## ISO 20468-6:2021 (E)

# Guidelines for performance evaluation of treatment technologies for water reuse systems — Part 6: Ion exchange and electrodialysis

## Contents

Foreword

#### Introduction

- 1 Scope
- 2 Normative references
- 3 Terms, definitions, and abbreviated terms
  - 3.1 Terms and definitions
  - 3.2 List of Abbreviated terms
- 4 Outline of ion exchange and electrodialysis
  - 4.1 General
  - 4.2 Principle of Ion exchange[11]-[19]
  - 4.2.1 System configuration
  - 4.2.1.1 Ion exchange resins
  - 4.2.1.2 Ion exchange resin tower
  - 4.2.2 Process
  - 4.2.2.1 Process design
  - 4.2.2.2 Ion exchange resin selection
  - 4.2.2.3 Operation
  - 4.3 Principle of Electrodialysis[11]-[19]
  - 4.3.1 System configuration
  - 4.3.1.1 Ion exchange membrane
  - 4.3.1.1.1 Classification by ion exchange group
  - 4.3.1.1.2 Classification by structure
  - 4.3.1.2 Electrodialyser
  - 4.3.2 Process
  - 4.3.2.1 Batch method
  - 4.3.2.2 One-pass method
  - 4.3.2.3 Feed & bleed method
  - 4.3.2.4 Multi-stage method
  - 4.4 Application examples
  - 4.4.1 Ion exchange
  - 4.4.2 Electrodialysis

5

- 4.5 Performance evaluation for ion exchange and electrodialysis
- Performance evaluation guideline for ion exchange resin[14]-[19]
  - 5.1 Performance evaluation
  - 5.1.1 Functional requirements
  - 5.1.1.1 Treated water quality
  - 5.1.1.2 Regeneration efficiency
  - 5.1.2 Non-functional requirements
  - 5.1.2.1 Water extractable residue
  - 5.1.2.2 Ion exchange resin lifetime
  - 5.1.2.3 Sustainability
  - 5.1.3 Timing for evaluating key factors
  - 5.2 Evaluation method
  - 5.2.1 Ion exchange resin
  - 5.2.1.1 Ion exchange capacity
  - 5.2.1.2 Water extractable residue
  - 5.2.1.3 Particle size and particle size distribution

- 5.2.1.4 Pressure drop of ion exchange resin column
- 5.2.1.5 Volume change ratio
- 5.2.1.6 Perfect beads content
- 5.2.1.7 Physical strength
- 5.2.1.8 Osmotic strength
- 5.2.1.9 Reaction rate
- 5.2.2 Treated water quality
- 5.2.2.1 Electrical conductivity
- 5.2.3 lon exchange resin tower
- 5.2.3.1 Pressure drop
- 5.2.4 Operation and maintenance

### 6 Performance evaluation guideline for electrodialysis [11]-[18]

- 6.1 Performance evaluation
- 6.1.1 Functional requirements
- 6.1.1.1 Product water quality
- 6.1.1.2 Water recovery rate
- 6.1.2 Non-functional requirements
- 6.1.2.1 Energy consumption
- 6.1.2.2 Membrane lifetime
- 6.1.2.3 Sustainability
- 6.1.3 Timing for evaluating key factors
- 6.1.3.1 Indication of initial evaluation
- 6.1.3.2 Indication of regular evaluation (maintenance, etc.)
- 6.1.3.3 Indication of continuous evaluation (daily or weekly)
- 6.2 Evaluation method[5],[7],[8],[9]
- 6.2.1 Ion exchange membrane
- 6.2.1.1 Electrical resistance
- 6.2.1.2 Transport number
- 6.2.1.3 Permselective coefficient
- 6.2.1.4 Mechanical strength
- 6.2.2 Stack performance
- 6.2.2.1 Leak current
- 6.2.2.2 Electrical current efficiency
- 6.2.3 Operation and maintenance
- Annex A (informative) Main process and typical applications of IER and IEM [20]
- Annex B (informative) Main treatment technologies and target constituents for reusing water
- Annex C (informative) Structural model of IER
- Annex D (informative) Selectivity and selectivity coefficient of IERs
- Annex E (informative) Comparison of various IERs
  - E.1 SAC and WAC
  - E.2 Comparison of SBA and WBA
- Annex F (informative) General operation of an IER process
- Annex G (informative) Flow diagram of IE and ED process [20]
- Annex H (informative) Feed water conditions
- Annex I (informative) Measurement method of electrical resistance of IEM
- Annex J (informative) Measurement method of transport number of IEM
- Annex K (informative) Permselective coefficient of IEM
- Annex L (informative) Mechanical strength of IEM
- Annex M (informative) Leak current calculation for a stack