

**COURSE DATA****Data Subject**

Code	33985
Name	Food Chemistry
Cycle	Grade
ECTS Credits	6.0
Academic year	2019 - 2020

Study (s)

Degree	Center	Acad. year	Period
1103 - Degree in Food Science and Technology	Faculty of Pharmacy and Food Sciences	2	Second term

Subject-matter

Degree	Subject-matter	Character
1103 - Degree in Food Science and Technology	12 - Food chemistry	Obligatory

Coordination

Name	Department
GARCIA LLATAS, GUADALUPE	265 - Prev. Medicine, Public Health, Food Sc., Toxic. and For. Med.

SUMMARY

Food Chemistry is a mandatory subject, carrying 6 ECTS in the second year, second semester of the Degree in Food Science and Technology. It is part of Module 2: Food Science, which includes other subjects such as Bromatology and Food Analysis.

To gain insight into the physicochemical changes that can occur in foods and act on them, producing the desired changes, the first thing we need to know are the characteristics of their components. Food Chemistry studies the different substances that can become part of the food, their structure, characteristics, physicochemical properties and reactions that may be involved and their possible interactions with other food components. Therefore, nutrients are studied (water, carbohydrates, lipids, proteins, vitamins and minerals) and other non-nutritional substances for the human organism, such as pigments, flavourings and food additives.



Foods derived from biological systems, i.e. from two main sources, animals and plants, undergo changes along time, in some cases due to their own cellular metabolism. In addition, the transformation undergone during processing and/or storage of foods requires a detailed study for each type of food, as these stages are influenced by their specific characteristics.

In short, the subject of Food Chemistry deals with the study of:

- a) Components of food: structure, physicochemical properties, reactions.
- b) The changes incurred during processing and/or storage of food.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

Subjects of the basic module, essentially, Biochemistry and Chemistry (General and Organic).

OUTCOMES

1103 - Degree in Food Science and Technology

- Develop skills to undertake further study.
- Acquire the knowledge and skill needed to elucidate the causes of organoleptic and/or nutritional modifications of components and/or food.
- Acquire knowledge to design and/or improve food.
- Saber aplicar esos conocimientos al mundo profesional, contribuyendo al desarrollo de los Derechos Humanos, de los principios democráticos, de los principios de igualdad entre mujeres y hombres, de solidaridad, de protección del medio ambiente y de fomento de la cultura de la paz.
- Poseer y comprender los conocimientos en el área de Ciencia y Tecnología de los Alimentos.
- The ability to transmit ideas, problems and solutions within the study area of modern languages and their literatures.
- Be familiar with discipline-specific terminology.
- Capacidad de interpretar datos relevantes.
- Know the physico-chemical properties, chemical reactions and technological functions of the components of food.
- Determine the influence of physical and chemical factors on the components of food.



- Know how to apply the knowledge acquired to the preparation and preservation of food.
- Adquirir capacidad de utilizar adecuadamente las fuentes de información y comunicación disponibles.

LEARNING OUTCOMES

To master the terminology of the subject

- Understand the effects of technological processes in the chemical properties of food components.
- Apply the knowledge acquired in the handling and storage of food.
- Evaluate possible causes of sensory changes and / or nutritional components and / or food.
- Apply the knowledge to design and / or improvement of food
- Know, appraise, manage and apply knowledge leading basic and specialized bibliographic sources and some sources for the dissemination of computer-related issues of food chemistry.
- Acquire the ability to synthesize and organize properly, the information obtained from various sources.
- Be able to adequately express, both orally and in writing, the knowledge gained and relate them with previous ones.
- Know how to apply scientific rigor in the laboratory and in the problems.
- Have the ability to prepare reports of studies related to the subject.

DESCRIPTION OF CONTENTS

1. Study of food components: structure, physical-chemical properties, reactions in foods.

- Item 1. Food Chemistry. Concept. Relationship with other subjects. Literature.
- Item 2. Water. Physical constants and structures of water and pure ice. Water-solute interactions. Water activity and alterations in foods.
- Item 3. Carbohydrates. Classification. Starch and modified starches.
- Item 4. Browning in foods I. Classification. Caramelisation and ascorbic acid degradation.
- Item 5. Browning in foods II. Maillard reaction.
- Item 6. Components of dietary fibre. Functional properties of carbohydrates.
- Item 7. Lipids. Physical properties of fatty acids and fats.
- Item 8. Lipid alterations. Classification. Lipid oxidation. Other lipid alterations. Frying process.
- Item 9. Modifications of fats and oils. Functional properties of lipids.
- Item 10. Proteins. Modifications of proteins during processing and storage. Functional properties.
- Item 11. Enzymes. Classification and action in foods. Enzymatic browning.
- Item 12. Minerals and hydrosoluble vitamins. Modification of mineral content during food processing. Hydrosoluble vitamins. Structures and stability.
- Item 13. Liposoluble vitamins. Structures and stability.
- Item 14. Pigments in foods. Structures and stability.
- Item 15. Aroma compounds. Concepts. Impact compounds. Aroma compounds generated in enzymatic and non-enzymatic reactions. Off-flavours. Food flavouring.
- Item 16. Food additives. Concept and classification. Description of additives.



