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Guidance for performance grading of recovered reverse osmosis (RO) membranes for water reuse

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Foreword

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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.

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Introduction

Reverse osmosis (RO) membranes are used in various applications such as seawater desalination, ultrapure water production, wastewater treatment, advanced treatment of secondary treated wastewater for reuse, etc. However, the performance of RO membranes gradually declines due to aging and membrane fouling caused by long-term use. At present, used RO membranes are disposed of as consumable materials after several years of use.[1]

However, used RO membranes, if recovered by an appropriate process such as chemical cleaning, can be reused for various water reclamation and reuse applications, with lower costs than those involved in new membrane production.[2][3] For example, in Japan, disposed RO membranes from Fukuoka seawater desalination plant have been reused for boiler feed water production in the waste water processing centre (sewage plant).

If a used membrane is graded based on its performance, then an appropriate membrane can be selected for each purpose for water reuse. For example, a Grade C1 membrane (lower salt rejection rate and higher flow rate) is suitable for reuse in treating sewage for irrigation usage, while a Grade A1 membrane (higher salt rejection and higher flow rate) is preferable for processing treated sewage for boiler feed water usage.

By reducing membrane disposal, the use of recovered RO membranes can contribute to sustainable development goals (SDGs). Membrane life extension will promote the reduction of old membrane disposal (GOAL12), and less production of new membranes will reduce the carbon footprint (GOAL13). Furthermore, reusing and repurposing RO membranes will also result in an inexpensive and safe water supply to more people (GOAL6).

In order to promote the use of recovered RO membranes, users need information on the membranes, including their performance. This will enable new users to apply the membranes to their intended purpose.

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Guidance for performance grading of recovered reverse osmosis (RO) membranes for water reuse

1 Scope

This document provides guidance and requirements for grade classification of performance of recovered reverse osmosis (RO) membranes for water reuse systems.

This standard is applicable to the spiral-wound type of recovered membranes from seawater reverse osmosis (SWRO) and brackish water reverse osmosis (BWRO) systems.

This standard is to ensure consistency in the performance of recovered RO membranes. It does not specify any method or process for the recovery of RO membranes.

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 20670:2023, *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 terminology databases for use in standardization at the following addresses:

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

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

3.1 Terms and definitions

3.1.1
differential pressure
delta-P
hydraulic pressure drop across the element feed channel that is a differential pressure from the feed water inlet to the concentrate outlet

[SOURCE: AWWA M53]

3.1.2
element
component containing the membrane, generally replaceable, such as a spiral wound cartridge

[SOURCE: ASTM D6161]

3.1.3
flux
membrane throughput

Note 1 to entry: Flux is usually expressed in volume of *permeate* (3.1.6) per unit membrane surface area, for example litre per square metre per hour ($l/m^2 \cdot h$) at a given temperature or normalized temperature (more than 20 °C).

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