Education in Sustainable Chemistry in Spain: The activities of the Spanish Network in Sustainable Chemistry

Santiago V. Luis

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Castellon, Spain
Education in sustainable chemistry in Spain

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TRAINING COURSES ON SPECIFIC TOPICS

Ph. D. STUDIES IN GREEN CHEMISTRY

MASTER DEGREE IN GREEN CHEMISTRY

SUMMER SCHOOLS IN GREEN CHEMISTRY

INTRODUCTION OF GREEN CHEMISTRY CONCEPTS IN CHEMISTRY CURRICULA

PUBLIC AWARENESS OF SCIENCE

PERMANENT TRAINING/PROFESIONAL TRAINING

POSTGRADUATE LEVEL

UNDER-GRADUATE LEVEL

GENERAL LEVEL
Education in sustainable chemistry in Spain

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Talks
Presentations at Schools and High Schools

Open Days, Science Weeks

Public Conferences
Talks
Mass media presentations

Senior Citizens' University

Conferences, Seminars, Round Tables for Entrepreneurs, Trade Unions, Politicians, Journalists

Summer Courses

STUDENTS

Pre-university levels

graduate students

Post-graduate students

Teachers

S&T publications

PROFESSIONALS

Chemistry-related Professional and Technicians

Seminars for Teachers

Scientific & Technological Conferences
Workshops

Specific Training Courses
CULTURAL HERITAGE POSTGRADE

(209 students in 2014)

- The current role of Science: Sustainability, Technology and Nature

Students in three groups:
- group A 72
- group B 62
- group C 68

Gender distribution:
- Male 66
- Female 136
The current role of Science: Sustainability, Technology and Nature

1. SCIENCE AND TECHNOLOGY IN TODAY’S WORLD: A CRITICAL VISION  
3 HOURS

2. CHEMISTRY AND THE ENVIRONMENT  
1.5 HOURS

3. SUSTAINABLE CHEMISTRY AND GREEN CHEMISTRY  
1.5 HOURS

4. INDUSTRIAL RAW MATERIALS: TOWARDS THE USE OF RENEWABLE RAW MATERIALS  
1.5 HOURS

5. SUSTAINABLE MATERIALS  
1.5 HOURS

6. SCIENCE, TECHNOLOGY AND ETHICS  
0.75 HOURS

7. CURRENT FRONTIERS IN SCIENCE AND TECHNOLOGY  
0.75 HOURS
Education in sustainable chemistry in Spain

Santiago V. Luis

Degree in Chemistry
300-340 ECTS
4-5 years

PhD in Sustainable Chemistry
32 ECTS + research work
3-4 years
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32 ECTS + research work
3-4 years

TEMPORAL EVOLUTION

Red Española de Química Sostenible

Menciones de calidad
2003 - 2004
2004 - 2005

QUÍMICA SOSTENIBLE

Programa de Doctorado Interuniversitario
Desarrollo de Nuevos Procesos Químicos con Bajo Impacto Ambiental
Education in sustainable chemistry in Spain

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Degree in Chemistry
300-340 ECTS
4-5 years

PhD in Sustainable Chemistry
32 ECTS + research work
3-4 years

Degree in Chemistry
180-240 ECTS
3-4 years

MSc in SC
60-120 ECTS
1-2 years

PhD in Sustainable Chemistry
research work
3-4 years
Degree in Chemistry  
300-340 ECTS  
4-5 years

Degree in Chemistry  
180-240 ECTS  
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3-4 years

Degree in Chemistry
180-240 ECTS
3-4 years

MSc in SC
60-120 ECTS
1-2 years

PhD in Sustainable Chemistry
research work
3-4 years

Degree in Chemistry
240 ECTS
4 years

MSc SC
60 ECTS
1 year

PhD in Sustainable Chemistry
research work
3-4 years

Degree in Chemistry
240 ECTS
4 years

MSc SC
60 ECTS
1 year

PhD in Sustainable Chemistry
research work
3 years
INTERUNIVERSITY MSc
IN SUSTAINABLE CHEMISTRY:
60 ECTS

Máster universitario en
Química Sostenible
[Interuniversitario | 12ª edición]

Participar en el Máster te permitirá:

- Adquirir los conocimientos y conceptos necesarios para hacer compatible el desarrollo tecnológico del campo de la Química con el medio ambiente.
- Alcanzar una formación diferencial encaminada a cubrir las nuevas necesidades de la industria química y relacionadas (alimentaria, farmacéutica, cosmética...)
- Formarte con profesores españoles y europeos líderes en sus campos respectivos.
- Formarte en contacto con estudiantes de distintas universidades españolas en un entorno internacional (< 35% de extranjeros).

