Universitat Autònoma de Barcelona

2020/2021

Food Chemistry

Code: 103238
ECTS Credits: 6

Degree	Type	Year	Semester
2501925 Food Science and Technology	OB	2	1

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

Contact

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Use of Languages

Principal working language: spanish (spa)
Some groups entirely in English: No
Some groups entirely in Catalan: No
Some groups entirely in Spanish: No

Teachers

Nuria Aguilar Puig
Bibiana Juan Godoy

Prerequisites

No official requirements are defined for this course. However, we strongly recommend that the student has passed the courses Chemistry I and II, and Biochemistry I.

Objectives and Contextualisation

This subject is in close relation with "Food Products", a subject that belongs to the same knowledment area. Likewise, the study of this subject cannot be conceived without taking into account the different manipulations to which the foods are subjected during processing, that is why a good assimilation of the matter Composition and Properties of Foods is necessary to take advantage for later subjects related to food processing.

Objectives of the subject are to know and contextualise:

- Properties and non-nutritional functions of the food components.

- Chemical and biochemical reactions involved in the transformation and deterioration of food, its mechanisms, factors and consequences.

- Additives, their functions, mechanisms of action and limitations.

- How to prevent food deterioration reactions.

- How the main technological treatments and the storage affect food components.

Competences

- Communicate effectively with both professional and non-professional audiences, orally and in writing, in the first language and/or in English.
- Display knowledge of the physical, chemical, biochemical and biological properties of raw materials and foods.
- Search for, manage and interpret information from different sources.
- Show understanding of the mechanisms by which raw materials deteriorate and the reactions and changes that take place during storage and processing, and apply the methods for controlling this.

Learning Outcomes

1. Classify and describe foods in terms of their nature and composition, and know their principal structural and stability characteristics.
2. Classify technological additives and auxiliaries and their applications in foods.
3. Communicate effectively with both professional and non-professional audiences, orally and in writing, in the first language and/or in English.
4. Describe the enzymes of food origin, their functions and their applications.
5. Describe the mechanisms and causes of abiotic deterioration of fresh and processed foods.
6. Explain the most important fermentation processes that take place in foods and their technological applications.
7. Identify potential interactions between food components in a specific context.
8. Identify the principal factors causing modifications to foods during storage and processing and evaluate their importance.
9. Identify the technologically-useful properties of food components.
10. Search for, manage and interpret information from different sources.

Content

THEORETICAL PROGRAM

The theoretical contents will be carried out in a non-face-to-face mode, through the Moodle platform. Power Point presentations with voice will be used. Likewise, several sessions will be held through Teams to reinforce the content and ask questions.

The planning will be carried out for weeks for an adequate follow-up of the subject. The detailed planning will be published in the Moodle of the subject.

Distribution Chemical characteristics. Sugars and syrups commonly used in food formulation. Physicochemical and functional properties. Applications

Polysaccharides: Starch structure and properties. Formation of starch gels. Retrogradation. Modified starches. Gums, cellulose and polysaccharides of animal origin: structure, chemical and functional properties. Modifications during processing. Applications. Food fibre.

Lipids: Distribution. Chemical characteristics. Functions of lipids in food. Types of lipids. Physical and functional properties. Effect of food processing.

Proteins: Distribution. Chemical and functional properties. Modifications of proteins in processing. Proteins of interest in food technology

Additives: Introduction. Use of additives. Clasification. Description and applications of the main families of additives.

Non-enzymatic degradation reactions: Non-enzymatic browning: effects, factors and control. Lipid oxidation: active oxygen, activation mechanisms. Oxidative reactions through radicals: autocatalytic oxidation of lipids: mechanism, products, causes. Influence of water activity.

Modifications caused by freezing: The growth of ice crystals. Cryoconcentration Changes in protein structures. Cryoprotectors. Effects on water activity. Water retention in frozen foods. Effects on enzymatic reactions. Modifications of the organoleptic properties.

Pigments: Porphyrin pigments. Chlorophylls. Carotenes and derivatives. Antocianines. Flavonoids Other natural pigments. Degradation reactions.

Vitamins: Classification and distribution. Main degradations during manipulation and processing of foods.

Enzymes in food chemistry: Sources of enzymes. Use. Immobilization mechanisms. Types of enzymes and use in the food industry.

Degradation enzymatic reactions: Reactions of enzymatic darkening. Amylases Pectic enzymes Lipolytic enzymes Lipoxygenase. Proteases Gustatory enzymes Peroxidase and catalase. Others

Fermentation in foods: Biochemical bases of fermentation. Types of fermentation: alcoholic, lactic, acetic and others. Fermentable substrates. Involved organizations Control of fermentation. Applications

2) SEMINARS

The program consists of two 3-hour face-to-face seminars (SQA1 and SQA2) in which teamwork is carried out through real cases, applying and relating themes of theory. Likewise, the results of practices, prior delivery of a report, will be held in a 2-hour non-face-to-face seminar.

3) PRACTICES

Each group carries out two face-to-face practice sessions lasting 4 hours on consecutive days. In order to complete the practical program, two practical sessions will be carried out in a non-classroom mode.

a) Non-contact practices: water activity and non-reversible gels

b) Face-to-face practices:

- Session 1 (4 h): Hydrocolloids and pectinesterases in the preparation of fruit juices
- Session 2 (4 h): Non-enzymatic browning and protein foams

Unless the requirements enforced by the health authorities demand a prioritization or reduction of these contents

Methodology

1) Theoretical classes.

The student acquires the scientific knowledge of the subject through the material provided and complementing it with personal study of the topics covered.

