Food and Agriculture Organization
of the United Nations

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FAO SPECIFICATIONS
FOR PLANT PROTECTION PRODUCTS

FENTIN ACETATE
Triphenyltim acetate

AND

FENTIN HYDROXIDE
Triphenyltin hydroxide

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 1988

Group on Pesticide Specifications

FAO Panel of Experts on Pesticide Specifications, Registration Requirements and Application Standards

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DISCLAIMER

FAO specifications are developed with the basic objective of ensuring, as far as possible, that pesticides complying with them are satisfactory for the purpose for which they are intended. However, the Group on Pesticide Specifications of the FAO Panel of Experts on Pesticide Specifications, Registration Requirements, Application Standards and Prior Informed Consent wishes to emphasize that, owing to the complexity of the problem involved, questions such as the suitability of pesticides for the control of a particular pest must be decided at national or provincial level. These specifications should not be assumed to be an endorsement of the use of a particular compound for a given purpose by either the Group of Experts or FAO.

Accordingly, neither the Food and Agriculture Organization of the United Nations (FAO) nor the members of the Group on Pesticide Specifications of the FAO Panel of Experts on Pesticide Specifications, Registration Requirements, Application Standards and Prior Informed Consent warrant that pesticides complying with these specifications are suitable for control of any given pest or for use in an particular area.

Furthermore, the preparation and use of pesticides complying with these specifications are not exempt from any safety regulation or other legal or regulatory provision applicable thereto. Neither FAO nor any member of the FAO Group of Experts shall be liable for any injury, loss, damage or prejudice of any kind that may be suffered as a result of the preparation or use of pesticides complying with these specifications.

Additionally, the Group of Experts wishes to warn users of specifications that improper field mixing and/or application of pesticides can result in either a lowering or complete loss of their efficacy. This holds true even in cases where such pesticides comply with the specifications indicated.

Accordingly, the Group of Experts and/or FAO can accept no responsibility for the consequences of improper field mixing and/or application.

INTRODUCTION

From time to time, FAO publishes 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, but during the interval between editions, revisions may be printed in the FAO Plant Protection Bulletin.

The specifications contained herein have been carefully reviewed and agreed by the Group on Pesticide Specifications of the FAO Panel of Experts on Pesticide Specifications, Registration Requirements and Application Standards after consultations with official government scientists, the pesticides industry through GIFAP (Groupement International des Associations Nationales de Fabricants de Produits Aqrochimiques) and, where appropriate, with individual manufactures 1/.

FAO edited a *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/). This manual contains 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 and Application Standards, such as:

1. Classes of Specifications

FAO (full) specifications (Code "S"). Specifications that have all necessary requirements together with CIPAC (full) methods, or other collaboratively studied (proven) methods. 2/ and 3/.

FAO Provisional specifications [Code (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 Tentative specifications (Code "ts") are those which have been recommended by FAO as preliminary specifications 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.

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

2. Expression of Active Ingredient Content

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

- for all other liquids the active ingredient content of the product shall be declared in terms o£ g/kg or g/l at 20°C. If the buyer 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

A declared content o£ active ingredient must be included in all specifications, and one of the problems immediately arising is the level of tolerance acceptable above the nominal figures. The tolerance is influenced by (a) the reproducibility o£ 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 content of active ingredient. For examples of such permitted tolerances, see the table on page 20 of the Manual.

4. Containers/Packaging

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

- Technical material, dustable powders and granules

Containers shall be suitable, clean, dry and as specified, and shall not adversely affect, or be affected by, the product/material, but shall adequately protect it 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, oxidation, 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 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 possible phytotoxicity of 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 1, p. 965 may be useful.

1/ Should national pesticide specifications developed from these approved FAO specifications deviate fend 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 or 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 t1983), 1C (1985) and ID (1988), 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 brackets in the specifications. A copy of a method 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 2PO, 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 Pesticides Control Officer, Plant Production and Protection Division, FAO, Via delle Terme di Caracalla, 00100, Rome, Italy.

