

FAO SPECIFICATIONS{PRIVATE } FOR PLANT PROTECTION PRODUCTS

PARAQUAT DICHLORIDE (AGP:CP/344)

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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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.

{PRIVATE }INTRODUCTION{TC \1 "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 revisions may be printed in the *FAO Plant Protection Bulletin* during the interval between editions.

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, Application Standards and Prior Informed Consent after consultations with official government scientists, the pesticides industry through GIFAP (Groupement International des Associations Nationales de Fabricants de Produits Agrochimiques or, in English, International Group of National Associations of Manufacturers of Agrochemical Products) and, where appropriate, with individual manufacturers.¹

FAO has published a *Manual on the development and use of FAO Specifications for Plant Protection Products*, FAO Plant Production and Protection Paper No. 128, Rome 1995 (available in English from the FAO Plant Protection Service).

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, 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), 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, 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 Plant Production and Protection Paper 128, *Manual on the Development and Use of FAO Specifications for Plant Protection Products, Fourth Edition*, FAO, Rome, 1995 (available in English).

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.

AGP:CP/344

{PRIVATE }PARAQUAT DICHLORIDE{TC \1 "PARAQUAT DICHLORIDE"}

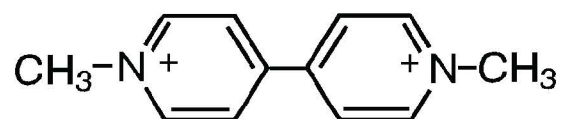
1,1'-dimethyl-4,4'-bipyridinium dichloride



INFORMATION

COMMON NAME: paraquat it the ISO name for the cation

STRUCTURAL FORMULA (CATION):



EMPIRICAL FORMULA: C₁₂H₁₄N₂ (cation)

RMM: 186.3 (cation)

CAS REGISTRY NUMBERS: 4685-14-7 (cation)
1910-42-5 (dichloride)

CIPAC CODE NUMBER: 56

CHEMICAL NAME: 1,1'-dimethyl-4,4'-bipyridinium dichloride (IUPAC and CA)

**{PRIVATE }PARAQUAT DICHLORIDE TECHNICAL CONCENTRATES{TC \1 2
"PARAQUAT DICHLORIDE TECHNICAL CONCENTRATES"}
FAO Specification 56/TK/S/F (1994)**

1. DESCRIPTION

The material shall consist essentially of an aqueous solution of paraquat dichloride, together with related manufacturing impurities containing not more than a trace of suspended matter, immiscible solvents or sediment, and containing an effective emetic. Technical concentrates may also include colourants.

2. ACTIVE INGREDIENT

2.1 Identity tests (56/SL/M/2, CIPAC G, p.128)

An identity test is required if the identity of the active ingredient is in doubt.

2.2 Paraquat dichloride (56/SL/M/3, CIPAC E, p.167)

The paraquat dichloride content (Note 1) shall be declared (not less than 500 g/l at 20°C, Note 2) and, when determined, the content obtained shall not differ from that declared by more than ± 25 g/kg.

2.3 Emetic content

An effective emetic must be included at a specified level. The content shall be declared and, when determined, shall not differ from that declared by more than $\pm 15\%$ (Note 3).

3. IMPURITIES

3.1 Free 4,4'-bipyridyl (56/13/M/7.4, CIPAC 1A, p.1317)

Maximum: 0.2% by weight of the paraquat dichloride content found under 2.2.

4. PHYSICAL PROPERTIES

4.1 pH range (56/13/M/7.5, CIPAC 1A, p. 1589)

pH range: 2.0 to 6.0.

5. CONTAINERS

Containers may be manufactured from suitable polymeric materials or metal, and must comply with pertinent national and international transport and safety regulations. If metal is used containers shall be lined with suitable polymeric material, or the internal surfaces treated to prevent corrosion of the container and/or deterioration of the contents. The product must not be allowed to come into direct contact with metal.

