



Advanced Course in Water Treatment Processes

Presented by the Department of Chemical Engineering, University of Pretoria

5 ECSA CPD Points | CPD Reg No: P005781-2019

5 SACNASP CPD Points | CPD Reg No: 2018-0115-000473

The **Advanced Course in Water Treatment Processes** provides you with an overview of both the theoretical and practical aspects of industrially relevant advanced water treatment processes. Topics include chemical water treatment, advanced oxidation processes, calculating the required chemical doses required for various chemical water treatment processes, desalination and membrane technology.

The course also includes a review of the current South African water crisis and the need for alternative water resources, development of new treatment processes, energy considerations, basic water chemistry, examples of advanced water treatment technologies, the scientific basis and limitations, operational considerations, case studies and advances in membrane technologies.

NEXT PAGE 

Shifting knowledge to insight



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Course content

Review of the South African water crisis and the need for alternative water resources

- South African water resources
- South African water use allocation and stressors
- Current strategic plans

Needs for advanced treatment processes

- Impaired water sources – decline of water quality in water bodies
- Recovery of industrial effluents
- Acid mine drainage desalination
- Sea water desalination
- Wastewater recovery (direct and indirect reuse)

Energy considerations

- The water-energy nexus
- Uncoupling the water-energy cycle

Review of basic water chemistry

- Acid-base and solubility equilibrium chemistry
- Chemistry of the carbonate system

Examples of advanced water treatment technologies

- Chemical water treatment processes
 - Chemical precipitation
 - Neutralisation
 - Oxidation-reduction
- Advanced oxidation processes
- Desalination
- Membrane technology
 - Low pressure membranes (microfiltration and ultrafiltration)
 - High pressure membranes (nanofiltration and reverse osmosis)
 - Passive membrane processes (forward osmosis)
- Electrodialysis and ion-exchange

Scientific basis and limitations

- Science behind operation of membrane systems
- Fouling and recovery
- Membrane cleaning methods
- Membrane fatigue and rate of replacement
- Operational economics of membrane plants

Operational considerations

- Calculations related to chemical water treatment
- Use of advanced oxidation processes in industry – advantages and limitation
- Design of advanced oxidation processes
- Desalination process considerations
- Practical considerations related to membrane technology
 - Operation and calculations related to low pressure membrane processes
 - Operation and calculations related to high pressure membrane processes
 - Fouling and pre-treatment
 - Permeate quality
 - Scaling and anti-scalants

Operation of electrodialysis and ion-exchange processes

- BAT standards and in-stream water quality

Case studies

- South African examples
- Global examples
- Field trip – Emalahleni Acid Water Desalination Plant (to be confirmed)

Advances in membrane technologies – emerging technologies

- Ultrathin and ultralight membrane materials (graphene and carbon nanotubes)
- Biodegradable membranes
- Catalytic membranes

Learning outcomes

After successfully completing this course, you will be able to

- calculate the required chemical doses required for various chemical water treatment processes
- explain and identify advantages of various advanced oxidation processes
- design advanced oxidation processes for removal of contaminants
- identify technologies for desalination
- explain and compare membrane-based and thermal-based desalination
- explain the basic principles of low pressure membranes
- explain the basic principles of high pressure membranes

NEXT PAGE 

Shifting knowledge to insight

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- select and design a membrane filtration system given specific feed and effluent requirements
- define and explain fouling and cleaning in low pressure membranes
- define and classify fouling and propose mitigation activities to control fouling in high pressure membrane systems
- evaluate need for pre-treatment and for post-treatment in membrane systems
- explain the basic principles of electrodialysis and ion-exchange, and
- evaluate the quality of an effluent water stream using BAT standards.

Who should enrol?

This course is ideal for professionals in water treatment companies, consulting agencies, ministries, and equipment suppliers. Background of the participants: civil engineers, chemical engineers, application engineers, process technologists, plant operators.

Course fees

R14 000.00 per delegate (VAT incl.)

Course fees include all course material, refreshments and other materials during contact days.

Course fees must be paid in full 14 days prior to course start dates. Proof of payment can be submitted to enrolments@enterprises.up.ac.za

Admission requirements

Prospective delegates should at least have a bachelor's degree in Science or Engineering, with a reasonable background in maths, physics or chemistry. Relevant work experience in water resource planning, treatment processes and/or operation is recommended.

Accreditation and certification

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Registration and enquiries

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