2) Seminars and supervised group sessions

The seminars are designed to discuss, resolve doubts and delve into specific topics as a result of work carried out (practices and their report) or self-learning activities. They consist of sharing with teachers to delve into the issues of self-learning.

3) Self-learning work

In groups of students, work is done in relation to specific foods that are on the market in order to deepen the knowledge of food chemistry: functionality of the components, additives, and modifications produced during processing and storage. Two seminars will be scheduled (SQA1 and SQA2) where the groups will make a presentation and discussion of the work commissioned according to the criteria established in the provided rubric.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Practical training	15	0.6	2, 1, 4, 5, 6, 8, 9, 7
Seminars and directed work	8	0.32	10, 2, 1, 4, 6, 8, 9, 7
Theoretical seminars	30	1.2	2, 1, 4, 5, 6, 8, 9, 7
Type: Autonomous			
Personal study	61	2.44	10, 2, 1, 4, 5, 6, 8, 9, 7
Self-learning	30	1.2	10, 2, 1, 3, 4, 5, 6, 8, 9, 7

Assessment

Competences of this subject will be evaluated by means of:

A test type assesment and a written assesment (which will include all the material worked throughout the course). Each of these qualifications has the same weight and must be passed individually to calculate the final mark of this theoretical part (65% of the final mark of the subject). Self-learning work account for 20% of the final grade.

The evaluation of the practices (15%) will be carried out by means of a test type assesment on the practice guideline before its completion and the presentation and delivery of the report on the results obtained.

Who has not submitted any of tests, can only do it by passing and exam with a minimum score of 6.

Assessment criteria: the student must demonstrate in each proposed activity that have sufficient knowledge of the subject. This means that, in addition to achieving the learning outcomes proposed for this subject, it must be demonstrate that she/he is able to express her/himself orally and in writing according to the level that corresponds to the university studies (without committing faults) spell and logical structuring of speech, especially when writing).

A serious conceptual error can mean the fail of the activity evaluated. Likewise, the scientific and technical lexicon of the subject must be used properly.

Student's assessment may experience some modifications depending on the restrictions to face-to-face activities enforced by health authorities

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Exams	65	0	0	2, 1, 4, 5, 8, 9, 7
Practical training	15	0	0	10, 2, 3, 8, 9, 7
Self-learning	25	6	0.24	10, 2, 1, 3, 4, 5, 6, 8, 9, 7

Bibliography

Badui Dergal, Salvador (2006) 4ªedición. Química de los Alimentos. Ed. Pearson, México.

Belitz H.D. I W. Grosch (2004) Food Chemistry. Ed. Springer-Verlag, Nueva York.

Bowers, J. (1992). Food theory and applications. Maxwell Macmillan International, Oxford.

Cubero, N., Monferrer, A., Villalta, J. (2002). Aditivos Alimentarios. ED. Mundiprensa, Madrid.

Eskin, M.; Robinson, D.S. (2001). Food shelf life stability: chemical, biochemical and microbiological changes. CRC Press, London.

Fennema O.R. (2000). 2ª ed. Química de los alimentos. Ed. Acribia, Zaragoza,

Multon J.L. (1988) Aditivos y auxiliares de fabricación en les industrias agroalimentarias. Ed. Acribia, Zaragoza.

Ordoñez, J. A. (1998). Tecnología de los Alimentos. Vol I. Ed. Síntesis, Madrid.

Pomeranz I. (1991) Functional properties of food components. Ed. Academic Press, San Diego.

Primo Yúfera, E. (1998) Química de los alimentos. . Ed. Síntesis, Madrid.

Robinson, D.S. (1991). Bioquímica y valor nutritivo de los alimentos. Ed. Acribia, Zaragoza.

Taub, I. A., Singh, R.P. (1998). Food storage stability. CRC Press, London.

Tucker, G.A I Woods, L.F.J.. (1991). Enzymes in the food processing. Avi Pub Comp., Inc., Westport.

Wong D.W.S. (1989) Mechanism and theory in food chemistry. Van Nostrand Reinhold, Nueva York. Nueva edición en Castellano.(1995). Ed. Acribia, Zaragoza.

Digital books (KNovel)

- General

Coultate, T. P. (2009). Food - The Chemistry of its Components (5th Edition). Royal Society of Chemistry. Online version available at:

http://app.knovel.com/hotlink/toc/id:kpFTCCE001/food-chemistry-its-components/food-chemistry-its-components

- Water activity

Singh, R. Paul Heldman, Dennis R.(2009). Introduction to Food Engineering (4th Edition) - 12.1.1 Water Activity. Elsevier. Online version available at:

http://app.knovel.com/hotlink/pdf/id:kt00CBUAG1/introduction-food-engineering/water-activity

Food stability

Kilcast, David Subramaniam, Persis. (2000). Stability and Shelf-Life of Food. Woodhead Publishing. Online version available at:

http://app.knovel.com/hotlink/toc/id:kpSSLF0002/stability-shelf-life/stability-shelf-life

- Additives

Saltmarsh, Mike. (2013). Essential Guide to Food Additives (4th Edition). Royal Society of Chemistry. Online version available at:

http://app.knovel.com/hotlink/toc/id:kpEGFAE018/essential-guide-food/essential-guide-food

- Ingredients

Linden, G. Lorient, D.. (1999). New Ingredients in Food Processing. Woodhead Publishing. Online version available at:

http://app.knovel.com/hotlink/toc/id:kpNIFP0004/new-ingredients-in-food/new-ingredients-in-food

Other web pages

http://www.magma.ca/~scimat/

http://milkscunizar.es/bioquimica/uso.html