Universitat Autònoma de Barcelona

2019/2020

Food Chemistry

Code: 103238
ECTS Credits: 6

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

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

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

Introduction

The Food Chemistry in the context of CTA.

Colloidal systems

Types and characteristics. Colloidal stability

Water in food

Structure and properties of water. Water activity. Factors that determine aw in foods. Sorption isotherms Influence of aw in degradative food reactions.

Sugars

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.

Vitamins

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

Pigments

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

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.

Enzymes in food chemistry

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

Enzymatic reactions

Reactions of enzymatic browning. Amylases. Pectic enzymes. Lipolytic enzymes. Lipoxygenase. Proteases. 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

Practical training

P0. Good practices al laboratory (0,5h)

P1. Water activity determination by different methods (2h)

P2. Pectinesterases in the production of fruit juices (3h)

P3. Enzymatic browning (3h)

P4. Thickeners and gelling agents (3h)

P5. Formation and stability of protein foams (3h)

Assessment of the previous work done by the student on the indications of the script (0,5h)

Methodology

Theoretical classes.

The student acquires knowledge of the subject attending the expositive classes and complementing them with the personal study of the subjects addressed.

Seminars and supervised group sessions

Seminars are designed to discuss and resolve doubts and deepen in the wake of work done such as laboratory practices once the report has been done (a two-hour session). Supervised group work sessions are activities that will be actively worked out in person, with the teaching staff in order to deepen the issues of self-learning. There will be three sessions (two related to self-learning and one of discussion of the results of practices).

Self-learning work

In groups of students, specific foods that are in the market will be used 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 an exposition and discussion of the work commissioned according to the criteria established in the rubric provided.

Practical training

The part of practical development of this subject will be done in laboratory groups. The objective of the practical classes is to apply and reinforce the knowledge acquired in the theoretical classes. The students will perform the practical sessions following a script that they will have to read and prepare before (this preparation will be evaluated). The results will be discussed in a seminar (SPQA) after the preparation of a report with the discussion of the results by the students (evaluable).

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.

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.

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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.

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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