Universitat Autònoma de Barcelona

2021/2022

Food Toxicology

Code: 103257
ECTS Credits: 6

Degree	Type	Year	Semester
2501925 Food Science and Technology	OB	3	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

Name: Eva Castells Caballé
Email: Eva.Castells@uab.cat

Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Prerequisites

Although there are no official prerequisites, it is advisable that the student has acquired the competencies associated with the following subjects: chemistry, animal, plant and cell biology and human physiology. A part of the recommended bibliography, of the readings and of the materials worked in class will be in English, reason why it is recommended that the student has minimum abilities in this language.

Objectives and Contextualisation

Foods contain a large number of chemical, natural and synthetic compounds that can represent a food safety problem. Some of these substances are added to foods deliberately during processing, such as additives (dyes, preservatives, etc.). Other substances, however, are naturally found in food (toxins) or as a result of accidental or intentional environmental pollution (pesticides, metals, drugs, industrial waste, etc.). The main objective of food toxicology is assessing the presence of toxic compounds in food and their relation to adverse effects on human health. This course will offer a broad vision of various branches of toxicology, including environmental toxicology, quantitative toxicology, experimental toxicology, toxicokinetics and toxicodynamics.

The students will develop the following competences:

a) Knowledge: to demonstrate knowledge on the main types of toxic substances present in foods and the methods of risk assessment as a result of the chemical intake of chemical contaminants

b) Abilities: to master analytical techniques that are common to food toxicology laboratories

c) Attitudes: to become aware on the presence of contaminants in the food chain

Competences

- Analyse, summarise, resolve problems and make professional decisions.
- Apply the scientific method to resolving problems.
- Appreciate the human population's need for food and avoid its deterioration and loss.
- Design experiments and interpret the results.
- Develop individual learning strategies and planning and organisation skills.

- Identify food hazards, their nature (physical, chemical, biological and nutritional), their origin or causes, their effects, and suitable methods for controlling them throughout the food supply chain so as to reduce risks to consumers.
- Search for, manage and interpret information from different sources.
- Select the appropriate analytical procedures (chemical, physical, biological and sensory) in accordance with the objectives of the study, the characteristics of the analytes and the fundamental principles of the technique.
- 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.
- Use IT resources for communication, the search for information within the field of study, data processing and calculations.
- Work individually or in unidisciplinary and multidisciplinary teams and in international contexts.

Learning Outcomes

1. Analyse, summarise, resolve problems and make professional decisions.
2. Apply the scientific method to resolving problems.
3. Describe national and international nutritional risk prevention strategies.
4. Describe the fundamental principles that govern experimental toxicology (evaluation of toxicity) and analytical toxicology.
5. Describe the principles behind toxicology of the environment and ecotoxicology,
6. Design experiments and interpret the results.
7. Determine the nutritional risk factors related to obesity, cancer, cardiovascular diseases and other diseases of nutritional origin.
8. Develop individual learning strategies and planning and organisation skills.
9. Discern the circumstances and processes that can lead to the appearance of toxics in water, drinks and foods that are in storage or being processed.
10. Recognise and identify the principal toxic agents, their action mechanisms and their presence, by accident or design, in water, drinks or foods.
11. Relate exposition to a toxic to the appearance of a particular symptomatology or pathology, in particular with the aim of establishing the origin and the agent of a particular contamination or food poisoning case.
12. Search for, manage and interpret information from different sources.
13. Select, collect and send samples for microbiological and toxicological analysis, and write the corresponding report for the receiving laboratory.
14. Use IT resources for communication, the search for information within the field of study, data processing and calculations.
15. Use the basic preparatory and analytic techniques of a toxicology and microbiology laboratory, always applying the basic safety regulations, and write the corresponding expert report.
16. Work individually or in unidisciplinary and multidisciplinary teams and in international contexts.

