Universidad Zaragoza

Academic Year/course: 2020/21

60646 - Alternative Solvents for Industry

Syllabus Information

Academic Year: 2020/21
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

1.1. Aims of the course

1.2. Context and importance of this course in the degree

1.3. Recommendations to take this course

2. Learning goals

2.1. Competences

2.2. Learning goals

2.3. Importance of learning goals

3. Assessment (1st and 2nd call)

3.1. Assessment tasks (description of tasks, marking system and assessment criteria)

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The learning process designed for this course combines theoretical concepts with assessment activities and the solving of practical cases close to reality. All these activities will be combined in a strategic way with the student's autonomous work to achieve the best academic output.

In particular, the following activities will be carried out: theory sessions, problem sets and case study, laboratory sessions, assessment tasks, study and reports.

- Theory sessions will be participatory and collective (class group) with the support of audiovisual media and the recommended bibliographic materials.
- Unsolved problems and lab sessions that require the use of computer tools will be carried out in small groups for an individualized assistance of the student.

The virtual platform Moodle will be used, among others, to offer teaching materials to evaluate activities and to solve doubts. https://moodle2.unizar.es/add/

4.2. Learning tasks

The course includes 3.0 ECTS organized according to:

- **Theory Sessions (0.6 ECTS): 15 h.** See the course syllabus.

- **Assessment Tasks (0.2 ECTS): 5 h.** Classroom presentation of assignments and reports.
- **Problem Sets and Case Study (0.2 ECTS): 5 h.** Individual solving of basic problems for the understanding of the chemical and physical properties of the solvents and the fluid phase equilibria at high pressures supported by computer tools like Excel and PE-2000.
- **Laboratory Sessions (0.2 ECTS): 5 h.** Lab sessions to show the experimental techniques for working with pressurized and supercritical fluids.
- **Study and Reports (1.8 ECTS): 45 h.** Autonomous work of the student to carry out the assignments, problem sets, preparation of lab sessions and reports.

4.3. Syllabus

The course will address the following topics:

Topic 1. Green Solvents

- Introduction. Green solvents. Evaluation criteria. Classification.

Topic 2. Solvent Properties

- Physicochemical properties of solvents. Polarity and Polarizability. Intermolecular forces. Dielectric permittivity. Surface tension. Refraction index. Density. Viscosity. Diffusion. Thermal conductivity.
- Solubility. Solution and Solvation. Solubility parameter. Cohesive energy density and internal pressure. Empirical models.

Topic 3. High Pressure Fluids and Supercritical Fluids

- Supercritical fluids as solvents. Thermodynamics on high pressure phase equilibria. Transport properties. Chemical reactions. Supercritical fluids in industrial analysis. Applications in the Pharmaceutical Industry, Cosmetic Industry and Agro Food Industry.

4.4. Course planning and calendar

Further information concerning the timetable, classroom, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the "Facultad de Ciencias" website https://ciencias.unizar.es/node/7073

4.5. Bibliography and recommended resources

- Kerton, Francesca M.. Alternative solvents for green chemistry / Francesca M. Kerton Cambridge : RSC Publishing, cop. 2009
- Leitner, W.. Handbook of green chemistry. V.3. Green Solvents. Wiley-Blackwell. 2010
- Prausnitz, John M.. Termodinámica molecular de los equilibrios de fases / John M. Prausnitz, Rüdiger N. Lichtenthaler, Edmundo Gomes de Azevedo ; traducción, Juan A. Rodríguez Renuncio, Concepción Pando García-Pumarino . - 3ª ed. Madrid : Prentice Hall, D.L. 2000
- Reichardt, Christian. Solvents and solvent effects in organic chemistry / Christian Reichardt . - 3rd., updated and enl. ed. Weinheim : Wiley-VCH, imp. 2004.
- Rodríguez Renuncio, Juan Antonio. Termodinámica química / Juan Antonio Rodríguez Renuncio, Juan José Ruiz Sánchez, José Santiago Urieta Navarro . - [2a ed.] Madrid : Síntesis, 2000
- Urieta Navarro, José Santiago. Fluidos supercríticos, aplicaciones actuales y perspectivas de futuro / discurso de ingreso leído por el académico electo José Urieta Navarro...el día 2 de diciembre de 1997 ; y discurso de contestación por Enrique J. Meléndez Andreu Zaragoza : Academia de Ciencias Exactas, Físicas, Químicas y Naturales de Zaragoza, 1997
- Green chemistry using liquid and supercritical carbon dioxide / Edited by Joseph M. DeSimone, William Tumas Oxford : Oxford University Press, 2003
- Green separation processes : fundamentals and applications / edited by Carlos A. M. Afonso, J. G. Crespo Weinheim : Wiley-VCH, cop. 2005
- Freemantle, Michael. An Introduction to ionic liquids / Michael Freemantle Cambridge : Royal Society of Chemistry, 2010
- Freemantle, Michael. An Introduction to ionic liquids / Michael Freemantle Cambridge : Royal Society of Chemistry, 2010
- Ionic liquids : industrial applications for green chemistry / Robin D. Rogers, Kenneth R. Seddon Washington : American Chemical Society, cop. 2002