Clasificado entre los estudios de Máster mas relevantes en Ciencia y Tecnología (ranking El Mundo, 2016)

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http://www.mqs.uji.es
http://www.facebook.com/quimicasostenible.uji
Grup de Química Sostenible y Supramolecular
http://www.quimicasostenible.uji.es
Participan: UV, URV, UJI, UAB
Colaboran: FEDOR, PTOS, ICT, CSIC, UNIR, UCD, UNED, ULLE, UCDP

INTERUNIVERSITY PhD
IN SUSTAINABLE CHEMISTRY:
COMPLEMENTARY TRAINING
+ RESEARCH WORK

Química Sostenible

FROM RELATED MASTERS,
AFTER APROVAL OF THE
ACADEMIC COMMITTEE
Education in sustainable chemistry in Spain

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Students from a degree in chemistry, science, engineering...

PhDs to research/industry

Masters to industry

Students from industry...

(Lifelong learning)
TRAINING MODULES IN THE SPANISH INTERUNIVERSITY POSTGRADUATE PROGRAM IN SUSTAINABLE CHEMISTRY

Complementary training in Chemistry

**Chemistry and Energy:**
- Chemistry and Energy (B)
- Electrochemistry (A+R)
- Photochemistry (A+R)
- Fuell-Cells (A)
- Microwaves in Chemistry (R)
- Sonochemistry (R)

**Biotransformations:**
- Biotransformations (B)
- Biotechnology (R)
- Enzymes in Chemistry (A)
- Whole Cells & Microorganisms in Chemistry (A)

**Benign Solvents:**
- General Concepts (B)
- Chemistry in Water (R)
- Ionic Liquids (A+R)
- Supercritical Fluids-Properties (R)
- Reactions/Extractions in scFs (A)
- Alternative Green Solvents (R)

**Green Catalysis:**
- General Concepts (B)
- Acid-Base Catalysis (A)
- Oxidation Catalysts (A)
- Enantioselective Catalysis (B)
- Zeolites & Related Materials (R)
- Supported Catalysts (R)
- Alternative Green Solvents (R)
- Industrial Catalytic Processes (A)

**Green Chemical Engineering:**
- Green Engineering Principles (B)
- Process Intensification (A)
- Green Metrics (B)
- Design and Evaluation of Reactors (R)
- High Pressure Chemistry (A)
- On-line Monitoring (R)
- Waste management (A)

**Other subjects:**
- Green Chemistry Principles (B)
- Renewable Raw Materials (B)
- Industrial Applications (B)
- (Eco)Toxicology (B)
- Environmental Chemistry (A)
- Risk Analysis (A)
- Environmental legislation (A)
- Economy & Sustainability (A)
- Facilitated Chemistry (B)
Education in sustainable chemistry in Spain

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**MASTER IN SUSTAINABLE CHEMISTRY**

- **CS1**
  - 21 ECTS
  - WORKSHOP IN SUSTAINABLE CHEMISTRY

- **CS2**
  - 18 ECTS

- HI COURSES: 3-21 ECTS
- PRACTICAL WORK: 18 ECTS

**3 YEARS**

COMPLEMENTARY TRAINING IN SUSTAINABLE CHEMISTRY AND TRANSVERSAL COMPETENCIES

- W IN SC
- W IN SC
- W IN SC

**PhD IN SUSTAINABLE CHEMISTRY**

CS: COMMON SITE
HI: HOME INSTITUTION

ICCE 2017
OSLO
COMMON INTENSIVE COURSES: 3 ECTS each

CS1
- General Concepts
- Industrial Applications
- Homogeneous Catalysis
- Heterogeneous Catalysis
- Supported Systems
- Biocatalysis
- Bening solvents

CS2
- Renewable Raw Materials
- Sustainable Energies
- Industrial Biotransformations
- Microwaves and Ultrasounds
- Electrochemistry & Photochemistry
- Supercritical Fluids
COMPLEMENTARY TRAINING IN SUSTAINABLE CHEMISTRY AND TRANSVERSAL COMPETENCIES

