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Specifications for pesticides used in public health

- Insecticides ■ Molluscicides ■
 - Repellents ■
 - Methods ■

SEVENTH EDITION

WORLD HEALTH ORGANIZATION
DIVISION OF CONTROL OF TROPICAL DISEASES
WHO PESTICIDE EVALUATION SCHEME

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Common names and chemical names of pesticides



Specifications for pesticides used in public health 7th edition

CORRIGENDUM

Replace “mm” by “ μm ”

Sieving (P 59, 72, 104, 215, 220, 236, 277, 382, 286, 334, 352, 386, 392, 405: L2, P 215, 286: L4, P 387: L7, P 427: L1) - *Special apparatus* (P 92, 100, 102, 106, 108, 114: L7, P 95: L3, P 121, 137: L4, P 152, 174, 323, 365: L6, P 365, 371, 377, 383: L6&7, P 454:L4) - *Sample preparation* (P 154: L9, P 350, 355: L5, P 459: L2, twice) - *Special reagents* (P 365, 371, 377, 383: L5& 7) - *Deet content* (P 418: twice L3, L15, twice L18) - *Procedure* (P 419: L3, twice).

Replace “ml” by “ μl ”

Linearity check (P 75, 274, 280, 291, 297: L5, P183, 190: L1, 4, 5, P197: L1, P 211, 372, 367, 385, 378: L4, P 367, 385, 379: L8) - *Sample preparation* (P 93, 101, 109: L5, P 103, 115: L3, P 107, 197: L7, P.197: L4, 8, P 283: L6, P 284, 373: L1).
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Page 17, S2.1.4 L1, replace “1 ml/l” by “10 ml/l”

Page 22, S1.1 L2, replace “Ig” by “It”

Page 43, L2, replace “will” by “well”

Page 57, S2.3. L6, insert “not” after “the sample should”

Page 77, S2.2 L6, insert “ \pm ” after “54”

Page 96, L2, replace “from” by “for”

Page 97, add the last paragraph of page 77

Page 109, S2.2.6 L5, replace footnote “1” by “6”

Page 130, 1st equation, delete 2.2.5

Page 138, S2.2.6, Electrometer sensitivity, replace “ 0^{-9} ” by “ 10^{-9} ”

Page 150, 1st equation, insert “x P” after m_1

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- Pages 169 & 177, last line, replace "10 mg/μl" by "10 μg/ml"
- Pages 203, & 210, S2.2.2.2 L3, replace "m" by "μ"
- Page 231, S2.1.4 L7, replace "soljtions" by "solutions"
- Page 255 & 267, S1.2.4 L1, insert "after" after "powder"
- Page 257, S2.1.7 L5, replace "Insert" by "Inject"
- Page 281, S2.1.9, r₂, replace "ration " by "ratio"
- Page 284, S2.2.9, insert the 1st equation from page 281..
- Pages 349 & 354, S2.1.2.2 L2, replace "£ 10-mm" by "≤ 10 μm"
- Page 352, S1.2.2 L1, insert "not" after "shall"
- Page 359, last line, insert "Date of preparation"
- Page 362, L9, replace "(see note, page 84)" by "(see note, page 363)"
- Pages 365, 371,377 and 383, S2.1.2.2 L3, replace "m" by "μ"
- Page 394, S2.1.4, m₁, replace "deermination" by "determination"
- Page 428,
- Page 466, S5ii L7, replace "100 l" by "100 ml"
- Page 470, equation, replace "C_a" by "Ca"
- Page 471, chlorpyrifos, replace "diethyyl" by "diethyl" & "detlamethrin" by "deltamethrin"
- Page 472 deltamethrin, replace "-2,2-imethylcyclopropane" by "-2,2-dimethylcyclopropane"; and malathion, replace "-phorylthie" by "-phorylthio"
- Page 473 bendiocarb, replace "2,2-demmethyl-" by "2,2-dimethyl"
- endosulfan, replace "-1,5,5a,6,9,9a-hexahydro-6,9-methano- by
 "-1,5,5a,6,9,9a-"
- Page 474 niclosamide, ethanolamine salt, replace "-sakicylanilide" by "-salicylanilide"
- pirimiphos-methyl, replace "O-2-" by "O-2"
- temephos, replace "-thiodi-p-" by "-thiodi-p-"
- Page 475 temephos, replace "O,O -thiodi-p-" by "O,O -thiodi-p-"

PREFACE

Specification for insecticides and for spraying and dusting apparatus were first published by WHO in 1953. These were based on the fourth report of the WHO Expert Committee on Insecticides and on two earlier reports and were intended to cover all the principal compounds used in controlling insects of public health importance. Developments in this field were so rapid, however, that only one year after publication it was necessary to convene a new Expert Committee to expand and revise the specifications. This was due both to the considerable increase in the use of pesticides in public health and to the accumulation of knowledge on procedures for quality control arising out of collaborative studies. The recommendations of the Committee resulted in the publication in 1956 of the first edition of Specifications for Pesticides. This incorporated specifications for molluscicides and rodenticides as well as for insecticides and for spraying and dusting equipment. A second edition appeared in 1961, following revisions recommended in a further Expert Committee report published in 1958.

