

WHO SPECIFICATIONS AND EVALUATIONS FOR PUBLIC HEALTH PESTICIDES

DDT¹

1,1,1-trichloro-2,2-bis(chlorophenyl)ethane



**World Health
Organization**

¹ The main component of technical DDT is p,p'-DDT. The technical product contains ≤ 30% o,p'-DDT which, being of insecticidal value, is not usually removed.

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Disclaimer¹

WHO 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 labeling 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.

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¹ This disclaimer applies to all specifications published by WHO.

PART ONE
SPECIFICATIONS

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WHO SPECIFICATIONS FOR PUBLIC HEALTH PESTICIDES

DDT INFORMATION

ISO common name

DDT (BSI, E-ISO, (*m*) F-ISO, ESA, JMAF)

p,p'-DDT (BSI, draft E-ISO, (*m*) draft F-ISO, for the major component)

Synonyms

zeidane ((*m*) France)

dicophane (BAN)

chlorophenothane (US Pharmacopoeia, for a mixture of isomers)

p,p' zeidane (France, for the major component)

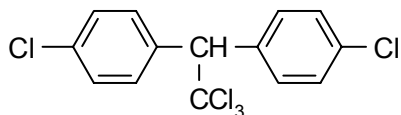
para,para'-DDT (Canada, for the major component)

Chemical names

IUPAC p,p'-DDT: 1,1,1-trichloro-2,2-bis(4-chlorophenyl)ethane
o,p'-DDT: 1,1,1-trichloro-2-(2-chlorophenyl)-2-(4-chlorophenyl)ethane
of mixture: 1,1,1-trichloro-2,2-bis(chlorophenyl)ethane

CA p,p'-DDT: 1,1'-(2,2,2-trichloroethylidene)bis[4-chlorobenzene]
o,p'-DDT: 1-chloro-2-[2,2,2-trichloro-1-(4-chlorophenyl)ethyl]benzene

Structural formula



Molecular formula

C₁₄H₉Cl₅

Relative molecular mass

354.5

CAS Registry number

p,p'-DDT: 50-29-3

mixture: 8017-34-3

CIPAC number

3

EEC number

200-024-3

Identity tests

GC retention time, mass spectrum (from GC-MS)

WHO SPECIFICATIONS FOR PUBLIC HEALTH PESTICIDES

DDT TECHNICAL MATERIAL

Full specification WHO/SIT/1.R9 (August 2009*)

1 Description

The material shall consist of DDT together with related manufacturing impurities, in the form of white or cream-colored granules, flakes or powder, free from visible extraneous matter and added modifying agents.

2 Active ingredient

2.1 Identity tests (3/TC/M/2, CIPAC Handbook E, p. 59, 1993)

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

2.2 p,p'-DDT content (3/TC/M/3, CIPAC Handbook E, p. 59, 1993) (Note1)

The p,p'-DDT content shall be declared (not less than 700 g/kg) and, when determined, the average measured content shall not be lower than the declared minimum content.

3 Relevant impurities

3.1 Chloral hydrate (2,2,2-trichloroethane-1,1diol, CAS No. 302-17-0) (Note 2)

Maximum: 0.25 g/kg.

3.2 Water content (MT 30.5, CIPAC Handbook J, p. 120, 2000)

Maximum: 10 g/kg.

3.3 Acetone insolubles (MT 27, CIPAC Handbook F, p. 88, 1995)

Maximum: 10 g/kg.

4 Physical properties

4.1 Acidity (MT 191, CIPAC Handbook L, p. 143, 2006)

Maximum acidity: 3 g/kg calculated as H₂SO₄.

* Specifications may be revised and/or additional evaluations may be undertaken. Ensure the use of current versions by checking at: <http://www.who.int/quality/en/>.

Note 1 The main component of technical DDT is p,p'-DDT. The technical product contains $\leq 30\%$ o,p'-DDT which, being of insecticidal value, is not usually removed. As the dose rates are still expressed on the basis of technical product, it is necessary to relate the p,p'-DDT content to the technical product and vice versa. For example a formulated product containing 750 g/kg DDT contains 540 g/kg p,p'-DDT.

Note 2 The method for determination of chloral hydrate content is described in Appendix 1 of the evaluation report 3/2009, in Part Two of this publication.

WHO SPECIFICATIONS FOR PUBLIC HEALTH PESTICIDES

DDT DUSTABLE POWDER

Full specification WHO/SIF/16.R8 (August 2009*)

1 Description

The material shall consist of a homogeneous mixture of technical DDT, complying with the requirements of WHO specification WHO/SIT/1.R9 (August 2009), together with carriers and any other necessary formulants. It shall be in the form of a fine, free-flowing, white, cream or grey powder, free from visible extraneous matter and hard lumps.