- Additional courses on Sustainable Chemistry
- Publications and Patents
- Participation in accredited courses
- Participation in accredited scientific/technological events
- Active participation in funded R+D projects
- Stays at other laboratories
- Participation in Workshops and Congresses
- Training in complementary skills
V WORKSHOP ON
SUSTAINABLE CHEMISTRY
NANOSCIENCE
15th MAY 2017
Edificio Centro de Posgrado y Consejo Social. Sala de Actos. Universitat Jaume I Castellón

09:30-09:45 Presentation
09:45-10:45 “Magnetic nanoparticles and nano-composites for biomedical applications: synthesis, assembly into functional clusters, evaluation costs and impacts of production” Prof. Dermot Brougham. University College of Dublin

10:45-11:45 “Polymer Therapeutics as Nano-sized medicines” Dra. M. Jesus Vicent Centro de investigación Príncipe Felipe, Valencia

11:45-12:45 Coffee break


13:15-15:30 Lunch

15:30-16:30 “Membrane Like Supported Ionic Liquid Nano Catalytic Devices” Prof. Jairton Dupont Nottingham University

16:30-17:30 “Metallo-Organic Capsules for Catalytic Applications” Dr. Vicente Martí Centelles University of Edinburgh

Agradecimientos. Escuela de Doctorado, Universitat Jaume I y Generalitat Valenciana PROMETEO 2016-071
XXI CENTURY: THE SEARCH FOR SUSTAINABILITY

- CATALYSIS
- Safer Reactions & Reagents
- Separation Processes
- Energy Efficiency
- Process Intensification
- Green Chemistry
- Solvent Replacement
- Use of Renewable Feedstocks
- Waste Minimisation

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XXI CENTURY: THE SEARCH FOR SUSTAINABILITY

SÉPARATION PROCESSES
SAFER REACTIONS & REAGENTS
SOLVENT REPLACEMENT
RENEWABLE FEEDSTOCKS
PROCESS INTENSIFICATION
WASTE MINIMISATION
ENERGY EFFICIENCY
CATALYSIS
GREEN CHEMISTRY

Universitat Jaume I
Education in sustainable chemistry in Spain

Santiago V. Luis

Catalysis

Process Intensification

Solvent Replacement

Renewable Feedstocks

Minimization

Waste

Safer Reactions & Reagents

Separation Processes

Energy Efficiency

Environmental Chemistry

Education and Training in Green Chemistry
WHAT ADVANTAGES A COOPERATIVE TRAINING (INTERUNIVERSITY PROGRAM) DOES PROVIDE?

All subjects are covered by high level specialists in the field

The program is set up by a combination of different ideas. Each participating Center contributes with its own expertise area and its own approach

Students from different Universities, interests and backgrounds are forced to interact very closely

Researchers and Professors from different Universities, interests and backgrounds interact within them and with the students, in particular during intensive sessions at common sites

Development of cooperation in experimental work and development of researches combining different subjects and expertises are favored

Scale Economy is gained: It is easier to reach a critical mass and the cost for individual Universities is very much reduced

The involvement of high level experts from industry and at an international level is greatly facilitated

Combines a common core of training with some degree of specialization based on the expertises at the Home Institution
WHAT DRAWBACKS A COOPERATIVE TRAINING INTERUNIVERSITY PROGRAM DOES PROVIDE?

- A period of mobility is required for both students and teachers.
- Some funding is essential to guarantee mobility.
- Permanent improvement of practical aspects is essential.
- Management aspects become much more complex.
- A strong and continuous effort of coordination is required.
- Legal aspects need to be considered very carefully.
- Involvement of working students is often difficult.

Permanent improvement of practical aspects is essential.
Where are we coming from?

Castellón, Spain
International Relevance of the
Spanish Interuniversity Postgraduate Program in Sustainable Chemistry:

International conferences:

- ACS Annual Green Chemistry & Engineering Conference, Washington - 2005
- 4th IUPAC Conference on Green Chemistry, Foz de Iguaçu (Brazil) – 2012
- 6th ANQUE International Congress of Chemistry, Puerto de la Cruz, Tenerife – 2006
- 6th Green Chemistry Conference, Barcelona – 2004
- Universidade Nova da Lisboa, Caparica (Portugal) – 2006
- 4th International Congress on Green Process Engineering, Sevilla -2014

Publications:

RED ESPAÑOLA DE QUÍMICA SOSTENIBLE
SPANISH NETWORK FOR SUSTAINABLE CHEMISTRY

REDQS:

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