Universitat de Lleida

DEGREE CURRICULUM

FOOD PHYSICS AND CHEMISTRY II

Coordination: ODRIOZOLA SERRANO, ISABEL ANDREA

Academic year 2022-23

FOOD PHYSICS AND CHEMISTRY II 2022-23

Subject's general information

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<tr><td>Subject name</td><td>FOOD PHYSICS AND CHEMISTRY II</td></tr>
<tr><td>Code</td><td>102224</td></tr>
<tr><td>Semester</td><td>2nd Q(SEMESTER) CONTINUED EVALUATION</td></tr>
<tr><td>Typology</td><td>
<table>
<tr><th>Degree</th><th>Course</th><th>Character</th><th>Modality</th></tr>
<tr><td>Bachelor's Degree in Food Science and Technology</td><td>2</td><td>COMPULSORY</td><td>Attendance-based</td></tr>
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<tr><td>Course number of credits (ECTS)</td><td>6</td></tr>
<tr><td>Type of activity, credits, and groups</td><td>
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<tr><th>Activity type</th><th>PRALAB</th><th>PRAULA</th><th>TEORIA</th></tr>
<tr><td>Number of credits</td><td>2</td><td>1</td><td>3</td></tr>
<tr><td>Number of groups</td><td>4</td><td>1</td><td>1</td></tr>
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<tr><td>Coordination</td><td>ODRIOZOLA SERRANO, ISABEL ANDREA</td></tr>
<tr><td>Department</td><td>FOOD TECHNOLOGY, ENGINEERING AND SCIENCE</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>Lectures: 60
Independent student work: 90</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
<tr><td>Language</td><td>Catalan/Spanish/English</td></tr>
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FOOD PHYSICS AND CHEMISTRY II 2022-23

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
ODRIOZOLA SERRANO, ISABEL ANDREA	isabel.odriozola@udl.cat	3,4	
SALVIA TRUJILLO, LAURA	laura.salvia@udl.cat	5,6	
VILANOVA TORREN, LAURA	laura.vilanova@udl.cat	3	

Subject's extra information

Food Physics and Chemistry II is a basic subject within the curriculum in which knowledge about food is taught, especially the physicochemical properties conferred by its components.

Learning objectives

The student must be able to:

1.- To know some important thermodynamic properties of foods

2.- To know the chemical interactions of food molecules during processing and storage and the changes in the physical properties they cause.

3.-Determine models that allow the industrial application of chemical reactions in food.

4.- To be able to determine physical and chemical parameters of foods with the data obtained in the laboratory of practices or of the problems of class and to interpret these data.

5.- Know how to write a practice report

Competences

The graduate in Food Science and Technology after completing his studies will have acquired the following knowledge and skills:

CE1. Select and apply the physical and mathematical foundations necessary for the development of other disciplines and the activities of the profession.

CE2. Identify and apply the chemical foundations necessary for the development of other disciplines and the activities of the profession.

CE5. Apply the basic processes of a laboratory and use equipment, handle reagents, meet safety conditions and prepare reports.

CE6. Pose and solve problems correctly applying the concepts acquired to specific situations. CE14. Recognize the chemical composition of foods and their chemical reactions.

CE15. Relate the composition of food with its physical, chemical and technological properties.

CE16. Interpret the physical, chemical and biochemical transformations that occur throughout the manufacturing and storage processes.

CE27. Interpret the physical and chemical changes that occur during the different food processing processes.

CB1. That students have demonstrated to possess and understand knowledge from the base of general secondary education at a level that, while supported by advanced textbooks, also includes some aspects that involve knowledge from the forefront of their field of study.

CB2. That students know how to apply their knowledge to their work or vocation in a professional way and possess the skills that are usually demonstrated through the development and defense of arguments and problem solving within their area of study

CB3. That students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include reflection on relevant social, scientific, or ethical issues.

CB4. That students can convey information, ideas, problems and solutions to both specialized and non-specialized audiences

CB5. That students have developed those learning skills necessary to undertake further studies with a high degree of autonomy.

CG1. Analyze specific situations, define problems, make decisions and implement action plans in the search for solutions.

CG2. Interpret studies, reports, data and analyze them numerically.

CG3. Select and manage available written and computerized sources of information related to professional activity.

CG4. Work alone and in a multidisciplinary team.

CG5. Understand and express themselves with the appropriate terminology.

CG7. Recycle in the new technological advances through continuous learning.

CG8. Value comprehensive training, personal motivation and mobility.

CG9. Analyze and assess the social and ethical implications of professional activity.

CG10. Have a critical and innovative spirit.

CG11. Analyze and assess the environmental implications in their professional activity.

CT1. Present information correctly orally and in writing

CT2. Communicate and master a foreign language

CT3. Use existing computer and communication tools as support for the development of their professional activity

CT4. Respect the fundamental rights of equality between men and women, the promotion of human rights and the values of a culture of peace and democratic values

Subject contents

THEORY

PART I. Other thermodynamic properties of foods

Lesson 1.-The Water and the Foods. Introduction. Water activity. Methods of measuring water activity. Prediction of aw in binary solutions. Aw prediction in multicomponent solutions. Adsorption isotherms.

