

## Química en la Indústria

2014/2015

Codi: 42426

Crèdits: 15

Titulació	Tipus	Curs	Semestre
4313385 Química Industrial i Introducció a la Recerca Química/Industrial Chemistry and Introduction to Chemical Research	OT	0	1

### Professor de contacte

Nom: José Peral Pérez

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### Utilització de llengües

Llengua vehicular majoritària: anglès (eng)

Grup íntegre en anglès: No

Grup íntegre en català: Sí

Grup íntegre en espanyol: No

### Equip docent

Joan Carles Bayón Rueda

José Luis Bourdelande Fernández

Jordi Marquet Cortés

Rosa Maria Ortuño Mingarro

Manuel Valiente Malmagro

Manel del Valle Zafra

Pau Ferrer Alegre

Carlos Valero Santiago

Xavier Sala Roman

Juan Antonio Baeza Labat

Gonzalo Guirado López

Jordi Saldo Periago

Albert Guisasola Canudas

Sergio Ponsa Salas

### Equip docent extern a la UAB

Amadeo Triviño

Antoni Torrens

Fernando Carrillo

Jesús Santamaria

Joan Gallardo

Miquel Osset

Montserrat Closa

Mónica Lira

## Prerequisits

No hi ha prerequisits

## Objectius

En aquesta assignatura es tracten aspectes ben diferenciats de l química industrial: per una part temàtiques comunes en una indústria basada en tecnologia química o Biotecnologia i, d'altra banda, monografies especialitzades de especial importància. El pes específic d'ambdues parts és, aproximadament, del 50%.

- Gestió de projectes. Valorització dels costos de producció. Activitat emprenedora. Tractament de residus i aigües residuals. Química verda. Energies sostenibles. Biotecnologia.

- Temes monogràfics sobre productes químics d'interès industrial: commodities, polímers, fàrmacs, tensioactius, colorants, aromes i fragàncies, pesticides, additius, ceràmiques, productes per l'alimentació.

## Competències

- Correctly apply new information capture and organisation technologies to solve problems in professional activity.
- Correctly evaluate the risks and environmental and socio-economic impact associated to special chemical substances.
- Define specialised concepts, principles, theories and facts in the different areas of Chemistry.
- Design processes that imply the treatment or elimination of dangerous chemical products.
- Evaluate responsibility in the management of information and knowledge in the field of Industrial Chemistry and Chemical Research.
- Evaluate the human, economic, legal and ethical dimension of professional practice, as well as the environmental implications of ones work.
- Foster innovation and entrepreneurship in chemical industry and research.
- Innovate in the spaces and environments of the field of work, showing initiative and an entrepreneurial spirit.
- Possess and understand knowledge that provides a basis or opportunity for originality in the development and/or application of ideas, often in a research context
- Propose alternatives for the solving of complex chemical problems in different chemical specialities.
- Student should possess an ability to learn that enables them to continue studying in a manner which is largely self-supervised or independent
- Students should know how to communicate their conclusions, knowledge and final reasoning that they hold in front of specialist and non-specialist audiences clearly and unambiguously
- Use scientific terminology in the English language to defend experimental results in the context of the chemistry profession.

## Resultats d'aprenentatge

1. Correctly apply new information capture and organisation technologies to solve problems in professional activity.
2. Describe and analyse monographic themes of chemical products of major industrial relevance.
3. Design chemical experiments.
4. Evaluate responsibility in the management of information and knowledge in the field of Industrial Chemistry and Chemical Research.
5. Evaluate risks related with industrial products.
6. Evaluate the human, economic, legal and ethical dimension of professional practice, as well as the environmental implications of ones work.
7. Explain waste treatment procedures.
8. Identify technological applications based on biological systems and living organisms for the creation and modification of products or processes.

9. Innovate in the spaces and environments of the field of work, showing initiative and an entrepreneurial spirit.
10. Manage projects, evaluate production costs and demonstrate entrepreneurial activity.
11. Possess and understand knowledge that provides a basis or opportunity for originality in the development and/or application of ideas, often in a research context
12. Student should possess an ability to learn that enables them to continue studying in a manner which is largely self-supervised or independent
13. Students should know how to communicate their conclusions, knowledge and final reasoning that they hold in front of specialist and non-specialist audiences clearly and unambiguously
14. Use scientific terminology in the English language to defend experimental results in the context of the chemistry profession.