2. Food of animal and plant origin: changes undergone during processing and/or storage.

Item 17. Meat. Post-mortem changes. Effects of thermal treatment. Meat products.

Item 18. Fish. Post-mortem changes. Changes during processing.

Item 19. Egg and egg products. Functional properties. Changes during storage. Changes during processing.

Item 20. Milk. Effects of thermal treatment. Dairy products. Changes during their elaboration.

Item 21. Cereals. Changes during storage of grain and flour. Changes during baking and storage of bread.

Item 22. Fruits and vegetable. Changes during ripening, storage and processing.

Item 23. Fermented beverages. Changes during their elaboration. Alterations.

Item 22. Fruits and vegetable. Changes during ripening and storage. Changes during processing.

Item 23. Fermented beverages. Changes during their elaboration. Alterations.

3. Laboratory sessions

Lab sessions are conducted to:

- a) identify or quantify the content of a component in food
- b) assess the modification of food by processing and/or storage
- c) observe the effect of certain properties of food components

These include:

- Modification of the myoglobin colour of meat.
- Assessment of water retention capacity in meat.
- Evaluation of the effect of heating on soluble proteins in dairy products.
- Evaluation of fermentation in dairy products:
 - a) Determination of lactose
 - b) Determination of acidity
- Assessment of frying oil quality:
 - a) Colorimetric assay
 - b) Measurement of capacitance
- Evaluation of flour strength. Pelshenke index. Effect of glutathione.
- Determination of Brix degrees in juices.
- Evaluation of fruit maturity index.
- Determination of hydroxymethylfurfural in honey.
- Determination of tartrazine in a commercialized food colouring.

**WORKLOAD**

ACTIVITY	Hours	% To be attended
Theory classes	38,00	100
Laboratory practices	15,00	100
Seminars	2,00	100
Tutorials	2,00	100
Development of group work	25,00	0
Study and independent work	61,00	0
Readings supplementary material	2,00	0
Preparation of evaluation activities	2,00	0
TOTAL	147,00	

TEACHING METHODOLOGY

Lectures: explanatory sessions and/or demonstration of contents, with a total of 38 hours/term. Classes are taught using audio-visual technical equipment. The student will have this material available on the online platform beforehand. At the end of each item, ICT tools might be used by the teacher in order to reinforce the most relevant aspects.

Seminars: Students gain insight through interaction and activities. Two coordinated seminars will take place on topics provided by the teacher and related to the course, and must follow the guidelines on coordinated seminars available at the website of the faculty.

The development of the seminar will be monitored through tutorials, to be agreed upon between the teacher and the students. The seminars will be presented in writing and explained orally by the students. After the oral presentation, discussion will take place with the other students, chaired by the teacher.

Practical lessons (laboratory): There will be four hands-on lab sessions, i.e. three of four hours and one of three hours. Practice exercises will be done in pairs. At the end of the lab sessions, students must fill in, in pairs, the report available on the online platform, and it must be delivered through this platform, within a week.

Tutorials: Students can attend tutorials either individually or in a group. Two tutorials of one hour each will take place. Students' queries about the subject, as well as the short questions and/or problems given previously on the online platform, will be dealt with.

Individual or group work and study: individual and in-group learning capacity will be developed.



EVALUATION

The acquisition of knowledge, competence and skills will be assessed continuously throughout the term.

Measurable parameters considered are:

- Written test which will assess the degree of general knowledge of theoretical and practical concepts and procedures presented for each item.
- Implementation of individual reports and/or group exercises related to activities performed in the classroom and laboratory, which will assess the acquisition of competence and skills.
- Attitude of the student (valued on the basis of individual and in group tutorials, theoretical and practical lessons and seminars).

The assessment will take place as follows:

1. Acquisition of theoretical/practical concepts and their expression through written tests (75%).

The exam matters will include the topics covered in the theoretical and practical sessions. There will be a written test with two calls with prior notice (2 h length) including open questions with short answers, or true-false responses with justifications; in the possible case of multiple-choice questions, wrong answers will be penalized; this test will also include identification of chemical structures of relevant compounds, numerical resolution of practical cases and short questions concerning the laboratory sessions (basics, purpose of used reagents, etc.). The correct expression of concepts (including spelling) as well as the correct use of the terminology will be taken into account for the mark. Students must reach 5 out of 10 to be added up with the rest of marks obtained and thus pass the subject.

