

Centre	University College of Engineering of Vitoria-Gasteiz
Name of subject	26095 – Industrial Waste Management
Qualification	Degree in Industrial Chemical Engineering
Type	Elective
Credits	6 ECTS
Year	4
Term(s)	2nd
Department	Chemical and Environmental Engineering
Language	Spanish

Outcomes / Objectives

BRIEF DESCRIPTION OF CONTENT

Major conventional technologies and advanced industrial waste treatment technologies. Minimisation and reuse as management strategies

OBJECTIVES

Have knowledge of the problems and main industrial waste management options and strategies.

OUTCOMES

1. Be able to categorise and assess the hazardousness of waste generated from industrial – and generally anthropogenic – activities, in compliance with current legislation.
2. Be able to question, make decisions and provide a reasoned argument for the Best Available Technology(ies) (BAT) from among the different technological options for the management of the main types of waste, using sustainability criteria.
3. Be able to correctly use relevant bibliographical sources to obtain, understand (in both Spanish and English), interpret and question new scientific-technical information related to waste management.
4. Be able to use appropriate terminology with rigour to express themselves in oral debates and in technical reports in relation to waste management.

Syllabus

Unit 1 – Environmental problems of waste.

Introduction to the environmental problems of toxic and hazardous waste. Concept of waste. Legislation. Waste generating activities. Management options. Characterisation. Categorisation criteria.

Unit 2 – Membrane-less separation technologies: Application to waste management.

Separation of solids. Separation of liquid effluent components.

Unit 3 – Membrane separation technologies: Application to waste management.

Microfiltration, ultrafiltration, nanofiltration and reverse osmosis. Permeation processes. Dialysis and electrodialysis. Criteria for the selection of separation technology(ies) for waste management.

Unit 4 – Conventional chemical technologies: application to waste management.

Conventional technologies. Neutralisation. Precipitation. Coagulation and flocculation. Emulsion breaking. Conventional physicochemical treatments.

Unit 5 – Non-conventional chemical technologies applicable to waste management and advanced technologies. Ion exchange. Electrochemical processes. Solvent extraction. Supercritical fluid extraction. Advanced oxidation. Technologies for the transformation of organochlorine compounds.

Unit 6 - Incineration: Application to waste management.

Legislation. Waste characterisation prior to incineration. Variables affecting efficiency of the process.

Environmental problems of gaseous effluents, solid waste and wastewater generated during the incineration process. Integrated industrial waste incineration management. Sustainability of incineration: environmental and socio-economic assessment.

Unit 7 – Solidification/stabilisation technologies: Application to the inerting of toxic and hazardous waste.

Basic solidification/stabilisation operations. Solidification/stabilisation technologies. Intended use of inerted products.

Unit 8 - Disposal and controlled storage: Application to toxic and hazardous waste management.

Legislation. Selecting a site. Waste acceptance criteria and procedures. Operation of a secure landfill. Leachate and gas sealing and collection systems. Cell cover system. Secure landfill or cell post closure management.

Construction of secure toxic and hazardous waste cells in the Basque Country. Sustainability of waste controlled confinement: environmental and socio-economic assessment.

Unit 9 – Minimisation and reuse: General waste-management strategies

Source reduction. Selection of raw materials. Changes to the manufacturing process. Alternative products.

Recovery, recycle and reuse. Criteria for selecting waste management options. Better Available Technologies (BAT).

Methodology

Teaching Method

Face-to-Face Teaching Hours

Lectures	Seminars	Classroom practice	Lab. practice	Computer sessions	Clinical practice	Workshops	Industrial workshops	Field practice
36	12	12						

Student Hours of Non Face-To-Face Activities

Lectures	Seminars	Classroom practice	Lab. practice	Computer sessions	Clinical practice	Workshops	Industrial workshops	Field practice
36	36	18						

Assessment System

General criteria

- Written essay exam
- Practical tasks (exercises, case studies or problems)
- Group assignments
- Presentation of assignments, reading...

Bibliography

Basic Bibliography

- AGUADO ALONSO J., RODRÍGUEZ JIMÉNEZ J.J. E IRABIEN GULIAS A. Los residuos peligrosos: caracterización, tratamiento y gestión. Madrid: Editorial Síntesis S.A., 2007.
- LAGREGA M.D. Gestión de residuos tóxicos. Tratamiento, eliminación y recuperación de suelos. New York: McGraw-Hill, 2006.
- NEMEROW N.L. Tratamiento de vertidos industriales y peligrosos. Madrid: Díaz de Santos, 2006.

In-depth Bibliography

- CID A. Caracterización y vías de gestión de residuos industriales generados en la Comunidad Autónoma del País Vasco. Vitoria-Gasteiz: Eusko Jaurilaritza, 2004.
- ELÍAS CASTELLS X. Reciclaje de residuos industriales: aplicación a la fabricación de materiales de construcción. Madrid: Díaz de Santos, 2000.
- IHOBE. Manual de productos peligrosos. Bilbao: IHOBE, 2002.
- LEVIN M.A. y GEALT M.A. Biotratamiento de residuos tóxicos y peligrosos: selección, estimación, monitorización, microorganismos y aplicaciones. Madrid: McGraw-Hill, 2007.
- MARAÑÓN E. Residuos industriales y suelos contaminados. Gijón: Universidad de Oviedo, 2000.
- TCHOBANOGLIOUS G. Gestión integral de residuos sólidos. Madrid: McGraw-Hill, 2007.

Magazines

- ASCE Practice Periodical of Hazardous Toxic and Radioactive Waste Management (USA). ASCE.
<http://www.pubs.asce.org/journals/hz.html>
- Environmental Law & Management. Wiley Interscience.
<http://www3.interscience.wiley.com/maintenance.html?DESCRIPTOR=PRINTISSN&VALUE=1067-6058>
- Environmental Science & Technology. American Chemical Society (ACS).
<http://pubs.acs.org/journals/esthag/index.html>
- Residuos. La revista técnica de Medio Ambiente.
<http://www.revistaresiduos.com/RevistaResiduos/>
- Warmer Bulletin España. Instituto para la sostenibilidad de los Recursos (ISR).
http://www.isrcer.org/warmer_new.asp
- Waste Management. International Journal of Integrated Waste Management, Science and Technology. Elsevier.
http://www.elsevier.com/wps/find/journaldescription.cws_home/404/description#description

Websites

- Activities of the European Union in the field of waste management. Legislation.
<http://europa.eu.int/scadplus/leg/es/s15002.htm>
- Community of Waste Management Professionals.
<http://www.ictnet.es/ICTnet/home/cv/?area=mAmb&cv=residuos>
- Instituto Nacional de Seguridad e higiene. Ministerio de Trabajo y Asuntos Sociales. Legislation.
http://www.mtas.es/insht/legislation/tl_res.htm
- Plan Nacional de residuos urbanos 2000-2006. Ministerio de Medio Ambiente.
http://www.mma.es/calid_amb/residuos/plan/index.htm
- Technoscience. Technical information about waste. Legislation.
<http://www.tecnociencia.es/especiales/residuos/>