

WHO SPECIFICATIONS AND EVALUATIONS FOR PUBLIC HEALTH PESTICIDES

PYRETHRUM (PYRETHRINS)¹



**World Health
Organization**

¹ Pyrethrum extract is defined as a mixture of three naturally-occurring, closely-related insecticidal esters of chrysanthemic acid, Pyrethrins I (pyrethrin I, cinerin I and jasmolin I), and the three corresponding esters of pyrethrin acid, Pyrethrins II (pyrethrin II, cinerin II and jasmolin II).

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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 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.

WHO disclaims any and all liability for any injury, death, loss, damage or other prejudice of any kind that may be 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, WHO 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.

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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

PYRETHRUM

INFORMATION

ISO common name

pyrethrins (pyrethrum)

pyrethrins (BSI, E-ISO, ESA, JMAF), pyrèthres (F-ISO)

pyrethrins (chrysanthemates)

pyrethrin I (BSI, E-ISO), pyrèthrine I (F-ISO)

cinerin I (BSI, E-ISO), cinérine I (F-ISO)

jasmolin I (BSI, E-ISO), jasmoline I (F-ISO)

pyrethrins (pyrethrates)

pyrethrin II (BSI, E-ISO), pyrèthrine II (F-ISO)

cinerin II (BSI, E-ISO), cinérine II (F-ISO)

jasmolin II (BSI, E-ISO), jasmoline II (F-ISO)

Synonyms

none

Chemical names

IUPAC

pyrethrins (chrysanthemates)

for pyrethrin I: (Z)-(S)-2-methyl-4-oxo-3-(penta-2,4-dienyl)cyclopent-2-enyl (1R)-*trans*-2,2-dimethyl-3-(2-methylprop-1-enyl)cyclopropanecarboxylate

for cinerin I: (Z)-(S)-3-(but-2-enyl)-2-methyl-4-oxocyclopent-2-enyl (1R)-*trans*-2,2-dimethyl-3-(2-methylprop-1-enyl)cyclopropanecarboxylate

for jasmolin I: (Z)-(S)-2-methyl-4-oxo-3-(pent-2-enyl)cyclopent-2-enyl (1R)-*trans*-2,2-dimethyl-3-(2-methylprop-1-enyl)cyclopropanecarboxylate

pyrethrins (pyrethrates)

for pyrethrin II: (Z)-(S)-2-methyl-4-oxo-3-(penta-2,4-dienyl)cyclopent-2-enyl (E)-(1R)-*trans*-3-(2-methoxycarbonylprop-1-enyl)-2,2-dimethylcyclopropanecarboxylate

for cinerin II: (Z)-(S)-3-(but-2-enyl)-2-methyl-4-oxocyclopent-2-enyl (E)-(1R)-*trans*-3-(2-methoxycarbonylprop-1-enyl)-2,2-dimethylcyclopropanecarboxylate

for jasmolin II: (*Z*)-(*S*)-2-methyl-4-oxo-3-(pent-2-enyl)cyclopent-2-enyl
 (*E*)-(1*R*)-*trans*-3-(2-methoxycarbonylprop-1-enyl)-2,2-
 dimethylcyclopropanecarboxylate

CA

pyrethrins (chrysanthemates)

for pyrethrin I: [1*R*-[1 α [*S*^{*}(*Z*)],3 β]]-2-methyl-4-oxo-3-(2,4-
 pentadienyl)cyclopenten-1-yl 2,2-dimethyl-3-(2-methyl-1-
 propenyl)cyclopropanecarboxylate

for cinerin I: [1*R*-[1 α [*S*^{*}(*Z*)],3 β]]-3-(2-butenyl)-2-methyl-4-oxo-2-
 cyclopenten-1-yl 2,2-dimethyl-3-(2-methyl-1-
 propenyl)cyclopropanecarboxylate

for jasmolin I: [1*R*-[1 α [*S*^{*}(*Z*)],3 β]]-2-methyl-4-oxo-3-(2-pentenyl)-2-
 cyclopenten-1-yl 2,2-dimethyl-3-(2-methyl-1-
 propenyl)cyclopropanecarboxylate

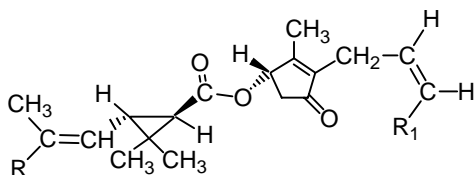
pyrethrins (pyrethrates)

for pyrethrin II:[1*R*-[1 α [*S*^{*}(*Z*)],3 β (*E*))]-2-methyl-4-oxo-3-(2,4-
 pentadienyl)-2-cyclopenten-1-yl 3-(3-methoxy-2-methyl-
 3-oxo-1-propenyl)-2,2-dimethylcyclopropanecarboxylate

for cinerin II: [1*R*-[1 α [*S*^{*}(*Z*)],3 β (*E*))]-3-(2-butenyl)-2-methyl-4-oxo-2-
 cyclopenten-1-yl 3-(3-methoxy-2-methyl-3-oxo-1-
 propenyl)-2,2-dimethylcyclopropanecarboxylate

for jasmolin II: [1*R*-[1 α [*S*^{*}(*Z*)],3 β (*E*))]-2-methyl-4-oxo-3-(2-pentenyl)-2-
 cyclopent-1-enyl 3-(3-methoxy-2-methyl-3-oxo-1-
 propenyl)-2,2-dimethylcyclopropanecarboxylate