2. Report on the lab sessions (8%) (0.8 out of 10) and the student's attitude and participation in the lab sessions (3%) (0.3 out of 10).

Attendance of the lab sessions is compulsory to pass the course.

Assessment criteria:

- Attitude and participation in the lab sessions development: Aspects like previous preparation of practical classes (to be assessed by means of the tests completed at the beginning of the lab sessions), active intervention in issues raised in the laboratory, the cooperative attitude, teamwork and the care and management of material will be considered.
- Application of acquired knowledge to resolve proposed questions and/or problems.
- In the reports, the presentation (wording and use of appropriate language), solving of calculations and



interpretation of the data obtained will be assessed.

3. Tutorials: the solution of questions proposed by the teacher through the online platform for each session will be assessed (0.02/session) and they will have to be delivered by means of it. The contribution of tutorials to the final mark will be **4%**.

Attendance of tutorials is compulsory in the first year of enrolment in order to pass the subject.

4. Seminars: the following items will be taken into account for their assessment: written work, presentation, defense and proposed activities, level of understanding of the contents as well as the skills for its presentation and discussion, aspects agreed for coordinated seminars (which are available on the website of the faculty). The contribution of seminars to the final mark will be **10%**.

Attendance of seminars is compulsory in the first year of enrolment in order to pass the subject.

Notes:

(i) Attendance of laboratory sessions, seminars and tutorials is compulsory to pass the subject.

(ii) Students who in the first call do not pass the written test, will keep their marks corresponding to seminars, tutorials and report from lab sessions until the second call of the same year.

(iii) Students retaking the subject will keep their marks corresponding to seminars and tutorials. Marks corresponding to the laboratory sessions will be kept for the following two years after their completion. After this period, lab sessions will have to be retaken.

(iv) Although, numerically the sum of the marks corresponding to seminars, tutorials and lab sessions will make up 50%, the subject will not be considered as passed if the mark corresponding to the written theoretical/practical test does not reached the established minimum.

REFERENCES

Basic

- BADUI, S.: Química de los Alimentos. 5ª ed., Ed. Pearson. 2013. México. (disponible también e-book).
- BELITZ H.D., GROSCH W.: Química de los Alimentos. 3ª ed., Ed. Acribia S.A., Zaragoza, 2012.
- CHEFTEL, J.C., CHEFTEL, H.: Introducción a la Bioquímica y Tecnología de los Alimentos. Ed. Acribia. Zaragoza, 2000.
- COULTATE, T.P.: Manual de Química y Bioquímica de los Alimentos. Ed. Acribia S.A. Zaragoza, 2007.



FENNEMA, O.R.: Química de los Alimentos. 3ª (y 4º) ed., Ed. Acribia. Zaragoza, 2010 (2019).
JEANTET, R. et al. Ciencia de los Alimentos. Vol 1 y 2. Ed. Acribia. Zaragoza. 2010.
LINDEN, G., LORIENT, D.: Bioquímica Agroindustrial. 2ª ed., Ed. Acribia. Zaragoza, 1996
LOPEZ DE LA TORRE, G., CARBALLO GARCIA, B.M.: Manual de Bioquímica y Tecnología de la Carne. Ed. Madrid Vicente. Madrid, 1991.
MATISSEK, R., SCHNEPEL, F.M., STEINER, G. Análisis de Alimentos. Ed. Acribia. Zaragoza, 1998.
ORDOÑEZ (ed.): Tecnología de los Alimentos. Vol. I. Componentes de los Alimentos y Procesos. Ed. Síntesis. Madrid, 1998.
PRIMO YUFERA, E.: "Química de los Alimentos". Ed. Síntesis. Madrid, 1998.
WEAVER, C.M., DANIEL, J.R. The Food Chemistry Laboratory, 2ª ed. CRC Press, Boca Raton (EE.UU.), 2003.
WONG, D.W.S.: Química de los Alimentos. Mecanismos y Teoría. Acribia. Zaragoza, 1994.

