications will be issued when necessary. However, all changes and revisions of FAO specifications are now subject to the new procedure described in the *Manual on the development and use of FAO and WHO Specifications for Plant Protection Products*, FAO Plant Production and Protection Paper No. 173, Rome 2002 (*Revised First Edition* available only on the FAO home page of the Internet at: <http://www.fao.org/pest-and-pesticide-management/en/>)

FAO specifications developed under the old procedure are based on the requirements defined in the Fourth Edition of the *Manual on the development and use of FAO specifications for plant protection products*, Plant Production and Protection Paper No. 128, Rome 1995.

This manual contained detailed definitions and other essential background information on basic procedures and technical principles adopted by the group on Pesticide Specifications of the FAO Panel of Experts on Pesticide Specifications, Registration Requirements, Application Standards and Prior Informed Consent, such as:

1. Categories of Specifications (Section 3.1 of the Manual)

FAO Tentative Specifications (Code 'S/T', formerly 'TS') are those which have been recommended by FAO as preliminary specifications and which are based on minimum requirements. The methods of analysis cited are normally supplied by the manufacturer or may already have been published or be the subject of collaborative work.

FAO Provisional Specifications [Code 'S/P', formerly ('S')] are those for which more evidence of the necessary parameters is available and where some collaborative study of the methods of analysis has been carried out.

FAO (full) Specifications (Code 'S/F', formerly 'S').

Specifications that have all necessary requirements together with CIPAC (full) methods, or other collaboratively studied (proven) methods.^{2,3}

Wherever possible, standards for apparatus and common names for pesticides are those approved by the International Organization for Standardization (ISO).

2. Expression of active ingredient content (Section 4.2.5 of the Manual)

- for solids, liquid technical materials, volatile liquids (of maximum boiling point 50°C) and viscous liquids (with minimum kinematic viscosity of $1 \times 10^3 \text{ m}^2/\text{s}$ at 20°C) the FAO Specification shall be based on expression of the content as g/kg;

- for all other liquids the active ingredient content of the product shall be declared in terms of g/kg *or* g/l at 20°C. If the customer requires both g/kg *and* g/l at 20°C, then in case of dispute the analytical results shall be calculated as g/kg.

3. Tolerance on content (Section 4.2.7 of the Manual)

A declared content of active ingredient must be included in all specifications, and one of the problems immediately arising is the level of tolerance acceptable about the nominal figure. The tolerance is influenced by (a) the reproducibility of the method of analysis, (b) the sampling error and (c) the manufacturing variance.

Allowable variations in analytical results (i.e. tolerances in content of active ingredient) with respect to specific pesticide consignments are intended to cover reasonable variations in the contents of active ingredients. For examples of such tolerances, see the table in Section 4.2.7 of the Manual.

4. Containers/packaging

FAO guidelines are in preparation.

Containers shall comply with pertinent national and international transport and safety regulations.

Technical materials, dustable powders and granules

Containers shall be suitable, clean, dry and as specified, and shall not adversely affect, or be affected by, the contents, but shall adequately protect them against external conditions.

Wettable powders

The product shall be packed in suitable, clean, dry containers as specified in the order. The container shall provide all necessary protection against compaction, atmospheric moisture, loss by vaporization and/or contamination to ensure that the product suffers no deterioration under normal transit and storage conditions.

The product shall be protected by an adequate moisture barrier. This may be a suitable bag of polyethylene or alternative means of giving equal or better protection.

Solutions and emulsifiable concentrates

Containers shall be lined, where necessary, with a suitable material, or the interior surfaces shall be treated to prevent corrosion and/or deterioration of the contents.

Additional information should be given in all specifications where particular pesticides present problems in packaging.

5. Biological information

Phytotoxicity

No test can be specified to cover the possible phytotoxicity of a formulation to all crops. When a crop is not mentioned in the instructions for use, purchasers should check with the supplier that the material is suitable, always provided that such a use is not restricted or legally forbidden.

Wetting of crops

The dilute spray should satisfactorily wet the leaves of the specified crops when used in accordance with the instructions. Test method MT 53.2, CIPAC F, p.162, may be useful.