General guidelines in 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.

COMMON NAME:	Fentin Acetate (ISO)
EMPIRICAL FORMULA:	$C_{20}H_{18}O_2Sn$
RMM:	409.0
CAS REGISTRY NUMBER:	900-95-8
CIPAC CODE NUMBER:	103A. 2a

CHEMICAL NAME:

triphenyltin acetate (IUPAC)
(acetyloxy) triphenylstannane (CA)

FENTIN ACETATE TECHNICAL
FAO Specification 103A.2a/TC/S (1989)

.1 DESCRIPTION

The material shall consist of fentin acetate together with related manufacturing impurities and shall be an off-white crystalline powder free from visible extraneous matter and added modifying agents.

.2 ACTIVE INGREDIENT

.2.1 Identity tests (CIPAC IB, 103A.2a + 61/WP/M/2.1 p. 1837)

Where the identity of the active ingredient is in doubt, then it shall comply with at least one additional test.

.2.2 Fentin acetate (CIPAC IA, 103A.2a /1/M/7.3, p. 1264)

The fentin acetate content shall be declared (not less than 940 g/kg) and when determined, the content obtained shall not differ from that declared by more than +/- 20 g.

.3 IMPURITIES

.3.1 Loss on vacuum drying (MT 17.4 CIPAC I,p.874)

Maximum: 10 g/kg.

.3.2 Inorganic tin*

Maximum: 5 g/kg

.4 PHYSICAL PROPERTIES

.4.1 Melting point range (MT 2. CIPAC IA, p. 1552)

118°C to 122°C

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* Methods available from the Plant Protection Officer, FAO Plant Production and Protection Division.

FENTIN ACETATE WETTABLE POWDERS
FAO SPECIFICATION 103A.2a/WP/S (1989)

.1 DESCRIPTION

The material shall consist of a homogeneous mixture of technical fentin acetate [complying with the requirements of FAO Specification 103A.2a/TC/S (1989)] together with fillers and any other necessary formulants. It shall be in the form of a fine powder free from visible extraneous matter and hard lumps.

.2 ACTIVE INGREDIENT

.2.1 Identity tests (CIPAC IB, 103A.2a + 61/WP/M/2.1, p. 1837)

Where the identity of the active ingredient is in doubt, then the isolated active ingredient shall comply with at least one additional test.

.2.2 Fentin acetate (CIPAC 1A, 103A.2a/3/M/6.3, p. 1265)

The fentin acetate content shall be declared (g/kg) and when determined, the content obtained shall not differ from that declared by more than the following amounts:

Declared Content	Permitted Tolerance
up to 400 g/kg	-10 to + 25% of the declared content
above 400 g/kg	-40 to + 100 g

.3 IMPURITIES

.3.1 Loss on vacuum drying (MT 17.4, CIPAC I, p. 874)

Maximum: 30 g/kg

.4 PHYSICAL PROPERTIES

.4.1 Wet sieve test (MT 59.3, CIPAC I, p. 981)

Maximum: 20 g/kg retained on a 44 µm test

.4.2 Suspensibility (CIPAC IA, 103A.2a/3/M/6.9, p. 1265) (Notes 1 and 2)

A minimum of 60% for the product as received, or 50% after the stability test at 54°C (.5.1) (Note 2) of the fentin acetate content found under 2.2 shall be in suspension after 30 minutes in CIPAC Standard Water C.

Alternatively, if the buyer requires other CIPAC Standard Waters to be used, then this shall be specified when ordering.

.4.3 Persistent foam (MT 47, CIPAC I, p. 954) (Note 3)

Maximum: 25 ml after 1 minute.

.4.4 Wetting of the product (MT 53.3.2, CIPAC I, p. 967)

It shall be completely wetted in 2 minutes with swirling.

.5 STORAGE STABILITY

.5.1 Stability at 54°C (MT 46.1.1, CIPAC I, p. 951) (Note 4)

After storage at 54 +/- 2°C for 14 days, the product shall continue to comply with .2.2 (except that the minimum permitted fentin acetate content shall be not less than 90% of that found under .2.2), and .4.1 (Note 4).

