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Corrosion and Fouling Control in Desalination Industry

Springer

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ISBN 978-3-030-34283-8 ISBN 978-3-030-34284-5 (eBook)
https://doi.org/10.1007/978-3-030-34284-5

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

Corrosion and fouling continue to be severe issues for modern society affecting all life aspects, including the water desalination industry. Many authors from different perspectives discussed the understanding of these two phenomena. However, within the context of sustainable and cost-effective freshwater production through desalination, it is necessary in our opinion to address these challenges by assessing the progress of phenomena understanding, best engineering practices, and research and development efforts. We have made an effort in this direction to collectively present important aspects of corrosion and fouling and their control methods that are specific to the desalination industry. The term fouling here is used in a broader perspective that also includes inorganic scaling.

This book consists of three parts: (I) desalination processes, (II) corrosion in desalination, and (III) fouling in desalination. In each part, the authors recall fundamentals of the topic before discussing practical solutions and pending challenges for future efforts.

Part I (Chaps. 1, 2, 3 and 4) covers the key design components, performance indicators, economics, and challenges of conventional and unconventional desalination systems. Chapter 1 focuses on the concepts and system components of industrial desalination systems and provides a detailed account of the different desalination techniques, their energy consumption, and environmental sustainability. Chapters 2 and 3 respectively deal with the thermal and reverse osmosis desalination systems and provide interesting accounts of process components, performance, and challenges of the two widely employed industrial desalination systems. Chapter 4 describes in detail the unconventional desalination technologies, including membrane distillation, forward osmosis, adsorption desalination, and freeze desalination.

Part II (Chaps. 5, 6, 7, 8, 9, 10 and 11) deals with corrosion challenges and mitigation practices within desalination plants. Chapters 5 and 6 respectively detail forms and mitigation practices of corrosion in thermal and reverse osmosis desalination plants. Chapter 7 focuses explicitly on corrosion and environment-assisted cracking of stainless steels, the most preferred corrosion-resistant alloy in desalination systems. Chapter 8 explains various corrosion monitoring techniques that are currently in use in industrial desalination systems, namely, both direct and indirect

corrosion monitoring techniques. Chapter 9 focuses on corrosion control in desalination plants utilizing chemical additives, particularly on corrosion inhibitors, and explains the inhibitors for MIC and oxygen scavengers. Chapter 10 deals with corrosion control strategies during acid cleaning in heat exchangers, which are a vital part of thermal desalination industry. Chapter 11 describes two cutting-edge corrosion control strategies that can be applied in desalination industry, namely smart coating and photoelectrochemical cathodic protection.

Part III (Chaps. 12, 13, 14, 15, 16 and 17) concentrates on fouling and its control methods in desalination industries. Chapter 12 focuses on inorganic scaling in desalination systems, while Chapter 13 provides an interesting account on biofouling of membranes in reverse osmosis desalination plants. Chapters 14 and 15, which both deal with control approaches to scaling, gives a general overview of various scale control strategies and provides a specific account of antiscalant chemical additives, respectively. Chapter 16 provides an interesting description of the practical ways of biofouling control in desalination systems and an account of biofouling monitoring techniques, while Chapter 17, the last chapter, explains strategies in fabricating antifouling desalination membranes.

The book encompassed a multidisciplinary group of authors, including academicians and industrial professionals, to combine knowledge and practical experience for a broad spectrum of interested readers. We hope that the present book will be a handy reference tool for scientists and engineers who are working in water desalination.

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