¹ *Should national pesticide specifications developed from these approved FAO specifications deviate from them, the National Authority responsible for making such changes is requested to inform the FAO Plant Protection Service of the nature of, and the reasons for, the modifications.*

² *Methods of analysis and miscellaneous techniques referred to in these specifications have been developed and adopted by CIPAC (Collaborative International Pesticides Analytical Council Ltd.). See CIPAC Handbooks 1 (1970), 1A (1980), 1B (1983), 1C (1985), D (1988), E (1993), F (1995), G (1995), CIPAC Proceedings 1980 and 1981, obtainable from Black Bear Press Limited, King's Hedges Road, Cambridge CB4 2PQ, England. The page numbers of specific methods are given in parentheses in the specifications. Copies of methods not yet published can be obtained from the FAO Plant Protection Service.*

³ *Information on standard waters for laboratory evaluation of pesticidal formulations will be found in CIPAC Monograph 1, Standard Waters and an FAO Survey on Naturally Occurring Waters (1972), Black Bear Press Limited, King's Hedges Road, Cambridge CB4 2PQ, England.*

SUBMISSION OF DRAFT SPECIFICATIONS TO FAO

Any organization, commercial firm or interested individual is encouraged to submit relevant specifications, or proposals for revision of existing specifications, for pesticide products for consideration and possible adoption by FAO. Correspondence should be addressed to the Pesticide Management Group, Plant Production and Protection Division, FAO, Viale delle Terme di Caracalla, 00153 Rome, Italy.

General guidelines on preparing draft specifications are given in the *Manual on the development and use of FAO and WHO Specifications for Plant Protection Products*, FAO Plant Production and Protection Paper No. 173, Rome 2002 (Revised First Edition available only on the FAO home page of the Internet at: <http://www.fao.org/pest-and-pesticide-management/en/>).

Specifications which are considered suitable for further processing are assigned priorities and circulated to appropriate organizations and specialists to comment. Comments, together with other relevant information, are then reviewed in detail by the Group on Specifications of the FAO Panel of Experts on Pesticide Specifications, Registration Requirements, Application Standards and Prior Informed Consent. The drafts are converted into FAO Provisional Specifications, or full FAO Specifications.

SULPHUR DUSTS

FAO Specification Code 18/2/S/4

.1 DESCRIPTION

The product shall be a homogeneous mixture containing sulphur as the only active ingredient, together with suitable fillers and any necessary formulants. It shall be a fine, free flowing, dustable powder, free from visible extraneous matter and hard aggregates.

.2 ACTIVE INGREDIENT

.2.1 *Sulphur* (See CIPAC I, p. 636, section 1.2, method 18/2/W/1.2)

The sulphur content of the product shall be declared and, when determined, the content obtained shall not differ from that declared by more than $\pm 2.5\%$ of the declared content.

.3 IMPURITIES

.3.1 *Arsenic* (Ibid., p. 637, section 1.4, method 18/2/m/1.4)

Maximum: $5.0\underline{x}$ ug/g, where \underline{x} is the percentage of sulphur declared under .2.1 (see note 1)

.4 PHYSICAL PROPERTIES

.4.1¹ *Flowability* (Ibid., p/ 637, section 1.5, method 18/2/(M)/1.5)

Under consideration.

.4.2 *Wet Sieve Test* (Ibid., p. 637, section 1.3, method 18/2/M/1.3)

Minimum: Not less than 98% of the product shall pass completely through a 53 um test sieve.

.5 STORAGE STABILITY

.5.1 *Heat Stability* (Ibid., p. 637, section 1.6, method 18/2/M/1.6)

After storage at $54\pm 2^\circ\text{C}$ for 14 days, the product shall continue to comply with .2.1, .4.1, and .4.2.

.6 CONTAINERS

Containers shall be suitable, clean, dry and as specified in the order. They shall not affect, or be affected by the product, but shall adequately protect it from external influences.

¹ For information

Containers shall comply with pertinent national and international transport and safety regulations.

.7 BIOLOGICAL PROPERTIES

.7.1¹ *Phytotoxicity*

At the present stage of our knowledge, no tests can be specified to cover phytotoxicity of formulations to crops.

