

DESALINATION ENGINEERING

by Mohamed Ali Darwish

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This book is the outline of the author's experience on water desalination over forty years working in research and academia. It was written for students for both graduate and undergraduate levels as well as practitioners in the field of seawater desalination. It covers the basic of thermal desalination processes: multi-effect (ME), multi-stage flash (MSF), mechanical vapor compression (MVC), and thermal vapor compression (TVC), as well as the most used membrane technology, reverse osmosis (RO). Since large thermal desalination units are usually combined with power plants, a chapter on cogeneration power desalting plants (CPDP) producing both electric power and desalted seawater is included.



Introduction: Water in the World

Water in the Gulf Cooperation Council Countries (GCC)

- Viable options to satisfy freshwater needs
- The Qatar water case
- Food

Desalination Processes

- Multi-stage flash (MSF)
- Multi-effect distillation (MED)
- Vapor compression (VC)
- Reverse osmosis (RO)
- Factors affecting the choice of a desalting system
- Hybrid desalting systems

Multi-Effect Desalination (MED)

- Single-effect submerged tube system
- MEB desalination system and its arrangement
- Modern MEB with regenerative heating system
- Typical conventional MEB units

Multi-Stage Flash (MSF)

Mechanical Vapor Compression (MVC)

Thermal Vapor Compression (TVC)

- Single-effect TVC system
- Multi-effect thermal vapor compression (ME-TVC) system

Reverse Osmosis (RO)

Background

- Water chemistry related to RO
- Membrane module configuration and arrangements
- Basic equations and definitions
- Water intakes, possible foulants, and pretreatment
- Feed water treatments to prevent scale formation
- Post-treatment
- RO system design

Cogeneration Steam Power Desalting Plants (CPDP) using Steam Turbines

- Desalting plants and their energy supply
- Methods of supplying energy to desalting systems
- The Rankine cycle and its development
- Combining steam turbines with thermally operated desalting plants
- Fuel allocation between desalted water and power
- Main characteristics of CPDP using steam turbines
- General rating of the CPDP as a whole and its components
- Case studies
- Examples using gas turbines in CPDP

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Professor Mohamed Ali Darwish is a Mechanical Engineer with a B.Sc. from Alexandria University in 1960, and a Ph.D. from Kansas State University in 1969.

He taught desalination in King Abdel Al-Aziz University from 1976 to 1985 and in Kuwait University from 1985 to 2009. He worked as a consultant to the Kuwait Foundation for the Advancement of Science (KFAS) from 2009 to 2011, and in the Qatar Environment and Energy Research Institute

from 2011 to present. He has more than 100 publications in peer reviewed journals as well as several books. He received several awards from the International Desalination Association (IDA) for outstanding contributions to the field of desalination science, and from the College of Engineering, Kuwait University as a best researcher.

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