## Continguts

Chemistry in Industry

Project Management (8 h)

Prof.: Carlos Valero ([Carlos.Valero@uab.cat](mailto:Carlos.Valero@uab.cat))

Overview of project management concepts:

1. Project initiation.
2. Setting objectives.
3. Planning.
4. The human factor.
5. Project execution and evaluation.

Skills and technical tools of the Project Manager:

1. Specification of appropriate objectives for the project.
2. Techniques of management by objectives.
3. Roles and responsibilities of the Project Manager.
4. Preparation of Project Plan and development.
5. Evaluation and implementation.

Entrepreneurship (4 h)

Prof.: Jordi Marquet ([jordi.marquet@uab.cat](mailto:jordi.marquet@uab.cat))

1. Introduction.
2. The entrepreneurial cycle: Innovation and creativity, risk, initiative, confidence and control.
3. Diagnosis: Culture, training and financing.
4. The tool box: The opportunity window and the business plan.
5. Funding: From "FFF" to "business angels" and "venture capital".
6. Managing and growing the venture.

Practical exercise: Each student will have to propose a business idea and to develop a hypothetical business plan for it.

Waste and Wastewater treatment (14 h)

Prof.: Albert Guisasola ([albert.guisasola@uab.cat](mailto:albert.guisasola@uab.cat))

1. Wastewater treatment.

- Wastewater characterisation: wastewater distribution, analytical parameters of conventional wastewaters.
- Biological, physical and chemical processes occurring during urban wastewater treatment in WWTP.
- Possibilities for industrial wastewater treatment.
- Potabilisation techniques for drinking water.

2. Solid waste treatment.

- Solid waste characterisation.
- Urban and Industrial waste treatment techniques.

Sustainable Energy (6 h)

Prof.: José Luis Bourdelande ([joseluis.bourdelande@uab.cat](mailto:joseluis.bourdelande@uab.cat)), Xavier Sala ([xavier.sala.roman@gmail.com](mailto:xavier.sala.roman@gmail.com)), and Mónica Lira ([monica.lira@cin2.es](mailto:monica.lira@cin2.es))

1. Sustainable chemistry: current energy challenge and alternatives.

2. Solar photochemical cells: artificial photosynthesis.

3. CO<sub>2</sub> photoreduction using solar energy.

4. Solar cells based on semiconductor junctions.

5. Ceramic materials for solar cells.

Biotechnology processes (10 h)

Prof.: Pau Ferrer ([pau.ferrer@uab.es](mailto:pau.ferrer@uab.es))

1. Introduction. Historic perspective. Bio-based products and processes: fields of application.

2. Industrial biotechnology in practice. Case studies of bio-based products and processes:

a. Biofuels: ethanol and others.

b. Organic acids and amino acids.

c. Antibiotics: penicillin.

d. Biopharmaceuticals.

Chemical and Biochemical process control (4 h)

Prof.: Juan Antonio Baeza ([juanantonio.baeza@uab.es](mailto:juanantonio.baeza@uab.es))

- Instrumentation for control of chemical and biochemical processes.

- Basic control schemes. Feedback, feedforward.
- Other control schemes. Cascade, ratio, override, auctioneering, split-range...
- Design and tuning of controllers.

#### Green Chemistry (7 h)

Prof.: Gonzalo Guirado ([gonzalo.guirado@uab.cat](mailto:gonzalo.guirado@uab.cat)) and José Peral ([jose.peral@uab.cat](mailto:jose.peral@uab.cat))

##### 1. Advanced Oxidation Processes for water and air treatment:

- Heterogeneous photocatalysis.
- Fenton and photo-Fenton.
- Ozonation.
- Chemical-biological coupling.

##### 2. Green solvents.

##### 3. Electrochemistry for greener processes.

#### Bulk Chemicals (10 h):

Prof.: Joan Carles Bayón ([joancarles.bayon@uab.cat](mailto:joancarles.bayon@uab.cat)) and Rosa Ortuño ([rosa.ortuno@uab.cat](mailto:rosa.ortuno@uab.cat)).

##### 1. Industrial chemicals: bulk and fine chemicals and specialties.

##### 2. Raw material and energy supply.

##### 3. Inorganic chemicals:

- Sulfuric acid.
- Lime.
- Ammonia.
- Nitric acid.
- Phosphoric acid and phosphates.
- Alkalis.
- Chlorine and hydrogen chloride.
- Sodium carbonate.

##### 4. Organic chemicals:

- C2-, C3- and C4-olefins.
- Methyl tert-butyl ether.
- Ethylene dichloride and vinyl chloride.
- BTX fraction.
- Methanol.
- Ethylbenzene and styrene.

- Ethylene oxide and ethylene glycol.
- Terephthalic acid and dimethyl terephthalate.

