

Course name (in English): Physical Chemistry of Foods Course name (in Spanish): Fisicoquímica de los Alimentos Course code: 14413004 Undergraduate/Postgraduate Degree (in English): Industrial Chemical Engineering Grade Undergraduate/Postgraduate Degree (in Spanish¹): Grado en Ingeniería Química Industrial Date²: 2008		
Department (in English): Physical and Analytical Chemistry Departament (in Spanish): Química Física y Analítica		
UJA credits³:4.8	ECTS credits: 6	Semester⁴:2 (Febrero > Julio)
Lecturer 1: Prof. Doctor Ruperto Bermejo Román Email: rbermejo@ujaen.es Telephone: 953648513 Building/Room: A001B Lecturer 4⁵: Email: rbermejo@ujaen.es Telephone: 953648513 Building/Room: A-001B		
Course description and teaching methodology⁶:		
Lecture (Theory): 2		Hours per week
Lecture (Practice):1		Hours per week
Seminars:1		Hours per week
Homework: 4		Hours per week

¹ Con indicación de tipo de titulación (Licenciatura / Diplomatura / Maestro / Ingeniería / Ingeniería Técnica / Grado).

² Fecha de alta en programa PATIE.

³ El ratio de conversión es el siguiente: 1 crédito ECTS = 1.25 créditos UJA.

⁴ 1 (Septiembre > Febrero), 2 (Febrero > Julio), 1 & 2 (Septiembre > Julio).

⁵ Opcional.

⁶ Con indicación de la metodología específica para estudiantes extranjeros acogidos al programa PATIE.

Content description:**THEORY:****1.–Introduction to the Physical Chemistry of Foods.**

Fresh and processed foods. Alteration of food. Stabilization, conservation, characterization, prediction and control of life in food. Revision of thermodynamic concepts: heat and power, diagrams of phases and compressibility, equation of Clapeyron, wet and overheated vapors, absolute and relative humidities.

2.–Physicochemical properties of food main components.

Proteins: Isoelectric point and osmotic pressure. Denaturation processes. Structure and function. Carbohydrates (polysaccharides). Fats (lipids). Vitamins: stability, causes of variations and losses, fat-soluble and water-soluble vitamins. Minerals: nutritional and toxicological aspects. Recommended intakes.

3.–Water in foods.

Physical and chemical properties of the water. Importance of water on food stability. Phase diagram of water and Clapeyron equation. The water activity in foods: determination methods. Adsorption isotherms. State of water in food. Hysteresis cycle. Influence of temperature and the composition and physical state of food.

4.–Foods kinetic deterioration.

Food general modes deterioration: microbial decomposition, senescence, enzymatic chemical deterioration, non-enzymatic processes (Maillard reaction), lipid oxidation (rancidity), loss of vitamins. General approach of the kinetics food deterioration. Stability based on water activity.

5.–Foods physicochemical treatment.

Energy transfer in food processing (heat capacity, specific heat, latent heat, conduction, convection). Stabilization through thermal methods: sterilization and pasteurization. Decreased activity of water stabilization: freezing, dehydration and freeze-drying. Stabilization by irradiation: microwave and infrared radiation.

6.–Physicochemical characterization of food additives.

Additives in foods. Acids and bases. Chelating agents. Antioxidants. Antimicrobial. Sweeteners.

Dyes: legislation, types, and properties.

7.–Foods rheology.

Viscosity. Rheograms. Influence of temperature. Types of viscosities: absolute and kinematic. Effect of the presence of solutes in the viscosity. Non-Newtonian fluids (independent and time dependent). Viscosity measurements. Viscosities of some foods. Rheology of solids.

PRACTICES:

- Refraction index determinations. Application to protein determination and vegetable oils identification.
- Phosphoric acid Physicochemical characterization like food additive. Determination of the acid constants.
- Absorption molecular spectroscopy. Application to vitamins determination in food samples.
- Color determination in foods. Physicochemical characterization of natural colorants in foods and drinks.
- Viscosity determination in food samples. Application to commercial juices and wines.
- Beer physicochemical characterization: pH and total acid content determination.

Assessment methodology:

During the development of the subject, the teacher will describe the subject contents and he will answer the questions proposed in the English language, in standar class and during the corresponding schedule of student tutorials.

In addition the teacher will provide the bibliographic references and other materials in relation with the course (problems, articles, images, ...) in English language.

Teacher will allow students the use of English language for questions and deliver jobs and other materials. Also there will be periodic seminars (at least two per month) in English language to complement the development of standar classes in English.

Evaluation system:

- Written exam about the theoretical contents develop and some problems similar to those resolved during the course.
- Practice and Oral exam about the laboratory experiments. It is necessary in order to know the level of the practice contents asimilated during the course by the students.

Teaching language (English / French / German): English

Level (1 – 2 – 3)⁷: Level 3 English

Main booklist:

- Damodaran, S., Parkin, K.L and Fennema, O. R., "Química de los Alimentos", CRC Press, 2008.
- Miller, D.D., "Química de los Alimentos. Manual de Laboratorio", Limusa Wiley, 2004.
- Chiral, A., Martinez, N., Camacho, M and González, C. , "Experimentos de fisicoquímica de los alimentos", Editorial Universitat Politecnica de Valencia, 2011.
- Atkins, P. W. Physical Chemistry (1999), Oxford University Press.
- Berry, R.S., Rice, S. y Ross, J., "Physical Chemistry", 2ªEd., John Wiley and Sons, Nueva York, 2000.
- Levine, I.N., "Fisicoquímica", 5ª edición, 2 vols., Mc Graw Hill, Madrid, 2004.

⁷ [1] Tutorial support sessions, materials and exams in English, French or German.

[2] Tutorial support sessions, materials, exams and seminars in English, French or German.

[3] Tutorial support sessions, materials, exams, seminars and regular lectures in English, French or German.