

60646 - Alternative Solvents for Industry

Syllabus Information

Academic year: 2023/24

Subject: 60646 - Alternative Solvents for Industry

Faculty / School: 100 - Facultad de Ciencias

Degree: 540 - Master's in Industrial Chemistry

ECTS: 3.0

Year: 1

Semester: Second semester

Subject type: Optional

Module:

1. General information

1. General Information

The aim of this subject is to make the students aware of the importance of solvents in industrial processes, teach them to be able to propose sustainable alternatives, to know the advantages, disadvantages and industrial viability of new solvents. For this purpose, the students must know the physical-chemical fundamentals governing their properties, the most suitable working conditions and the selection criteria. The training activities proposed are intended for the student to achieve some of the general and transversal objectives of the degree, such as communicating knowledge and conclusions without ambiguity, obtaining, analysing and distinguishing bibliographic sources, using computer tools effectively, as well as using scientific English, among others.

These approaches and objectives are aligned with the following Sustainable Development Goals (SDGs)

Goal 6: Clean water and sanitation. **Goal 7:** Affordable and clean energy. **Goal 9:** Industry, innovation and infrastructure. **Goal 12:** Responsible production and consumption. **Goal 13:** Climate action.

2. Learning results

The student, in order to pass this subject, must demonstrate the following learning results:

- To distinguish the most relevant parameters in the selection of the most suitable solvent for chemical processes and for the protection of the environment.
- To classify the main types of green solvents and their properties.
- To explain the benefits of replacing common solvents with more environmentally friendly ones. To recognize the physicochemical properties of supercritical fluids.
- To identify the main industrial applications of supercritical fluids. To write reports on the results of the activities.
- To write on a specific topic related to the subject and to defend it orally.

3. Syllabus

Green Solvents

Introduction. Green solvents. Green solvent assessment criteria. Classification.

Solvent properties

2. Chemical-physical properties of solvents. Polarity and polarizability. Intermolecular forces. Permittivity. Surface tension. Refractive index. Density. Viscosity. Diffusion. Thermal conductivity.

Solubility. Dissolution and solvation. Solubility parameter: cohesive energy density and internal pressure, empirical models.

Pressure and supercritical fluids

4. Supercritical fluids as solvents. Thermodynamics of fluid phase equilibrium at high pressures. Transport properties in supercritical fluids. Solubility in supercritical fluids. Materials and surface treatments. Supercritical fluids and chemical reactions. Applications of supercritical fluids in instrumentation. Applications in the cosmetic, pharmaceutical and agroalimentary Industry.

4. Academic activities

The subject is made up of 3 ECTS:

- **Lectures**(0.6 ECTS): 15 hours.
- **Teaching assignments** (0.2 ECTS): 5 hours.
- **Problems and cases** (0.2 ECTS): 5 h. Individualized solving in small groups of problems for the understanding of the chemical-physical properties of solvents and phase equilibrium in fluids at high pressures with the support of computer tools (PE-2000).
- **Laboratory practices**(0.2 ECTS): 5 hours. Demonstration of experimental techniques to work with pressurized and supercritical fluids.
- **Study and preparation of papers/reports**(1.8 ECTS): 45 h. Autonomous work of the student for the realization of the activities.

5. Assessment system

The student must demonstrate that they has achieved the expected learning results through the assessment activities that will be distributed throughout the term.

- **Problem solving.** It will account for**15%** of the final grade. The delivery of results will be distributed in the first half of the term.
- **Performance and presentation of a work in class.** It will account for**15%** of the final grade. The exposition will be held in the second half of the term.

Criteria in the assessment of works exposition:

- Treatment of the scientific search (depth, selection criteria, sources used, etc.):**30%** of the grade of the section.
- Ability to summarise and analyse (presentation of objectives, relation with the sections of the syllabus, adequacy of the extension of the work, critical vision, etc.):**40%** of the grade of the section.
- Oral and technical skills (structure of the work, quality of the presentation, expository capacity, mastery of language and terminology, etc.):**30%** of the block's grade.

Attendance to the practical classes is mandatory, as well as the delivery of the requested reports and assignments within the deadline established by the teacher.