Lesson 2.-Collective Properties of the Solutions. Introduction. Decrease in chemical potential and vapor pressure.

Cryoscopic descent. Cooling curves and phase diagram. Ebulloscopic augmentation. Osmotic pressure.

Lesson 3.-Transition of Phase in Foods. Introduction. Classification of phase transitions. Experimental determination. Phase diagrams in mono and multicomponent systems. Phase transition of fundamental components in food. Vitreous transition and ice formation in food. Changes in the physical properties of the system during the vitreous transition.

Lesson 4.-Superficial Properties of the Foods. Surface tension. Laplace equation. Kelvin equation. Surface activity. Interfacial tension. Young and Dupre equations. Colloidal systems. Measurement of contact angle and surface tension.

PART II. Reactions in food

Lesson 5.- Kinetics of Reaction. Introduction. Reaction rate. Conversion. Types of reactors. Material balances and integrated solutions for different types of reactors. Examples of typical reactions in food. Useful life.

Lesson 6.- Enzymatic Reactions. Introduction. Michaelis-Menten equation. Intermittent fermenter and piston flow. Continuously stirred tank fermenter. Obtaining kinetic parameters. Inhibition of enzymatic reactions.

Lesson 7.- Microbial Reactions. Introduction. Fractional yields. Kinetic models. Monod equation. Fermenters with limiting substrate. Fermenters with product poisoning.

PART III. Special food components

Lesson 8. Vitamins. Structure.- Classification.- Physico-chemical properties.- Forms of degradation.- Stability during processing.- Functions in food.- Methods of analysis.- Presence and distribution.

Lesson 9. Phenolic components. Structure.- Classification.- Physico-chemical properties.- Presence and distribution.- Antioxidant properties.- Influence of phenols on the sensory properties of foods.- Stability during processing.- Methods of analysis.-

Lesson 10. Pigments (Carotenoids and Chlorophylls). Structure.- Classification.- Physico-chemical properties.- Presence and distribution.- Stability during processing.- Methods of analysis.-

LABORATORY PRACTICES
1. Determination of water activity in food
2. Making an apple pectin gel and measuring its consistency
3. Determination of the degree of esterification of a pectin
4. Obtaining milk casein
5. Influence of different emulsifiers on the stability of emulsions
6. Determination of the amylase capacity (maltose index) of a semolina or corn flour
7. Determination of kinetics and enzymatic activity
8. Determining the shelf life of a fruit juice
9.- Determination of the concentration of vitamin C in juices.
10.- Evaluation of the total content of phenols in vegetables.
11.- Estimation of the total content of anthocyanins in vegetables.
12.- Effect of processing on the lycopene content of tomato derivatives.

Methodology

Type of activity	**Description**	**Student presential hours**		**Student no presential activity**		**Evaluation**	**Total time/ECTS**
		Objectives	**Horas**	**Student work**	**Hours**	**Hours**	**Hours**
Lectures	Master classes	Explanation of the concepts	**30**	Acquisition of the main knowledge	**35**	3	**68/2.72**

Problems and cases	Participatory class (Class large group)	Problem solving	**10**	Learn to solve problems and cases	**32**	**5**	**47/1.88**
Laboratory	Laboratory Practice (Small group)	Execution of the practice: understanding phenomena,	**20**	Preparing the reports and exams	**15**		**35/1.4**
Totaels			**60**		**82**	8	**150/6**

Evaluation

Types of activity	**Evaluation activity**		**Weight rating**
	Procedure	**Number**	
Master classes and problems	Written tests on the theory and problems of the syllabus of the subject	3	**80**
Laboratory	Delivery of reports	3	**20**
Total			**100**

Bibliography

PART I and II

Belitz, H.D. ; Grosch, W..- ***Química de los Alimentos*** (Ed. Acribia)

Cheftel, J.C. ; Cheftel, H. .- ***Introducción a la Bioquímica y Tecnología de Alimentos.*** (Ed. Acribia)

Fennema, O.R.- ***Química de los Alimentos.*** (Ed. Acribia)

Ibarz, A.; Barbosa-Cánovas, G.V.- ***Introduction to Food Process Engineering***. (Ed. CRC Press)

Levenspiel, O. - ***El Omnilibro de los Reactores Químicos*** (Ed. Reverté)

Levenspiel, O. - ***Ingeniería de las Reacciones Químicas*** (Ed. Reverté)

Martínez, N.; Andrés, A.M; Chiralt, A.; Fito, P..- ***Temodinámica y Cinética de Sistemas Alimento-Entorno*** (Ed. Servicio Publicaciones, UPV)

Ordóñez, J. A. y otros.- ***Tecnología de los Alimentos*** (Ed. Síntesis)

Primo Yúfera, E.- ***Química de los Alimentos*** (Ed. Síntesis)

Sahin, S.; Sumnu, S.G. - ***Propiedades Físicas de los Alimentos*** (Ed. Acribia)

PART III

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Landrum, J.T. 2010. Carotenoids: Physical, chemical and biological functions and properties. CRC Press, London, New York.

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Tung-Ching, L., Chi-Tang, H. 2002. Bioactive compounds in foods: effects of processing and storage. American Chemical Society, Washington.