INTERNATIONAL STANDARD

ISO 20468-7

First edition
2021-06

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

Part 7: Advanced oxidation processes technology

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

Partie 7: Technologie des processus d'oxydation avancés

Reference number
ISO 20468-7:2021(E)

COPYRIGHT PROTECTED DOCUMENT

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on 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 the following URL: 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 systems*.

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.

Introduction

Global warming and climate change have become worldwide concerns as many countries suffer from water shortages. There has been global investment to develop alternative water resources and secure water supplies. One of such efforts is water reclamation/reuse since it is readily available. At the same time, the implementation of the water reuse technology raises public and regulatory concerns on potential human health, environmental, and its social impacts. The water reclamation/reuse technology vendors and technology users have increased needs for defining various aspects of water reuse projects, for regulation and for international standardization. Without ISO water reuse standards, many opportunities for sustainable development based on water reuse could be lost.

Standardization of water reuse should include objective specifications, assessments of service level and water reuse system performance dependencies such as safety, environmental protection, resilience, and cost-effectiveness. Therefore, appropriate methods are needed to evaluate the performance of the reuse system.

Varying amounts of persistent organic pollutants (POPs) can be found dependent on the biological activity of the surrounding watershed and the geochemical circulation. POPs are organic compounds that are resistant to degradation. POPs typically are halogenated organic compounds which exhibit high lipid solubility, thus bioaccumulate in fatty tissues. Polyhalogenated organic compounds are of particular concern because of the stability and lipophilicity which are often correlated to their halogen content. Since POPs accumulate and are persistent, they can adversely affect human health and the environment as a result.

The performance of the treatment technology for water reuse should be properly evaluated in order to select the most appropriate technology to achieve the objectives of the water reuse project. Despite considerable research and development on therapeutic techniques, such scientific knowledge is largely depending on the scope of commercial interests. This document establishes a specific performance evaluation method for advanced oxidation processes (AOPs) for water reuse systems based on ISO 20468-1 as a generic standard. To address these issues, this document provides the evaluation of the performance of water reuse systems in many applications by providing methods that most stakeholders can accommodate.

At the ISO TC282/SC3 meeting, a general standard for performance evaluation based on the discussion entitled "Guidelines for Performance Evaluation of Processing Technologies for Water Reuse Systems - Part 1: General" in ISO 20468-1 was discussed. Technology, and combinations, thereof, and descriptions of representative technologies should be included in the individual standards submitted in accordance with ISO 20468-1. In this context, this document establishes a specific performance evaluation method for advanced oxidation processes (AOPs) for water reuse systems based on ISO 20468-1 as a generic standard.

AOP technologies represent a group of treatment processes (e.g., hydrogen peroxide/ozone, hydrogen peroxide/UV, ozone/UV, pH elevated ozonation, etc.) that rely on the production of hydroxyl radicals as a strong oxidant capable of the complete oxidation of most organic compounds.

In water reuse systems, AOP technologies are mainly applied for disinfection and for removing total organic carbon (TOC) including persistent organic pollutants (POPs) that are barely decomposed by conventional oxidation processes, as indicated in Table A.1 (Annex A). For instance, direct oxidation of chlorobenzene by ozone is known to occur very slowly; this reaction's second-order kinetic rate constant is less than 1 $M^{-1}s^{-1}$. On the other hand, the oxidation of chlorobenzene by ·OH is extremely rapid (up to 4×10^9 $M^{-1}s^{-1}$).

AOPs as an advanced level treatment are generally applied to tertiary treated water, as shown in Figure 1 of ISO 20468-1.

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

Part 7:
Advanced oxidation processes technology

1 Scope

This document provides a performance evaluation method of treatment technology using advanced oxidation processes (AOPs) for water reuse treatment. It introduces a system of evaluating water quality to validate AOP performance through typical parameters such as the concentration of hydroxyl radicals.

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 20670:2018, *Water reuse — Vocabulary*

3 Terms, definitions, and abbreviated terms

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 Terms and definitions

3.1.1
persistent organic pollutant (POP)
chemical substances that persist in the environment, bio-accumulate through the food web, poses a risk of causing adverse effects to human health and the environment, and can be subject to long range transport away from its original source

Note 1 to entry: Substances are classified as POPs according to either The Protocol to the regional UNECE Convention on Long-Range Transboundary Air Pollution (CLRTAP) on POPs, opened for signatures in June 1998 and entered into force on 23 October 2003 or the global Stockholm Convention on POP, opened for signatures in May 2001 and entered into force on 17 May 2004.

[SOURCE: ISO 26367-2:2017, 3.8[1]]

3.1.2
advanced oxidation process (AOP)
process that generates hydroxyl radicals in sufficient quantity to remove organics by oxidation