NOTE 1 The product should be tested at the highest and lowest rates of use recommended by the supplier, provided this does not exceed the conditions given in the method.

NOTE 2 This test will normally only be carried out after the heat stability test .5.1.

NOTE 3 The amount of sample to be used in the test should be specified.

NOTE 4 The maximum storage temperature should be stated on the label.

FENTIN HYDROXIDE + MANEB WETTABLE POWDERS

FAO Specification 103A.2a + 61/WP/S (1989)

.1 DESCRIPTION

The material shall consist of a homogeneous mixture of technical fentin acetate [complying with the requirements of FAO Specification 103A.2a/TC/S (1989)] and maneb [complying with the requirements of FAO specification 61/I/S/16, AGP:CP/82 (1979)], together with fillers and any other necessary formulants. It shall be in the form of a fine powder free from visible extraneous matter and hard lumps.

.2 ACTIVE INGREDIENT

.2.1 Identity tests (CIPAC D, 103A.2a + 61/WP/M/2, p. 95)

Where the identity of the active ingredients is in doubt, then it shall comply with at least one additional test.

.2.2. Fentin acetate (CIPAC 1B, 103A.2a + 61/WP/M/3, p. 1837).

The fentin acetate content shall be declared (g/kg) and when determined, the content obtained shall not differ from that declared by more than +/- 5% of the declared content.

.2.3 Maneb (CIPAC D, 103A.2a + 61/WP/M/4, p. 95)

The maneb content shall be declared (g/kg) and when determined, the content obtained shall not differ from that declared by more than the following amounts:

Declared Content	Permitted Tolerance
up to 200 g/kg	+/- 15% of the declared content
above 200 g/kg	+/- 10% of the declared content

.2.4 Manganese (MT 93, CIPAC IA, p. 1609)

Minimum: 20.7% of the maneb content found under .2.3

Maximum: 22.5% of the maneb content found under .2.3

.3 IMPURITIES

.3.1 Inorganic tin*

Maximum: 0.5% of the fentin acetate found under .2.2

.3.2 Loss on vacuum drying (MT 17.4, CIPAC I, p. 874)

Maximum: 20 g/kg

.4 PHYSICAL PROPERTIES

.4.1 Wet sieve test (MT 59.3, CIPAC I, p. 981)

Maximum: 20 g/kg retained on a 75 µm test

.4.2 Suspensibility (CIPAC IB, 103A.2h + 61/WP/M/5, p. 1841) (Notes 1 and 2)

A minimum of 60% of the fentin acetate and maneb contents found under 2.2 and .2.3 respectively, shall be in suspension after 30 minutes in CIPAC Standard Water C.

Alternatively, if the buyer requires other CIPAC Standard Waters to be used, then this shall be specified when ordering.

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* Method available from the Plant Protection Officer FAO Plant Production and Protection Division

.4.3 Persistent foam (MT 47, CIPAC I, p.954) (Note 3)

Maximum: 25 ml after 1 minute.

.4.4 Wetting of the product (MT 53.3.1, CIPAC I, p. 967)

It shall be completely wetted in 2 minutes without swirling.

.5 STORAGE STABILITY

.5.1 Stability at 40°C (MT 46.1.1, CIPAC I, p. 951) (Note 4)

After storage at 40 +/- 2°C for 28 days, the product shall continue to comply with .2.2 (except that the minimum fentin acetate content shall be not less than 90% of that found under .2.2), .2.3 (except that the minimum permitted maneb content shall be not less than 90% of that found under .2.3), .3.1, .3.2 and .4.1.

NOTE 1 The product should be tested at the highest and lowest rates of use recommended by the supplier, provided this does not exceed the conditions given in the method.

NOTE 2 This test will normally only be carried out after the heat stability test .5.1.

NOTE 3 The amount of sample to be used in the test should be ' specified.

NOTE 4 The maximum storage temperature should be stated on the g label.