Notes

1. *Multiply the paraquat ion content as determined by CIPAC method 56/SL/M/3 by 1.38*
2. *If the buyer requires both g/l at 20°C and g/kg, then in case of dispute the analytical results shall be calculated as g/kg.*
3. *To be effective the emetic must meet the following criteria:*
 - *It must be rapidly absorbed (more rapidly than paraquat) and be quick acting. Emesis must occur in about half an hour in at least 50% of cases.*
 - *It must be an effective (strong) stimulant of the emetic centre to produce effective emesis. The emetic effect should have a limited 'action period' of about two to three hours to allow effective treatment of poisoning.*
 - *It must act centrally on the emetic centre in the brain.*
 - *It must not be a gastric irritant because, as paraquat itself is an irritant, this could potentiate the toxicity of paraquat.*
 - *It must be toxicologically acceptable. It must have a short half-life in the body (to comply with the need for a limited action period).*
 - *It must be compatible with and stable in the paraquat formulation and not affect the herbicidal efficiency or occupational use of the product.*

**{PRIVATE }PARAQUAT DICHLORIDE AQUEOUS SOLUTIONS{TC \12
"PARAQUAT DICHLORIDE AQUEOUS SOLUTIONS"}**

FAO Specification 56/SL/S/F (1994)

1. DESCRIPTION

The material shall consist essentially of an aqueous solution of technical paraquat dichloride, together with wetting and safening agents which will include an effective emetic and blue/green colourants, and may include other safeners including stenching agents and thickeners. It shall contain not more than a trace of suspended matter, immiscible solvents and sediment. The technical paraquat dichloride shall comply with the requirements of FAO specification 56/TK/S/F (1994).

2. ACTIVE INGREDIENT

2.1 Identity tests (56/SL/M/2, CIPAC G, p.128)

An identity test is required if the identity of the active ingredient is in doubt.

2.2 Paraquat dichloride (56/SL/M/3, CIPAC E, p.167)

The paraquat dichloride content (Note 1) shall be declared (g/kg and/or g/l at 20°C, Note 2) and, when determined, the content obtained shall not differ from that declared by more than the following amounts.

<u>Declared content</u>	<u>Permitted tolerance</u>
25 up to 100 g/kg or g/l	± 10% of the declared content
Above 100 up to 250 g/kg or g/l	± 6% of the declared content
Above 250 up to 500 g/kg or g/l	± 5% of the declared content

2.3 Emetic content

An effective emetic must be included at a specified level. The content shall be declared and, when determined, shall not differ from that declared by more than ± 15% (Note 3).

3 PHYSICAL PROPERTIES

3.1 Stability on dilution (MT 41, CIPAC F, p.131)

The product, after dilution with CIPAC Standard Water C, shall give a clear and homogeneous solution after standing for 18 hours at 20°C (Note 4).

3.2 pH range (MT 75.1, CIPAC F, p.205)

pH range: 6.0 to 8.0.

4. STORAGE STABILITY

4.1 Stability at 0°C (MT39.2, CIPAC F, p.129)

After storage at $0 \pm 1^\circ\text{C}$ for 48 hours, there shall not be more than a trace of separated material.

4.2 Stability at 54°C (MT 46.1.3, CIPAC F, p.149)

After storage at $54 \pm 2^\circ\text{C}$ for 14 days, the determined average active ingredient content must not be lower than 97% relative to the determined average content found before storage (Note 5), and the product shall continue to comply with 3.1 and 3.2.

5. CONTAINERS

Containers may be manufactured from suitable polymeric materials or metal, and must comply with pertinent national and international transport and safety requirements. Where metal is used containers shall be lined with suitable polymeric material, or the internal surfaces treated to prevent corrosion of the container and/or deterioration of the contents. The product must not be allowed to come into direct contact with metal.

NOTES

1. *Multiply the paraquat ion content as determined by CIPAC method 56/SL/M/3 by 1.38.*
2. *If the buyer requires both g/l at 20°C and g/kg, then in case of dispute the analytical results shall be calculated as g/kg.*
3. *To be effective the emetic must meet the following criteria:*

- *It must be rapidly absorbed (more rapidly than paraquat) and be quick acting. Emesis must occur in about half an hour in at least 50% of cases.*
 - *It must be an effective (strong) stimulant of the emetic centre to produce effective emesis. The emetic effect should have a limited 'action period' of about two to three hours to allow effective treatment of poisoning.*
 - *It must act centrally on the emetic centre in the brain.*
 - *It must not be a gastric irritant because, as paraquat itself is an irritant, this could potentiate the toxicity of paraquat.*
 - *It must be toxicologically acceptable. It must have a short half-life in the body (to comply with the need for a limited action period).*
 - *It must be compatible with and stable in the paraquat formulation and not affect the herbicidal efficiency or occupational use of the product.*
4. *Some formulations containing additional wetter may show signs of layering and produce an oily precipitate under the conditions of test in MT41. This is acceptable, and does not affect biological efficacy or spray characteristics at normal spray dilution.*
5. *Samples of the product taken before and after the storage stability test should be analysed together after the test to reduce the analytical error.*