In 1963, a meeting of the WHO Expert Committee on Insecticides was convened to review the question of the equipment used for the application and dispersal of pesticides, the specifications and procedures recommended by this Committee were published in 1964 and a second edition was published in 1974.¹ Extensive revisions of the specifications for the pesticides themselves were recommended by the WHO Expert Committee on Insecticides in 1965. These recommendations were taken into account in preparing the third edition, which was published in 1967 under the amended title Specifications for Pesticides used in Public Health. The new title was intended to emphasize that the specifications are designed to meet the requirements of public health programmes and may not be applicable to pesticides used in agriculture. The specifications were again reviewed by the WHO Expert Committee on Insecticides in its nineteenth report in 1971², and by the WHO Expert Committee on Vector Biology and Control (the successor of the WHO Expert Committee on Insecticides) in its second report in 1978³.

¹ Equipment for vector control, 2nd ed., Geneva, World Health Organization, 1974.

² WHO Technical Report Series, No. 475. 1971.

³ WHO Technical Report Series, No. 620. 1978.

The recommendations contained in these last two reports formed the bases of the fourth and fifth editions, which were published in 1973 and 1979, respectively. The fifth edition excluded specifications for rodenticides which were published separately in collaboration with the Food and Agriculture Organization of the United Nations (FAO)⁴.

The task of once again bringing the specifications up to date was undertaken by the WHO Expert Committee on vector Biology and Control at a meeting held in 1983⁵ and 1989⁶. Note was taken of the potential within developing countries for the physicochemical analysis of pesticides. A brief inventory of the main equipment and reagents needed for modern analytical methods was produced for laboratories with limited resources. The need was stressed to standardize equipment and operating conditions as far as possible. It recommended that, whenever appropriate, the new analytical methods that had been found to be superior to existing methods and that had been the subject of collaborative trials in several laboratories should be included in the manual.

New pesticides and their formulations and new formulations of older compounds currently being used in vector control were also included. On the other hand, some substances that are no longer used in vector control were deleted, together with some general methods that have no further application.

The names of pesticides used in the specifications are either the names recommended by the International Organization for Standardization (ISO) or the chemical names. The latter are in accordance with the rules of the International Union of Pure and Applied Chemistry (IUPAC) as interpreted by the American Chemical Society in Chemical Abstracts. An alphabetical list of common names and chemical names of pesticides included in the specifications, with cross references, will be found in Annex 1.

The units of measurement used in the present volume are in accordance with the International System of Units (SI)⁷ developed by the General Conference on Weights and Measures.

⁴ FAO Plant Production and Protection Paper No. 16, 1980.

⁵ WHO Technical Report Series, No. 699, 1984.

⁶ WHO Technical Report Series, No. 798, 1990.

⁷ The SI for the health professions. Geneva, World Health Organization, 1982.

INTRODUCTION

The specifications include physicochemical characteristics of pesticides and the test methods used for the determination of those characteristics.

A specification almost always represents a compromise between what the manufacturer can make, what the user wants, and what he is prepared to pay for the product. Specifications for pesticides and pesticide formulations are no exception to this rule. In some instances, it may be technically impossible to meet the user's requirements; in others, it may be technically possible but very costly to do so. Sometimes, desirable requirements in respect of physical or chemical properties conflict with criteria governing biological efficacy. It is therefore very necessary for all concerned-particularly manufacturers and those responsible for quality control or inspection of supplies-to know (a) for what purpose the material is required, how it is to be used, and what abnormal conditions of storage might have to be met, and (b) the reasons for inclusion of the different requirements and test methods in the specification.

The specifications for pesticides included in this volume are designed specifically to meet the requirements of public health programmes. These differ in many respects from the requirements for pesticides used in agriculture, notably in the performance requirements and in the content of active ingredient in the various formulations. On the other hand, the specifications for the technical products, which are intended to define the quality of the material to be used in preparing the formulations, are of broader application. Indeed, in selecting the analytical methods for inclusion in these specifications, one of the guiding principles has been that they should be acceptable alike to the manufacturer, the public health worker, and the agricultural user.

