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Guidelines for treated wastewater use for irrigation projects —

Part 5: Treated wastewater disinfection and equivalent treatments

Lignes directrices pour l'utilisation des eaux usées traitées dans les projets d'irrigation —

Partie 5: Désinfection des eaux usées traitées et traitements équivalents

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Foreword

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 282, *Water reuse*, Subcommittee SC 1, *Treated wastewater reuse for irrigation*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

Disinfection of treated wastewater (TWW) is a critical phase in the process of TWW use. Its purpose is to reduce or eliminate major health risks to the wastewater treatment plant's operators and to anybody who may come in contact with TWW or with crops that were irrigated with TWW.

This document provides a guideline for the available methods of disinfection, their effectiveness and the factors impacting those methods, along with their advantages and disadvantages, regarding technical and environmental aspects and effective inactivation or removal of various pathogens in wastewater and TWW for use in irrigation.

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Guidelines for treated wastewater use for irrigation projects —

Part 5: Treated wastewater disinfection and equivalent treatments

1 Scope

This document provides a guideline for the application of various available methods of treated wastewater (TWW) disinfection for an effective inactivation or removal of pathogens from TWW, which is intended for irrigation purposes.

This document deals with:

— chemical and physical technologies, principles of operation, and establishment of effective doses to be applied, possible interferences, and technical guidance for design and monitoring;

— comparison of the advantages and disadvantages of various disinfection methods suitable for TWW;

— potential environmental effects of the disinfection methodologies and ways to minimize those impacts;

— disinfection at different locations in the TWW use system, including in the wastewater treatment plant, within the distribution system and at the point of use.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 20670, *Water reuse — Vocabulary*

3 Terms, definitions, and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 20670 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1.1
advanced oxidation process
AOP
process that generates hydroxyl radicals in sufficient quantity to remove organics by oxidation

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3.1.2
ballast
unit inserted between the supply and one or more discharge lamps, which by means of inductance, capacitance, or a combination of inductance and capacitance, serves mainly to limit the current of the lamp(s) to the required value so as to convert and regulate incoming power to UV lamps to produce UV light

Note 1 to entry: The ballast provides the proper voltage and current required to initiate and generate UV photons.

3.1.3
fouling
process leading to deterioration of membrane flux due to surface or internal blockage of the membrane

Note 1 to entry: See AWWA B130-13[1].

3.1.4
pore size
size of the opening in a porous membrane

Note 1 to entry: Pore sizes are expressed either as nominal (average) or absolute (maximum), typically in terms of µm.

Note 2 to entry: See in AWWA B130-13[1].

3.1.5
reduction equivalent dose
RED
dose of UV in a given device which is determined by biodosimetry

Note 1 to entry: See *UV dose* (3.1.9) and "biodosimetry"

Note 2 to entry: This *UV dose* (3.1.9) is determined by measuring the inactivation of a challenge microorganism after exposure to UV light in a UV unit and comparing the results to the known UV dose response curve of the same challenge organism determined via Bench scale collimated beam testing.

3.1.6
ultrafiltration
UF
Note 1 to entry: pressure driven process employing semipermeable membrane under hydraulic pressure gradient for the separation components in a solution

Note 2 to entry: The pores of the membrane are of a size smaller than 0.1µm, which allows passage of the solvent(s) but will retain non-ionic solutes based primarily on physical size, not chemical potential.

Note 3 to entry: See in ASTM D6161-10.

3.1.7
UV disinfection system
combination of *UV disinfection units* (3.1.8) with associated controls and instrumentation

3.1.8
UV disinfection unit
independent combination of single or multiple bank(s) in series with a common mode of failure (e.g., electrical, cooling, cleaning system, etc.)

3.1.9
UV dose
UV fluence
amount of UV energy given as the time integral of the fluence rate or irradiance (W/m^2)

Note 1 to entry: This is given in units of mJ/cm^2 or J/m^2

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3.1.10
UV intensity sensor
UV irradiance meter or radiometer instrument to measure UV irradiance

3.1.11
UV transmittance
fraction of photons in the UV spectrum transmitted through a material such as water or quartz

Note 1 to entry: It is preferable that an online UVT sensor be installed and used to verify UVT.

Note 2 to entry: The wavelength of the UVT (%) should be specified, often using a path length of 1 cm. The measurement is calibrated compared to ultra pure water (ISO 3696 grade 1 or equivalent).

Note 3 to entry: UVT is related to the UV absorbance (A) by the following formula (for a 1 cm path length): % UVT = 100×10^{-A}.

3.2 Abbreviated terms

A254	absorbance at 254
CT	product of the total residual chlorine and contact time
DBP	disinfection by-products
EPA	Environmental protection agency
DOC	dissolved organic carbon
DVGM	German Technical and Scientific Association for Gas and Water (deutsher veriein des gas- und wasserfaches e.v.)
LP	low pressure
LPHO	low pressure high output
LRV	log removal value
MF	microfiltration
MP	medium pressure
MWCO	molecular weight cut off
NOM	natural organic matter
ONORM	Austrian Standard (*Österreichisches Normungsinstitut*)
QA/QC	quality assurance/quality control
RED	reduction equivalent dose
RO	reverse osmosis
TDS	total dissolved solids
THM	trihalomethanes
TMP	trans membrane pressure
TOC	total organic carbon

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