

**Bioremediation and Degradation of Industrial  
Pollutants**

Code: 43333  
ECTS Credits: 6

Degree	Type	Year	Semester
4314579 Biological and Environmental Engineering	OB	2	1

## Contact

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## Use of Languages

Principal working language: spanish (spa)

## Teachers

Maria Teresa Vicent Huguet  
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## Prerequisites

Basic knowledge on material and energy balances and stoichiometry.

## Objectives and Contextualisation

The main goal is to understand the potential and mechanisms used by microorganisms to degrade environmental pollutants, their application in contaminated sites and the tools for monitoring the success of bioremediation.

## Competences

- Seek out information in the scientific literature using the appropriate channels and integrate this information, showing a capacity for synthesis, analysis of alternatives and critical debate.
- Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
- Use knowledge of chemical engineering to design and optimise processes of pollution remediation in natural environments.

## Learning Outcomes

1. Apply knowledge of microorganisms' role in biodegradation processes and as bioindicators, and their potential in the implementation of clean technologies.
2. Develop and apply the knowledge and skills acquired in real cases.
3. Differentiate between biodegradation, degradation, mineralisation and other related concepts.
4. Identify systems for treating polluted natural environments, showing a holistic perspective on the process.
5. Identify the factors that determine the effectiveness of a biodegradation process.
6. Propose the most suitable biodegradation strategy for the type of contaminant and the stage(s) it is at.

7. Seek out information in the scientific literature using the appropriate channels and integrate this information, showing a capacity for synthesis, analysis of alternatives and critical debate.
8. Synthesize and interpret, in a logical and reasoned information from studies of biodegradability or molecular biology.
9. Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.

## Content

This unit contains 7 sections:

1. Introduction (definition of basic concepts, strategies to implement a bioremediation project)
2. Metabolic and cometabolic principles involved in biodegradation. Diagnostic and monitoring tools.
3. Use of stable isotope techniques in bioremediation.
4. Assessment of biodegradability. Use of respirometric technics and anaerobic biodegradability tests. Toxicity tests.
5. Bioremediation technologies.
6. Soil remediation. Characteristics of soils. Case studies. Mangement of a soil bioremediation project.
7. Phytoremediation

## Methodology

The subject is developed through theory classes, problems and tutorials.

## Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Case study	37	1.48	3, 9
Type: Supervised			
Problem-based learning	15	0.6	1, 2, 5, 4, 6, 8
Type: Autonomous			
Theory classes	95	3.8	7, 6, 8

## Assessment

Evaluation activities include:

- Attendance and active participation (5%)
- Case study (20%)
- Oral presentation (25%)
- Exam (50%)

The minimum score to pass the course is 5 out of 10.

Retaking Final test: There will be a final test for those students who have not passed the continuous assessment. However, the folloing activities cannot be re-evaluated:

- Attendance and active participation (5%)
- Case study (20%)
- Oral presentation (25%)

Students have the right to the revision of the final grades of their evaluation activities. The date for reviewing the qualifications will be informed in a timely manner through the Moodle platform.

A distinction can be given to students who score 9.0 or higher in a subject. The number of distinctions awarded to students cannot be higher than 5% of the total number of students enrolled in a subject. If the total number of students is lower than 20 then only one distinction will be awarded.

The returning date of the corrected reports will be informed in a timely manner, so that students can to review the correction and improve the aspects that are necessary for the following reports.

Without prejudice to other disciplinary measures, and in accordance with current academic regulations, any irregularities committed by the student that could lead to a variation of the score of an evaluation act will be scored with a zero. Therefore, copying or allowing to copy a practice or any other evaluation activity will imply a zero (0) in the attitude note and, therefore, suspend the course.

Repeaters are obliged to pass the full course.

## Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Exam	50%	0	0	1, 7, 2, 3, 5, 4, 6, 8, 9
Attendance and active participation	5%	0	0	1, 2, 3, 5, 4, 6, 8, 9
Case study	20%	2	0.08	1, 2, 3, 5, 4, 6, 8, 9
Oral presentation	25%	1	0.04	1, 7, 2, 3, 5, 4, 6, 8, 9

## Bibliography

- Stroo, H. F., Lesson, A., Ward, C. H. Bioaugmentation for groundwater remediation. 2013. Springer.
- Alvarez, P. J. J., Illman W. A. Bioremediation and natural attenuation. 2006. Wiley-Interscience.
- Haug, R.T. The practical handbook of compost engineering. 2003. Lewis Publishers
- McBean, E.A., Rovers, F.A., Farquhar, G.J. 1995. Solid waste landfill engineering and design. Prentice Hall
- Landfill Mining. Preserving Resources through Integrated Sustainable Management of Waste. Technical Brief from the World Resource Foundation.(<http://www.enviroalternatives.com/landfill.html>, Maig 2013).
- Gilbride KA, Lee D-Y , Beaudette LA. 2006. Molecular techniques in wastewater: Understanding microbial communities, detecting pathogens, and real-time process control. Journal of Microbiological Methods 66:1-20.
- Copp,J.B., Spanjers, H., Vanrolleghem, P.A. (1998) Respirometry in control of the activated sludge process principles. IAWQ Task Group on Respirometry. London International Association on Water Quality. Can be found in the URV Library (504.631 Res).
- Environmental isotopes in biodegradation and bioremediation". Editors: C.M. Aelion; P. Höhnener; D. Hunkeler; R. Aravena. CRC Press. 2010. Boca ratón, FL. ISBN: 978-1-56670-661-2.
- A Guide for assessing biodegradation and source identification of organic ground water contaminants using compound specific isotope analysis (CSIA). 2009. Environmental Protection Agency, USA. Disponible a: <http://bit.ly/21nWgWI>
- Biotratamiento de residuos toxicos y peligrosos MA Levin and MA Gealt Ed Mc Graw-Hill 1997

- Environmental Degradation and transformation of organic chemicals AH Neilson and AS Allard CRC Press
- Clean Technology and the environment RC Kirkwood and AJ Longley Blackie Academic
- Treatment on contaminated soil R Stegmann and col Springer 2001
- Principios de Biorecuperación JB Eweis and col Mc Graw Hill, 1999
- Organohalide-respiring bacteria. L. Adrian and F. Löffler, 2016. Springer-Verlag Berlin Heidelberg. ISBN 978-3-662-49873-6.