Structural formula



R = -CH₃ (chrysanthemates) or -CO₂CH₃ (pyrethrates)

R₁ = -CH=CH₂ (pyrethrin) or -CH₃ (cinerin) or -CH₂CH₃ (jasmolin)

Molecular formulae

pyrethrins (chrysanthemates)

pyrethrin I: C₂₁H₂₈O₃

cinerin I: C₂₀H₂₈O₃

jasmolin I: C₂₁H₃₀O₃

pyrethrins (pyrethrates)

pyrethrin II: C₂₂H₂₈O₅

cinerin II: C₂₁H₂₈O₅

jasmolin II: C₂₂H₃₀O₅

Relative molecular mass

pyrethrins (chrysanthemates)

pyrethrin I: 328.4
cinerin I: 316.4
jasmolin I: 330.5

pyrethrins (pyrethrates)

pyrethrin II: 372.4
cinerin II: 360.4
jasmolin II: 374.5

CAS Registry numbers

pyrethrins (pyrethrum) 8003-34-7

pyrethrins (chrysanthemates)

pyrethrin I: 121-21-1
cinerin I: 25402-06-6
jasmolin I: 4466-14-2

pyrethrins (pyrethrates)

pyrethrin II: 121-29-9
cinerin II: 121-20-0
jasmolin II: 1172-63-0

CIPAC number

32

Identity tests

GC retention times, mass spectra (from GC-MS)

WHO SPECIFICATIONS FOR PUBLIC HEALTH PESTICIDES

PYRETHRUM TECHNICAL CONCENTRATE

Full specification WHO/SIT/7.R3 (August 2009*)

1 Description

The material shall consist of extracts or concentrates of substances occurring naturally in pyrethrum flowers. It shall be in the form of a pale to dark oily viscous liquid, free from visible extraneous matter and added modifying agents.

2 Active ingredient

2.1 Identity tests (32+33+345/TK/(M)/2, CIPAC Handbook H, p. 239, 1998)

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 Pyrethrum (pyrethrins) content (32+33+345/TK/(M)/3, CIPAC Handbook H, p. 239, 1998) (Note 1)

The pyrethrum (pyrethrins) content shall be declared (not less than 200 g/kg) and, when determined, the average measured content shall not be lower than the declared minimum content.

Note 1 Pyrethrum content is determined as the sum of Pyrethrins I content (pyrethrin I, cinerin I and jasmolin I) and Pyrethrins II content (pyrethrin II, cinerin II and jasmolin II).

* 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/>.

PART TWO

EVALUATION REPORTS

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WHO SPECIFICATIONS FOR PUBLIC HEALTH PESTICIDES

PYRETHRUM

FAO/WHO EVALUATION REPORT 32/2009

Recommendations

The Meeting recommended the following.

- (i) The existing WHO specifications for pyrethrum WHO/SIT/7.R2 (TK, December 1999) should be withdrawn.
- (ii) The revised WHO specification for pyrethrum TK, 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 specification for pyrethrum (pyrethrins): WHO/SIT/7.R2 (TK, December 1999). The revised specification includes the following changes by comparison with the old specification.

General considerations

- The revised specification for pyrethrum TK was written according to the format requirements (specification guidelines) of the FAO/WHO Manual (March 2006 revision of the first edition).
- Information on pyrethrum was added in the revised specifications.
- 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.

Pyrethrum technical concentrate (TK)

- A clause of identity tests referring to the CIPAC method for pyrethrum TK was added in the revised specification.
- The method for pyrethrum (pyrethrins) content extensively written in the old specification was referenced in the revised specification to the existing CIPAC method.
- The clause of minimum 190 g/kg for pyrethrins content in the old specification was adapted in the revised specification. Indeed the method of the old specification determines pyrethrum content as the sum of pyrethrin I, cinerin I, pyrethrin II and cinerin II, whilst the CIPAC method referenced in the revised specification determines pyrethrum content as the sum of pyrethrin I, cinerin I, jasmolin I, pyrethrin II, cinerin II and jasmolin II. Taking into account that the ratio of individual esters (pyrethrins:cinerins:jasmolins) is 71:21:7, a clause of minimum 200 g/kg was proposed by the Meeting.

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.