INFORMATION

COMMON NAME:	fentin hydroxide (ISO)
EMPIRICAL FORMULA:	$C_{18}H_{16}OSn$
RMM:	367.0
CAS REGISTRY NUMBER:	76 - 87 - 9
CIPAC CODE NUMBER:	103A. 2h

CHEMICAL NAME:

triphenyltin hydroxide (IUPAC)
hydroxytriphenylstannane (CA)

FENTIN HYDROXIDE TECHNICAL
FAO Specification 103A.2h/TC/S (1989)

.1 DESCRIPTION

The material shall consist of fentin hydroxide together with related manufacturing impurities and shall be an off-white crystalline powder free from visible extraneous matter and added modifying agents.

.2 ACTIVE INGREDIENT

.2.1 Identity tests (CIPAC IB, 103A.2h + 61/WP/M/2.1 p. 1840)

Where the identity of the active ingredient is in doubt, then it shall comply with at least one additional test.

.2.2 Fentin hydroxide (CIPAC IA, 103A.2h/1/M/7.3, p. 1267)

The fentin hydroxide content shall be declared (not less than 960 g/kg) and when determined, the content obtained shall not differ from that declared by more than +/- 20 g.

.3 IMPURITIES

.3.1 Loss on vacuum drying (MT 17.4 CIPAC I, p.874)

Maximum: 10 g/kg.

.3.2 Inorganic tin*

Maximum: 5 g/kg

.4 PHYSICAL PROPERTIES

.4.1 Melting point range (MT 2. CIPAC I, p. 1552)

118°C to 122°C

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* Method available from the Plant Protection Officer, FAO Plant Production and Protection Division.

FENTIN HYDROXIDE WETTABLE POWDERS
FAO SPECIFICATION 103A.2h/WP/S (1989)

.1 DESCRIPTION

The material shall consist of a homogeneous mixture of technical fentin hydroxide [complying with the requirements of FAO Specification 103A.2h/TC/S (1989)] together with fillers and any other necessary formulants. It shall be in the form of a fine powder free from visible extraneous matter and hard lumps.

.2 ACTIVE INGREDIENT

.2.1 Identity tests (CIPAC IB, 103A.2h 61/WP/M/2.1, p. 1840)

Where the identity of the active ingredient is in doubt, then the isolated active ingredient shall comply with at least one additional test.

.2.2 Fentin hydroxide (CIPAC 1A, 103A.2h/3/M/6.3, p. 1268)

The fentin hydroxide content shall be declared (g/kg) and when determined, the content obtained shall not differ from that declared by more than the following amounts:

Declared Content	Permitted Tolerance
up to 400 g/Kg	-10 to + 25% of the declared content
above 400 g/kg	-40 to + 100 g

.3 IMPURITIES

.3.1 Loss on vacuum drying (MT 17.4, CIPAC I, p. 874)

Maximum: 30 g/kg

.4 PHYSICAL PROPERTIES

.4.1 Wet sieve test (MT 59.3, CIPAC I, p. 981)

Maximum: 20 g/kg retained on a 44 µm test

.4.2 Suspensibility (CIPAC IA, 103A.2h/3/M/6.9, p. 1268) (Notes 1 and 2)

A minimum of 60% of the fentin hydroxide content found under 2.2 shall be in suspension after 30 minutes in CIPAC Standard Water C.

Alternatively, if the buyer requires other CIPAC Standard Waters to be used, then this shall be specified when ordering.

.4.3 Persistent foam (MT 47, CIPAC I, p. 954) (Note 3)

Maximum: 25 ml after 1 minute.

.4.4 Wetting of the product (MT 53.3.2, CIPAC I, p. 967)

It shall be completely wetted in 2 minutes with swirling.

.5 STORAGE STABILITY

.5.1 Stability at 54°C (MT 46.1.1, CIPAC I, p. 951) (Note 4)

After storage at 54 +/- 2°C for 14 days, the product shall continue to comply with .2.2 (except that the minimum permitted fentin hydroxide content shall be not less than 90% of that found under .2.2), and .4.1 (Note 4).

