UNIVERSITEIT GENT

Studiefiche

Vanaf academiejaar 2019-2020

Biotechnological Processes of Environmental Sanitation (I001498)

Cursusomvang (nominale waarden; effectieve waarden kunnen verschillen per opleiding)

Studiepunten	5.0	Studietijd	135 u	Contacturen	60.0 u

Aanbodsessies en werkvormen in academiejaar 2019-2020

A (semester 1)	Engels	begeleide zelfstudie	6.25 u
		werkcollege: geleide oefeningen	15.0 u
		groepswerk	5.0 u
		werkcollege: PC-klasoefeningen	10.0 u
		hoorcollege	23.75 u

Lesgevers in academiejaar 2019-2020

Rabaey, Korneel	LA25	Verantwoordelijk lesgever
Ganigué, Ramon	LA25	Medelesgever

Aangeboden in onderstaande opleidingen in 2019-2020	stptn	aanbodsessie
Master of Science in Environmental Sanitation	5	A

Onderwijstalen

Engels

Trefwoorden

Environmental biotechnology, microbiology, potable water, waste water

Situering

This course presents an engineering based approach towards sanitation processes based on microbial conversions. These conversions are the foundation of a wide variety of environmental technical constructions. The course mainly deals with wastewater treatment, but also to a lesser extent discusses drinking water preparation. Not only conventional activated sludge is discussed, we also highlight novel technological solutions such as membrane bioreactors. This is further completed with an introduction into gene technology applied for environmental studies. The practical exercises consist of design calculations and process measurements in the context of a case study.

Inhoud

Theory

1 Wastewater treatment
1.1 What is wastewater?
1.2 Legislative framework for wastewater treatment
1.3 Wastewater treatment approach

2 Activated sludge
2.1 General overview of this chapter
2.2 General and historical
2.3 Definition of parameters and terms
2.4 Process design and biokinetics
2.5 Nutrient removal
2.6 Aeration
2.7 Sludge sedimentation
2.8 Control, modeling and automation
2.9 Microbial ecology of the activated sludge process
2.10 Flocculation of activated sludge

3 Special types of activated sludge processes
3.1 Sequencing Batch Reactors
3.2 Extended aeration
3.3 Pure oxygen driven aeration
3.4 High oxygen transfer through deep shaft or tower reactors
3.5 Powdered activated carbon (PAC) assisted activated sludge
3.6 Multistage systems/ A-B process
3.7 Aerobic granulation

4 Membrane bioreactors
4.1 Introduction
4.2 MBR configurations

5 Biofilm based wastewater treatment
5.1 Fundamentals of substrate utilization in biofilms
5.2 Biofilm-based treatment processes

6 Resource recovery from wastewater
6.1 Water recovery: a case study for Flanders (text after IWVA)
6.2 Energy
6.3 Biosolids

7 Economic aspects of wastewater treatment
7.1 General breakdown of costs
7.2 Specific for Flanders – Calculations of the water pollution taxes

8 Biological aspects of drinking water production
8.1 Introduction: legislation, quality levels
8.2 Drinking water from groundwater
8.3 Drinking water from surface water

Case study
Part of the coursework consists of visiting a treatment facility. The students (per four) are asked to evaluate if the process described in the course corresponds with the actual situation in the field. Moreover, they are encouraged to inquire about the strengths/weaknesses of the process as it is occurring and the putative need for optimization. This way, the student learns to test his knowledge in situ and to explore for opportunities for further development.
Exercises
The *practical exercises* deal with calculations concerning the unit processes covered in the course. Examples are given how to design, monitor and control these processes. Also investment and
operational costs of treatment processes are briefly addressed.

Begincompetenties

Chemistry, mathematics and physics: level of bachelor of science

Eindcompetenties

1 Capacity to evaluate the biotechnology of clean water production and of aerobic waste treatment.

2 Capable to comprehend the engineering principles of the processes covered in the course.
3 Be able to design the important biotechnological unit processes.
4 Have the attitude to judge the various processes in terms of performance and order of magnitude of overall opex and capex.

Creditcontractvoorwaarde

Toelating tot dit opleidingsonderdeel via creditcontract is mogelijk mits gunstige beoordeling van de competenties

Examencontractvoorwaarde

Dit opleidingsonderdeel kan niet via examencontract gevolgd worden

Didactische werkvormen

Begeleide zelfstudie, groepswerk, hoorcollege, werkcollege: geleide oefeningen, werkcollege: PC-klasoefeningen

Toelichtingen bij de didactische werkvormen

Theory: oral lectures
Exercises : class room based exercise solving Case study : guided by a tutor, groups of 4 students create together a case study on a treatment plant. They will present the case study to an assessment panel besides providing a case study document

Leermateriaal

Lecture notes are available.
Illustrations for the various topics are additionally provided via Minerva. Geraamde totaalprijs: 7 EUR

Referenties

Environmental Biotechnology – Principles and Applications. (B.E. Rittmann & P.L. McCarty, Eds.). McGraw-Hill International Editions, Biological Sciences Series, 754 p. ISBN 0-07-118184-9
W. Verstraete and E. Van Vaerenbergh. 1986. Aerobic activated sludge, p. 44 112. Chapter 2. In : Biotechnology Vol. 8. H.J. Rehm and G. Reed (Eds.). VCH Verlagsgesellschaft, Weinheim
M. Waweru, V. Herrygers, H. Van Langenhove and W. Verstraete. 2000. Process engineering of biological waste gas purification. In : Biotechnology, Volume 11c 'Environmental Processes III – Solid waste and waste gas treatment, Preparation of Drinking water'; Chapter II 'Waste gas treatment – General aspects'. Pp. 260-272. J. Klein and J. Winter (Eds.). Wiley-VCH Verlag GmbH, Weinheim. ISBN 3-527-28336-6
S. Aiyuk, J. Amoako, L. Raskin, A. Van Haandel and W. Verstraete. 2004. Removal of carbon and nutrients from domestic wastewater using a low investment, integrated treatment concept. Water Res. 38, 3031 3042

Vakinhoudelijke studiebegeleiding

For the students which have difficulties with certain topics, there are make-up lectures at their requests. Secondly, there are rehearsal sessions at the end of the seminar in which questions are answered and examples of examination exercises are given. In terms of the home work (in casu the visit to an actual site), the students are invited to prepare this visit properly by contacting an assistant. Moreover, after the visit, they are requested to report to the course responsible and to discuss with him their experiences and potential questions.

Evaluatiemomenten

periodegebonden evaluatie

Evaluatievormen bij periodegebonden evaluatie in de eerste examenperiode

Openboekexamen, mondeling examen, werkstuk

Evaluatievormen bij periodegebonden evaluatie in de tweede examenperiode

Openboekexamen, mondeling examen, werkstuk

Evaluatievormen bij niet-periodegebonden evaluatie

Tweede examenkans in geval van niet-periodegebonden evaluatie

Niet van toepassing

Toelichtingen bij de evaluatievormen

Theory : written closed book examination
Exercises : written examination, open book
Case study: presentation and defence with panel

Eindscoreberekening