When a certain crop is not specifically mentioned in the instructions for use, purchasers should check with the supplier to ensure that the product is suitable, always provided that the proposed use is not restricted or legally forbidden.

¹ For information

SULPHUR DISPERSIBLE POWDERS

FAO Specification Code 18/3/S/5

.1 DESCRIPTION

The product shall consist of a homogeneous mixture containing sulphur as the only active ingredient, together with suitable carriers and any necessary formulants. It shall be a free flowing powder, free from visible extraneous materials and hard aggregate.

.2 ACTIVE INGREDIENT

.2.1 *Sulphur* (See CIPAC I, p. 637, section 1.2, method 18/3/M/1.2)

.2.1.1 *Minimum*

Minimum: 70%.

.2.1.2 *Declared Content*

The sulphur content of the product shall be declared and, when determined, the content obtained shall not differ from that declared by more than ± 2.5 percentage units.

.3 IMPURITIES

.3.1 *Arsenic* (Ibid., p. 640 section 1.6, method 18/3/m/1.6)

Maximum: $5.1\underline{x}$ ug/g, where \underline{x} is the percentage of sulphur declared under .2.1.2 (see note 2)

.4 PHYSICAL PROPERTIES

.4.1 *Wet Sieve Test* (Ibid., p. 640, section 1.5, method 18/3/M/1.5)

Maximum: Not more than 0.05% of the product shall remain on a 75 um test sieve.

.4.2 *Particle Size Distribution* (Ibid., p. 637, section 1.3, method 18/3/M/1.3)

The sulphur shall be present in particles of diameters as follows:

Minimum: 40% of 6 um, or less.

Minimum: 9% of 2 um, or less (see note 3).

.4.3 *Suspensibility* (Ibid., p. 639 section 1.4, method 18/3/M/1.4)

A minimum of 80% of the sulphur content declared under .2.1.2 shall be in suspension after 30 min. in CIPAC Standard Water A, when determined on the product as received, and 80% in CIPAC Standard Water C, after the Heat Stability Test.

Alternatively, if the buyer requires other CIPAC Standard Waters to be used, he should specify accordingly when ordering.

.4.4 *Wettability of the Product* (Ibid., p. 640, section 1.7, method 18/3/M/1.7)

It shall be completely wetted in 1 min, without swirling.

.4.5 *Persistent Foam* (Ibid., p. 640, section 1.8, method 18/3/M/1.8)
Maximum: 25 ml of foam after 1 min.

.5 STORAGE STABILITY

.5.1 *Heat Stability* (Ibid., p. 640, section 1.10, method 18/3/M/1.10)
After storage at $54 \pm 2^{\circ}\text{C}$ for 14 days, the product shall continue to comply with .2.1, .4.1 (see note 8), and with .4.2 and .4.4.

.6 CONTAINERS

The product shall be packed in suitable, clean, dry containers as specified in the order. The container shall provide all necessary protection against compaction, atmospheric moisture, oxidation, loss by vaporization and/or contamination with the container material to ensure that the product suffers no deterioration under normal transit and storage conditions.

The product shall be protected by an adequate moisture barrier. This shall be an inner bag of polyethylene (see note 4) or alternative means of giving equal or better protection.

.7 BIOLOGICAL PROPERTIES

.7.1¹ *Phytotoxicity*

At the present stage of our knowledge, no tests can be specified to cover phytotoxicity of formulations to crops.

When a certain crop is not specifically mentioned in the instructions for use, purchasers should check with the supplier to ensure that the material is suitable, always provided that the proposed use is not restricted or legally forbidden.

.7.2 *Wetting of Crops* (Ibid., p. 640, section 1.9, method 18/3/M/1.9)

The dilute spray shall satisfactorily wet the leaves of the specified crops when used in accordance with the instructions.

However, owing to wide variations in crops and diseases, no specific figures can be assigned to wetting of crops, but this test may prove useful.

¹ For information

SULPHUR AQUEDOUS DISPERSIONS

FAO Specification Code 18/7/S/5

.1 DESCRIPTION

The product shall consist of an aqueous dispersion containing sulphur as the only active ingredient, together with any necessary formulants.