NOTE 1 The product should be tested at the highest and lowest rates of use recommended by the supplier, provided this does not exceed the conditions given in the method.

NOTE 2 This test will normally only be carried out after the heat stability test .5.1.

NOTE 3 The amount of sample to be used in the test should be specified.

NOTE 4 The maximum storage temperature should be stated on the label.

FENTIN HYDROXIDE + MANEB WETTABLE POWDERS
FAO Specification 103.A.2h + 61/WP/S (1989)

.1 DESCRIPTION

The material shall consist of a homogeneous mixture of technical fentin hydroxide [complying with the requirements of FAO Specification 103A.2h/TC/S (1989)] and maneb [complying with the requirements of FAO specification 61/I/S/16, AGP:CP/82 (1979)], together with fillers and any other necessary formulants. It shall be in the form of a fine powder free from visible extraneous matter and hard lumps.

.2 ACTIVE INGREDIENT

.2.1 Identity tests (CIPAC D, 103A.2h + 61/WP/M/2, p. 98)

Where the identity of the active ingredients is in doubt, then it shall comply with at least one additional test.

.2.2 Fentin hydroxide (CIPAC 1B, 103A.2h + 61/WP/M/3, p. 1840).

The fentin hydroxide content shall be declared (g/kg) and when determined, the content obtained shall not differ from that declared by more than +/- 5% of the declared content.

.2.3 Maneb (CIPAC D, 103A.2h + 61/WP/M/4, p. 99)

The maneb content shall be declared (g/kg) and when determined, the content obtained shall not differ from that declared by more than the following amounts:

Declared Content	Permitted Tolerance
up to 200 g/kg	+/- 15% of the declared content
above 200 g/kg	+/- 10% of the declared content

.2.4 Manganese (MT 93, CIPAC IA, p. 1609)

Minimum: 20.7% of the maneb content found under 2.3

Maximum: 22.5% of the maneb content found under 2.3

.3.1 Inorganic tin*

Maximum: 0.5% of the fentin hydroxide found under 2.2

.3.2 Loss on vacuum drying (MT 17.4, CIPAC I, p. 874)

Maximum: 20 g/kg

.4 PHYSICAL PROPERTIES

.4.1 Wet sieve test (MT 59.3, CIPAC I, p. 981)

Maximum: 20 g/kg retained on a 75 µm test sieve

.4.2 Suspensibility (CIPAC IB, 103A.2h + /WP/M/5 p. 1841) (Notes 1 and 2)

A minimum of 60% of the fentin hydroxide and maneb contents found under 2.2 and .2.3 respectively, shall be in suspension after 30 minutes in CIPAC Standard Water C.

Alternatively, if the buyer requires other CIPAC Standard Waters to be used, then this shall be specified when ordering.

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* Method available from the Plant Protection Officer FAO Plant Production and Protection Division

.4.3 Persistent foam (MT 47, CIPAC I, p. 954) (Note 3)

Maximum: 25 ml after 1 minute.

.4.4 Wetting of the product (MT 53 3.1, CIPAC I, p. 967)

It shall be completely wetted in 2 minutes without swirling.

.5 STORAGE STABILITY

.5.1 Stability at 40°C (MT 46.1.1, CIPAC I, p. 951) (Note 4)

After storage at 40 +/- 2°C for 28 days, the product shall continue to comply with .2.2 (except that the minimum fentin hydroxide content shall be not less than 90% of that found under .2.2), .2.3 (except that the minimum permitted maneb content shall be not less than 90% of that found under .2.3), .3.1, .3.2 and .4.1.

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NOTE 1 The product should be tested at the highest and lowest rates of use recommended by the supplier, provided this does not exceed the conditions given in the method.

NOTE 2 This test will normally only be carried out after the heat stability test .5.1.

NOTE 3 The amount of sample to be used in the test should be specified.

NOTE 4 The maximum storage temperature should be stated on the label.