#### Polymers (7 h)

Prof.: Joan Carles Bayón ([joancarles.bayon@uab.cat](mailto:joancarles.bayon@uab.cat)) and Jesús Santamaria

1. Classification of polymers.
2. Polymers properties.
3. Polyolefins.
4. Polyesters and polyamides.
5. Polyurethanes.

#### Pharmaceuticals (10 h)

Prof.: Rosa M. Ortuño ([rosa.ortuno@uab.cat](mailto:rosa.ortuno@uab.cat)), Antoni Torrens and Montserrat Closa.

1. Historical introduction:
  - Active principles in folk medicine.
  - Drug development in the early twentieth century: from aspirin to antibiotics.
  - Some main hits in the last 50 years: anti-tumour and antiviral drugs.
2. Drug discovery from natural products. Pain killers: from morphine to tapentadol.
3. Pharmaceutical Industry overview.
4. Research & Innovation: breakthroughs and blockbusters.
5. Drug discovery and development. From the original idea to the marketplace.
6. Analytical development of active pharmaceutical ingredients (APIs).
7. Good manufacturing practices (GMPs) and regulations.

#### Surfactants (4 h)

Prof.: Miquel Osset.

1. Applied chemistry of surfactants:
  - Industrial sectors.
  - Applications.
  - Suppliers and formulations.
2. Surfactants as key ingredients in a wide variety of uses and intermediate solutions to provide consumer relevant products.

#### Dyes (4 h)

Prof.: Fernando Carrillo.

1. Introduction.
2. Clasification of Dyes and chemical structures.
3. Dyeing of textile materials.
4. Qualitycontrol of dyed textiles.
5. Environmental aspects of textile dyeing.

Flavors and fragrances (4 h)

Prof.: Amadeo Triviño.

1. Food and its constitution: a) Basic components; b) Components of biological mechanisms; c) Active substances of sensory system.
2. Sensory attributes of food: a) The flavour of food; b) Chemical composition of natural flavours:
  - Classification
  - Origin
  - Biogenesis of flavours
  - Flavours generated by enzymatic action
  - Flavours generated by heat
  - Flavours generated by oxidation-rancidity
3. Human senses: taste and smell
4. Food flavours: a) Food flavouring definition; b) Function; c) Structure; d) Traditional raw materials; e) Synthetic raw materials; f) Innovative raw materials; g) Carriers and solvents.
5. Flavour design: a) Methodology; b) Organoleptic and physical properties; c) Chemical structure and odour; d) Olfactory notes; e) Olfactory families; f) Evolution of aromatic composition; g) Appearance; h) Application.
6. Sensory analysis: a) Types of analysis; b) Quantitative Descriptive Analysis.
7. Flavour production: a) Scaling; b) Practical aspects
8. Legislation: a) Definition and classification of flavours; b) Legislation in the labelling of flavors.

Food Chemistry (10 h)

Prof.: Manuel Valiente (Manuel.Valiente@uab.es), Jordi Saldo (Jordi.Saldo@uab.es ) and Joan Gallardo.

1. Food main components and chemical properties:
  - Amino acids, peptides and proteins
  - Hydrocarbons.
  - Oils and fats.
2. Food technology, modifications during storage and industrial processes:
  - Water activity (Sorption isotherms, water binding, effect on food stability).
  - Processing methods related withchanges in water activity, oils and fats, proteins and

hydrocarbons.

Chemical Diagnostics (4 h):

Prof.: Manel del Valle ([manel.delvalle@uab.cat](mailto:manel.delvalle@uab.cat))

1. Automation concepts in chemical analysis.
2. Digital and analogue signal acquisition.
3. Diagnostic kits.
4. Use of biological reagents.
5. Omics technologies.
6. Case applications in the clinical, food & beverage sectors.

## Metodologia

Classes magistrals

Classes de resolució de problemes

Activitats cooperatives

Seminaris

Elaboració i presentació oral de treballs tutoritzats

Tutories

## Activitats formatives

Títol	Hores	ECTS	Resultats d'aprenentatge
Tipus: Dirigides			
Classes de resolució de problemes	30	1,2	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
Classes magistrals	100	4	1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
Estudi individual	170	6,8	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
Seminaris	20	0,8	2, 10, 14

## Avaluació

L'avaluació es realitzarà amb la següent distribució aproximada:

1. Exàmens escrits (60%)
2. Treballs per realitzar en hores no presencials (25%)
3. Presentacions en classe (15%)

## Activitats d'avaluació

Títol	Pes	Hores	ECTS	Resultats d'aprenentatge
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Exàmens	60	30	1,2	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
Presentacions	15	10	0,4	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
Treballs	25	15	0,6	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14

## **Bibliografia**

Cada professor assignarà la bibliografia corresponent