Additional

- <http://milksci.unizar.es/bioquimica/uso.html>

<http://www.cyberlipid.org/>

<http://lipidlibrary.aocs.org/>

http://www.aecosan.msssi.gob.es/AECOSAN/web/home/aecosan_inicio.htm

<http://www.efsa.europa.eu/>

<http://www.eufic.org/index/es/>

Revistas: Alimentaria (a través de los BBDD de la UV)

Revistas: Alimentación, equipos y tecnología (disponible en la Biblioteca de la Facultad)

Revistas: Alimentación, nutrición y salud (Instituto Danone)

(<http://www.institutodanone.es/cas/publicaciones3.htm>)

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

1. Continguts / Contenidos



Se mantienen, prácticamente en su totalidad, todos los contenidos inicialmente programados en la guía docente para las sesiones teóricas hasta el tema 17 (Carne), además del tema 20 (Leche). No se impartirán los temas 18 (Pescado), 19 (Huevo), 21 (Cereales) y 22 (Frutas y hortalizas), por lo que no entran en evaluación. El tema 23 (Bebidas fermentadas) se impartirá como seminario, pero no será evaluable.

2. Volum de treball i planificació temporal de la docència/Volumen de trabajo y planificación temporal de la docencia

Se mantiene la planificación docente de las distintas actividades en volumen de trabajo (ECTS) hasta finalización del periodo docente de la asignatura excepto en el caso de las sesiones prácticas de laboratorio (15 horas) puesto que solo un 25% de los alumnos las habían realizado en el momento de inicio de la docencia no presencial. En este caso, se mantienen las 15 h de las sesiones prácticas sustituyendo las actividades a realizar en el laboratorio por explicación teórica de los procedimientos, así como planteamiento y corrección de ejercicios con datos similares a los que se obtendrían en el laboratorio.

Se mantiene la planificación temporal docente tanto en días como en horario.

3. Metodologia docent/Metodología docente

Clases teóricas: Desde el 23 de marzo de 2020, sustitución de la clase presencial por transparencias (Power point en formato pdf) junto con archivos vídeo+audios correspondientes. Los materiales se han subido al aula virtual de la asignatura con temporalidad acorde a como se impartirían con presencialidad.

Propuesta de actividades por AV: se proponen 3 actividades puntuables (mapas conceptuales de contenidos prioritarios para sustituir la lección magistral), a entregar antes de la fecha de examen mediante la opción Tarea, para favorecer la evaluación continua. Para las dudas en su realización, se ha habilitado un foro en el aula virtual.

Tutorías regladas: Restaba una tutoría para el 4 de mayo. Se ha subido al aula virtual la tutoría con actividades propuestas y evaluables, a entregar mediante la opción de “Tarea” (fijando el tiempo de entrega), con resolución de dudas mediante foro habilitado en aula virtual y, a posteriori, se les proporcionará un documento con las soluciones a través del aula virtual. La entrega de las actividades en el plazo fijado en la “Tarea” será considerada como equivalente a asistencia en modalidad presencial.

Tutorías no regladas: Se habilitan 7 foros en el aula virtual, organizados por bloques temáticos, para el planteamiento y respuesta de dudas (tipo debate) y se facilita a los estudiantes un cronograma en el que se han establecido 6 tutorías de dudas por videoconferencia, síncronas, con asistencia voluntaria.



Seminarios coordinados: Restaban dos horas de seminario coordinado (8 y 11 de mayo). Se mantienen los requerimientos de presentación de memoria, diario de trabajo y realización de un Power point. Se sustituye la exposición oral del trabajo por Power point locutado o con notas en cada diapositiva.

4. Avaluació/Evaluación

Se modifica la proporción de algunas actividades evaluables sobre la nota final establecida en la guía docente del siguiente modo:

- Seminario coordinado: se mantiene el 10%.
- Tutorías regladas: se incrementa del 4% al 8%, para favorecer la evaluación continua.
- Prácticas: se incrementa del 11% al 20%, siendo solo evaluable del informe de resultados.
- Actividades propuestas en el aula virtual: la realización de las 3 actividades (mapas conceptuales de contenidos prioritarios para sustituir la lección magistral) supondrá un máximo de 12% (4% cada una). Estas actividades, propuestas para favorecer la evaluación continua, no estaban incluidas en la guía docente.
- *Examen*: disminuye de un 75% a un 50%, para evaluar tan solo los conceptos teóricos. Se realizará como prueba objetiva-tipo test (con, entre otras, preguntas de opción múltiple, verdadero/falso, emparejamiento y/o de rellenar huecos) con tiempo limitado razonable (no superior a 45 minutos), apareciendo las preguntas de manera aleatoria para cada estudiante.

Si alguna persona no dispone de medios para establecer conexión y acceder al aula virtual, deberá contactar con el profesorado, por correo electrónico, en el momento de publicación de este anexo a la guía docente.

5. Bibliografia/Bibliografía

La bibliografía recomendada se mantiene pues es accesible en versión electrónica y el profesorado ha facilitado enlaces a los manuales. Asimismo, se han facilitado diapositivas con audio+vídeo en el aula virtual y enlaces a vídeos explicativos que refuerzan y facilitan la comprensión de la materia