.2 ACTIVE INGREDIENT

.2.1 *Sulphur* (See CIPAC I, p. 641, section 1.2, method 18/7/M/1.2)

.2.1.1 *Minimum Content*
Minimum 40% w/w.

.2.1.2 *Declared Content*
The sulphur content of the product shall not differ from that declared by more than $\pm 5\%$ of the declared content.

.3 IMPURITIES

.3.1 *Arsenic* (Ibid., p. 641, section 1.6, method 18/7/m/1.6)
Maximum: $5.0\bar{x}$ ug/g, where \bar{x} is the percentage of sulphur declared under .2.1.2 (see note 5).

.4 PHYSICAL PROPERTIES

.4.1 *Wet Sieve Test* (Ibid., p. 641, section 1.5, method 18/7/M/1.5)
Maximum: Not more than 0.05% of the product shall remain on a 75 um test sieve.

.4.2 *Particle Size Distribution* (Ibid., p. 641, section 1.3m method 18/7/M/1.3)
The sulphur shall be present in particles of diameters, as follows:
Minimum: 90% of 6 um, or less
Minimum: 55% of 2 um, or less (see note 6)

.4.3 *Suspensibility* (Ibid., p. 641, section 1.4, method 18/7/M/1.4)
A minimum of 80% of the sulphur content, declared under .2.1.2, shall be in suspension after 30 min in CIPAC Standard Water A, when determined on the product as received and 80% in CIPAC Standard Water C, after the Heat Stability Test.

Alternatively, if the buyer requires other CIPAC Standard Waters to be used, he should specify accordingly when ordering.

.5 STORAGE STABILITY

.5.1 *Heat Stability* (Ibid., p. 641, section 1.8, method 18/7/M/1.8)

After storage at $54 \pm 2^{\circ}\text{C}$ for 14 days in a closed container, the product shall continue to comply with .2.1, .4.1 and .4.2.

.6 CONTAINERS

They shall be lined, where necessary, with a suitable material, or the interior surfaces shall be treated to prevent corrosion and/or deterioration of the contents.

Containers shall comply with pertinent national and international transport and safety regulations.

.7 BIOLOGICAL PROPERTIES

.7.1¹ *Phytotoxicity*

At the present stage of our knowledge, no tests can be specified to cover phytotoxicity of formulations to crops.

When a certain crop is not specifically mentioned in the instructions for use, purchasers should check with the supplier to ensure that the product is suitable, always provided that the proposed use is not restricted or legally forbidden.

.7.2¹ *Wetting of Crops* (Ibid., p. 641, section 1.7, method 18/7/M/1.7)

The dilute spray shall satisfactorily wet the leaves of the specified crops when used in accordance with the instructions.

However, owing to wide variations in crops and diseases, no specific figures can be assigned to wetting of crops, but this test may prove useful.

¹ For information

NOTES

1. On a declared content of 50% sulphur, the maximum permitted amount of arsenic would be 50×5 ug/g, i.e. 250 ug/g.
2. On a declared content of 70% sulphur, the maximum permitted amount of arsenic would be 70×5 ug/g; i.e. 350 ug/g.
3. On a declared content of 70% sulphur, the minimum permitted percentage of particles of 6 um or less in diameter would be 28%, and that of less than 2 um would be 6.3%. For a declared content of 80%, the respective figures would be 32% and 7.2%
4. Because of variation in the nature and size of the container, its destination, and other factors, it is not possible to specify the thickness of the polyethylene, but as a guideline for a container with 50 kg of product the inner liner should be not less than 0.075 mm thick.
5. On a declared content of 40% sulphur, the maximum permitted amount of arsenic would be 40×5 ug/g; i.e. 200 ug/g.
6. On a declared content of 40% sulphur, the minimum permitted amount of sulphur present in the form of particles of 6 um or less would be 36%, and that of less than 2 um would be 22%. For a declared content of 50%, the respective figures would be 45% and 27.5%.
7. In hot climates particles should be somewhat coarser than in cold climates.