2 Active ingredient

2.1 Identity tests (3/DP/M/2, CIPAC Handbook E, p. 63, 1993)

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

2.2 p,p'-DDT content (3/DP/M/3, CIPAC Handbook E, p. 64, 1993) (Note 1)

The p,p'-DDT content shall be declared (g/kg) and, when determined, the average measured content shall not differ from that declared by more than the following tolerance:

Declared content, g/kg	Tolerance
Above 25 up to 100	± 10% of the declared content
Note: the upper limit is included in the range	

3 Relevant impurities

4 Physical properties

4.1 Acidity or alkalinity (MT 191, CIPAC Handbook L, p. 143, 2006)

Maximum acidity: 1 g/kg calculated as H₂SO₄.

Maximum alkalinity: 2 g/kg calculated as NaOH.

4.2 Dry sieve test (MT 59.1, CIPAC Handbook F, p. 177, 1995) (Note 2)

Maximum: 2% retained on a 150 µm test sieve.

The residue remaining on the sieve shall be free from grittiness.

* Specifications may be revised and/or additional evaluations may be undertaken. Ensure the use of current versions by checking at: <http://www.who.int/quality/en/>.

5 Storage stability

5.1 Stability at elevated temperature

(MT 46.3, CIPAC Handbook J, p. 128, 2000)

After storage at $54 \pm 2^\circ\text{C}$ for 14 days, the determined average active ingredient content must not be lower than 95% relative to the determined mean content found before storage (Note 3) and the formulation shall continue to comply with the clauses for:

- acidity or alkalinity (4.1);
- dry sieve test (4.2).

Note 1 The main component of technical DDT is p,p'-DDT. The technical product contains $\leq 30\%$ o,p'-DDT which, being of insecticidal value, is not usually removed. As the dose rates are still expressed on the basis of technical product, it is necessary to relate the p,p'-DDT content to the technical product and vice versa. For example a formulated product containing 100 g/kg DDT contains 72 g/kg p,p'-DDT.

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

Note 3 Samples of the formulation taken before and after the storage stability test should be analyzed concurrently after the test in order to reduce the analytical error.

DDT WETTABLE POWDER

Full specification WHO/SIF/1.R9 (August 2009*)

1 Description

The material shall consist of a homogeneous mixture of technical DDT, complying with the requirements of WHO specification WHO/SIT/1.R9 (August 2009), together with filler(s) and any other necessary formulants. It shall be in the form of a fine, free-flowing, white to cream-colored powder, free from visible extraneous matter and hard lumps.

2 Active ingredient

2.1 Identity tests (3/WP/M/2, CIPAC Handbook E, p. 62, 1993)

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

2.2 p,p'-DDT content (3/WP/M/3, CIPAC Handbook E, p. 62, 1993) (Note 1)

The p,p'-DDT content shall be declared (g/kg) and, when determined, the average measured content shall not differ from that declared by more than the following tolerance:

Declared content, g/kg	Tolerance
above 100 up to 250	± 6% of the declared content
above 250 up to 500	± 5% of the declared content
above 500	± 25 g/kg

Note: the upper limit is included in each range

3 Relevant impurities

4 Physical properties

4.1 Acidity or alkalinity (MT 191, CIPAC Handbook L, p. 143, 2006)

Maximum acidity: 2 g/kg calculated as H₂SO₄.

Maximum alkalinity: 2 g/kg calculated as NaOH.

4.2 Wet sieve test (MT 185, CIPAC Handbook K, p. 149, 2003) (Note 2)

Maximum: 2% retained on a 75 µm test sieve.

* Specifications may be revised and/or additional evaluations may be undertaken. Ensure the use of current versions by checking at: <http://www.who.int/quality/en/>.

4.3 Suspensibility (MT 184, CIPAC Handbook K, p. 142, 2003) (Notes 2 & 3)

A minimum of 60% of the p,p'-DDT content found under 2.2 shall be in suspension after 30 min in CIPAC Standard Water D at $30 \pm 2^\circ\text{C}$ (Note 4).

4.4 Persistent foam (MT 47.2, CIPAC Handbook F, p. 152, 1995) (Note 3)

Maximum: 60 mL after 1 min in CIPAC Standard Water A.

4.5 Wettability (MT 53.3, CIPAC Handbook F, p. 164, 1995) (Note 2)

The formulation shall be completely wetted in 2 min in CIPAC Standard Water D without swirling.

5 Storage stability

5.1 Stability at elevated temperature

(MT 46.3, CIPAC Handbook J, p. 128, 2000)

After storage at $54 \pm 2^\circ\text{C}$ for 14 days, the determined average active ingredient content must not be lower than 95% relative to the determined mean content found before storage (Note 5) and the formulation shall continue to comply with the clauses for:

- acidity or alkalinity (4.1);
- wet sieve test (4.2);
- suspensibility (4.3);
- wettability (4.5).