The specifications are part of the WHO Pesticide Evaluation Scheme (WHOPES) which includes four phases. When a formulation of a compound has shown activity against one or several disease vectors or intermediate hosts in the first three phases of the Scheme¹, interim specifications are prepared by the industry, WHO Collaborating Centers, and WHO, in collaboration. They are distributed in a special series of documents. The final specifications are established during the WHO Expert Committee meetings. This constitutes phase 4 of WHOPES.

¹ Unpublished WHO document, CTD/WHOPES/IC/96.1

For public health purposes, the majority of insecticides are still procured in the form of water-dispersible powder. Since many vector control operations take place in remote areas with difficult lines of communication, these insecticide formulations may have to be stored for considerable periods under tropical conditions, and during this time they must remain in a satisfactory state for immediate use. The active ingredient must not deteriorate and the physical properties, particularly the suspensibility, must not become impaired. In this connection attention is drawn to the specifications for DDT powder for overseas shipment (WHO/SIF.26.R4) and malathion water-dispersible powder (WHO/SIF.10.R6). The DDT specification includes a requirement for long storage life since it is particularly important that powders ordered for use in malaria control programmes maintain their suspensibility after being shipped and stored in the field in hot climates. The malathion water dispersible powder specification includes a heat stability treatment designed to exclude powders that could form an impurity hazardous to spraymen and other workers.

Emulsifiable concentrates may deteriorate if exposed for considerable periods to low temperatures. Procurement agencies placing orders for such products should therefore give indications of any special requirements of this kind that will have to be met.

Special attention must be paid to packaging, which often has to withstand poor storage and transport conditions in adverse tropical climates.

To make the best use of specifications, those responsible for obtaining supplies of pesticides should state in the purchase order or request for bids:

- (1) the name of the pesticide, and its type of formulation,
- (2) the WHO specification number,
- (3) the concentration of active ingredient required²,
- (4) the type of packaging required and the kind of labeling, including language,
- (5) the inspection and sampling to be made after completion of the order but before its acceptance.
- (6) the name of the inspection agent and/or laboratory responsible for determining whether the pesticide meets all the requirements of the specification and the purchase order,
- (7) any special requirements that the purchaser may have (e.g. long-term storage); this will guide the manufacturer in the preparation of a satisfactory product.

² In the case of HCH-based formulations, the γ -isomer content should be specified.

Since many pesticides are toxic to man and animals, it is essential that the labels on the containers should carry a clear warning of the hazards, with instructions for safe handling and, where appropriate, an indication of the measures to be taken in the event of suspected intoxication. Minimum cautionary notices are included in the specifications. More detailed recommendations on the safe handling of pesticides, the protection of operators, the detection of exposure, and the treatment of intoxication will be found in the sixteenth and the twentieth reports of the Expert Committee on Insecticides³, and in the third, ninth and the fourteenth reports of the WHO Expert Committees on Vector Biology and Control⁴.

The use of benzene as a solvent is still included in several of the older analytical procedures. Since this chemical may pose a hazard if improperly used, the analytical chemist is advised to avoid exposure to either the chemical or its fumes.

Some of the specifications require reference materials for standardizing the analytical procedures. Laboratories can obtain analytical standards either directly from the manufacturers or from institutions such as Station de Phytopharmacie, Gembloux, Belgium.

Recommendations on the most suitable pesticides formulations for the control of particular vectors and on the appropriate methods of applying will be found in Annex 18 to the seventeenth report of the WHO Expert Committee on Insecticides⁵, and in Chemical methods for the control of arthropod vectors and pests of public health importance⁶ (under revision). A guide to the major items of equipment used in the application of pesticides as well as specifications and instructions on their use is given in Equipment for vector control⁷.

Throughout the specifications, pressures are given in kilopascals.

Equivalent values are, approximately:

$$1\text{kPa} = 0.01 \text{ kgf/cm}^2 = 7.5 \text{ mmHg} = 0.145 \text{ lb/in}^2$$

³ WHO Technical Report Series: No.356, 1967 and No.513, 1973

⁴ WHO Technical Report Series: No.634, 1980; No.720, 1985; No 813, 1991

⁵ WHO Technical Report Series, No. 443, 1970, p.165.

⁶ World Health Organization, Geneva, 1985

⁷ Equipment for vector control, 3rd ed. Geneva. World Health Organization, 1990

Part I
INSECTICIDES