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Guidelines for performance evaluation of treatment technologies for water reuse systems —

Part 3: Ozone treatment technology

Lignes directrices pour l'évaluation des performances des techniques de traitement des systèmes de réutilisation de l'eau —

Partie 3: Technique de traitement à l'ozone

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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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 3, *Risk and performance evaluation of water reuse system*.

A list of all parts in the ISO 20468 series can be found on the ISO website.

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

The rapidly growing global market for water reuse technologies inevitably demands standards which are applicable on a world-wide basis. Many regions in the world are facing water shortages, and there is great interest in the use of technologies that can treat wastewater and make the reuse water available for a wide range of reuse applications that can satisfy non-potable water demands, thereby conserving precious potable water supplies. Simultaneously, the implementation of water reuse schemes is raising public and regulatory concerns regarding potential human health, environmental and societal impacts. This has led to an increasing need to specify various aspects of water reuse projects and there is a growing need on behalf of regulators, reuse technology suppliers, and users of those technologies for international standardization. Without ISO water reuse standards, a great number of opportunities for sustainable development based on water reuse will be lost.

Standardization needs to include objective specification and evaluation of levels of service and water reuse system performance dependability, including safety, environmental protection, and resilience and cost-effectiveness considerations. Hence, appropriate methods are needed to evaluate the performance of water reuse systems.

The performance of treatment technologies for water reuse, inter alia, should be evaluated properly in order to select the most appropriate technologies in an unbiased way to achieve the objectives of the water reuse project. Despite considerable research and development on treatment technologies, such scientific knowledge is largely held within commercial interests. Given less than ideal communication between producers and users of reuse technologies with regards to treatment performance, clear information as to what to measure on the one hand and what level of performance is required on the other is currently missing. To address these challenges, this document provides methods and tools, which can be accepted by most stakeholders, to evaluate the performance of treatment technologies for water reuse systems from multitude of applications.

Based on the discussion in the meetings of ISO/TC 282/SC 3, ISO 20468-1 titled “Guidelines for performance evaluation of treatment technologies for water reuse systems — Part 1: General” has been developed to establish the standard of generic aspects for performance evaluation. In this context, this document stipulating specific ways of performance evaluation of ozone treatment technology, commonly known as ozonation, for water reuse systems, based on ISO 20468-1 as the generic standard, is established herein.

Ozone (O_3) is an allotrope of oxygen (O_2) and is the second strongest oxidiser after fluorine. Its strong oxidative decomposition power makes it effective as a disinfectant and in removal of oxidizable constituents in water. There are cases where ozonation at high doses is used to remove micro-pollutants in wastewater for environmental protection.

In various types of water reuse systems, the disinfection and the removal of colour and odour are essential. Then it can be said that ozone technology plays an important role to improve these water qualities for the purpose of water reuse, working well with secondary or tertiary treated water as shown in Figure 1 of ISO 20468-1:2018 and in Annex A.

In this guideline, the dedicated features to ozone technology for water reuse are described and the requirements for proper and accurate evaluation of ozone system for water reuse are offered.

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Guidelines for performance evaluation of treatment technologies for water reuse systems —

Part 3:
Ozone treatment technology

1 Scope

This document specifies performance evaluation methods of treatment technology using ozone for water reuse systems. It deals with how to measure typical parameters which indicate performance of ozone treatment technology.

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

For the purposes of this document, the following 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 Terms and definitions

3.1.1
ambient ozone concentration
concentration of ozone existing in the air or surrounding the ozone treatment apparatus

3.1.2
exhaust residual ozone concentration
ozone concentration (3.1.6) at the outlet of an off-gas ozone treatment unit

3.1.3
generated ozone amount
mass of ozone generated in a unit time

3.1.4
generated ozone concentration
ozone concentration (3.1.6) in the gas phase at the outlet of an ozone generator

3.1.5
off-gas ozone concentration
ozone concentration at the outlet of an ozone contactor

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3.1.6
ozone concentration
volume, mass or mole of ozone in a unit volume or mass of gas or liquid

3.1.7
ozone concentration monitor
instrument capable of measuring ozone concentration in samples continuously

3.1.8
ozone demand
amount of ozone consumed to oxidize material in water

3.1.9
ozone dose
mass of ozone injected into a unit volume of water

Note 1 to entry: Ozone dose is expressed in units of mass-per-volume concentration (g/m^3 or mg/l).

3.1.10
residual ozone concentration
dissolved ozone concentration measured after a given contact time

Note 1 to entry: It is expressed in mg/l.

3.1.11
transferred ozone dose
mass of ozone applied into a unit volume of water

Note 1 to entry: Transferred ozone dose is expressed in units of mass-per-volume concentration (g/m^3 or mg/l).

3.2 Abbreviated terms

CT product of residual concentration and time

EPDM ethylene propylene diene monomer

FRP fiber-reinforced plastic

GHG greenhouse gases

LOX liquid oxygen

LRVs log-reduction values

PTFE polytetrafluoroethylene

SS stainless steel

UV ultraviolet

4 System configuration

4.1 General

The ozone system for water treatment consists of:

— a feed gas supply unit

— an ozone generation unit

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