Note 1 The main component of technical DDT is p,p'-DDT. The technical product contains $\leq 30\%$ o,p'-DDT which, being of insecticidal value, is not usually removed. As the dose rates are still expressed on the basis of technical product, it is necessary to relate the p,p'-DDT content to the technical product and vice versa. For example a formulated product containing 750 g/kg DDT contains 540 g/kg p,p'-DDT.

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

Note 3 The formulation will be tested at the use rate of 18 g/L of p,p'-DDT.

Note 4 Chemical assay is the only fully reliable method to measure the mass of active ingredient still in suspension. However, simpler methods such as gravimetric and solvent extraction determination may be used on a routine basis provided that these methods have been shown to give equal results to those of chemical assay. In case of dispute, chemical assay shall be the "referee method".

Note 5 Samples of the formulation taken before and after the storage stability test should be analyzed concurrently after the test in order to reduce the analytical error.

PART TWO

EVALUATION REPORTS

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WHO SPECIFICATIONS FOR PUBLIC HEALTH PESTICIDES

DDT

FAO/WHO EVALUATION REPORT 3/2009

Recommendations

The Meeting recommended the following.

- (i) The existing WHO specifications for DDT WHO/SIT/1.R8 (TC, December 1999), WHO/SIF/16.R7 (DP, December 1999) and WHO/SIF/1.R8 (WP, December 1999) should be withdrawn.
- (ii) The revised WHO specifications for DDT TC, DP and WP, as proposed by JMPS, should be adopted by WHO and published under the category of old specifications.

Appraisal

The Meeting considered the review of the existing WHO specifications for DDT: WHO/SIT/1.R8 (TC, December 1999), WHO/SIF/16.R7 (DP, December 1999) and WHO/SIF/1.R8 (WP, December 1999). The revised specifications include the following changes by comparison with the old specifications.

General considerations

- The updated specifications for DDT TC, DP and WP were written according to the format requirements (specification guidelines) of the FAO/WHO Manual (March 2006 revision of the first edition).
- Information on DDT was added in the revised specifications.
- The methods for p,p'-DDT content extensively written in the old specifications were referenced in the revised specifications to the existing CIPAC methods.
- While maintaining the clauses and their respective limits, the methods for physico-chemical properties referenced in the old specifications were updated in the revised specifications according to the current CIPAC methods.
- The information on packing and marking of packages of the old specifications were withdrawn in the revised specifications because this information is available in the Appendix A of the FAO/WHO Manual.

p,p'-DDT technical material (TC)

- The clause of setting point of the old specification was replaced in the revised specification by the clause of identity tests.
- The method for chloral hydrate content extensively written in the old specification was included in the revised specification as an appendix.

p,p'-DDT dustable powder (DP)

- A clause of identity tests referring to the CIPAC method was added in the revised specification.

p,p'-DDT wettable powder (WP)

- A clause of identity tests referring to the CIPAC method was added in the revised specification.
- For the suspensibility, persistent foam and wettability tests, the WHO standard hard and soft waters mentioned in the old specification were replaced in the revised specification by the CIPAC Standard Water D and A respectively.

Although the specifications were revised according to the guidelines of the FAO/WHO Manual (March 2006 revision of the first edition), the Meeting agreed to publish them under the category of old specifications because no new data were provided by the manufacturers and evaluated by the JMPS.

Appendix 1
to FAO/WHO evaluation report 3/2009

**Method for the determination of chloral hydrate content
in DDT technical material**

Outline of method

The sample is mixed with water and the chloral hydrate distilled off. The distillate is treated with sodium hydroxide and pyridine, and the resulting colour is compared with that from a standard chloral hydrate solution.

Reagent

Standard chloral hydrate solution. Dissolve 5 mg of chloral hydrate in 100 mL of distilled water.

Apparatus

Distillation apparatus consisting of:

- 500 mL round-bottomed flask, fitted with two necks.
- mechanical stirrer, mercury sealed, to fit flask.
- distillation set to fit flask, the condenser should be a double surface pattern, e.g., Davies type.

Procedure

Place 20 g of the sample and 200 mL of carbon dioxide-free distilled water in a 500 mL round-bottomed flask equipped with a mercury-sealed mechanical stirrer. Heat in an oil-bath at a temperature between 140°C and 160°C, with rapid stirring to prevent superheating, and distil the mixture through a well cooled condenser, at such a rate that 100 mL of distillate are obtained in not less than 3 minutes and not more than 1 hour. Collect exactly 100 mL of distillate in a centrifuge tube and centrifuge to effect complete separation of the water-insoluble material.

Place 2 mL of a 400 g/L sodium hydroxide solution in a test-tube and add 1 mL of colourless pyridine and 4 mL of the distillate. In another test-tube, place 2 mL of the same 400 g/L sodium hydroxide solution and add 1 mL of colourless pyridine and 4 mL of standard chloral hydrate solution. Shake the two tubes and heat in a bath of boiling water for 1 minute. The red colour that develops in the pyridine layer shall not be darker in the sample solution than in the standard solution.