Content

THEORY PROGRAM

SECTION A. INTRODUCTION TO TOXICOLOGY

Unit 1. Introduction to food toxicology (SEM, TE)

Unit 2. Basic principles of toxicology (TE). Factors that determine toxicity: the substance, the organism and the environment

SECTION B. TOXIC SUBSTANCES PRESENTS TO FOODS

Unit 3. Industrial Contaminants and Pesticides (TE). Introduction to pollution. Historical perspective Classification of pollutants. Heavy metals. Dioxins. Pesticides. Radioactivity Microplastics. PBT and vPvB substances

Unit 4. Toxics originated during food processing and storage. Adulterants (SEM). Substances generated during cooking. Transfer of substances from packaging. Substances added illegally to food.

Unit 5. Toxins from plants, animals and fungi (TE). General introduction to toxins. Phytotoxin poisoning: Control and Prevention. Variability in the production of phytotoxins. Main groups of phytotoxins. Intoxication by ingestion of mushrooms. Marine toxins Poisoning by bivalves. Poisoning by fish consumption.

SECTION C. PHASES OF TOXICITY: FROM EXPOSURE TO EFFECTS

Unit 6. Environmental toxicology (TE). The compartments in the earth: atmosphere, hydrosphere, lithosphere and biosphere. Mobility of contaminants by the environment. Transport in fluids. Bioaccessibility. Partition coefficients H ', Koc and Kow. Bioaccumulation. Biomagnification

Unit 7. Toxicokinetics (TE). Dose and internal exposure. Absorption. Type of cellular transport. Absorbtion pathways. Absorption rates. Distribution Pre-systemic elimination. Plasma proteins. Accumulation and remobilization. Phases I and II metabolism. Characteristics of metabolism: specificity, induction and inhibition. Detoxification and metabolic activation. Excretion. Relationship between metabolism and excretion.

Unit 8. Toxicodynamics (TE). Types of toxiceffects. Molecular toxicity. Toxicity in organs and systems. Genotoxicity Carcinogenesis. Teratogenesis. Endocrine disruptors

SECTION D. TOXICITY ASSESSMENT

Unit 9. Analytical toxicology (PLAB). Chemical and biological monitoring. Phases of chemical monitoring: pre-analytical, analytical and post-analytical. Extraction, purification and determination of an analyte. Chromatography. Calculation of concentrations. Interpretation of toxicological analysis.

Unit 10. Quantitative toxicology. Dose-response and evaluation of toxicological risk (TE). Dose and concentration concept. Type of answer. Acute toxicity index (DL50, CL50). Subchronic toxicity index (NOAEL and LOAEL). Maximum exposure limits (ADI, TDI, RfD). Uncertainty factors Maximum permissible concentrations (MRL). Characterization of toxicological risk.

Unit 11. Experimental toxicology methods to determine toxicity (TE). Models to evaluate toxicity. Theoretical estimates. In vitro studies. In vivo studies. Epidemiological studies. Communication of toxicological risk. Globally Harmonized System (GHS). Labeling of chemical products and safety sheets.

Unit 12. Synthesis of the subject (SEM, TE).
In parentheses, the academic typology corresponding to each topic is indicated:

TE Class of theory and classroom activities

SEM Seminar

PLAB Lab practice

PROGRAM OF LABORATORY AND SEMINARS

Laboratory practices

Qualitative, semiquantitative and quantitative determination of toxic substances present in foods using chromatographic techniques (5 sessions of 3 hours)

Seminars

Individual and collaborative work for the resolution of practical cases and search for information in toxicology databases (3 sessions of 3 hours)

Methodology

Several methodologies will be combined so that the student has an especially active role throughout his training process:

1) Theory classes. The theory classes include lectures and participative classroom activities, some of which will be evaluable. These sessions will be complemented by diverse teaching materials that will be delivered to students through the Moodle platform.

2) Seminars. These are sessions of work with a smaller number of students based on questions or exercises for their accomplishment in class.

3) Laboratory practice. The student will perform several analytical techniques that are habitual in laboratories of analytical nutrition toxicology. In laboratory practices, you must bring the practicals script, the robe and a calculator.

The proposed teaching methodology may experience some modifications depending on the restrictions to face-to-face activities enforced by health authorities.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Laboratory practice	15	0.6	1, 2, 4, 8, 6, 15, 13, 16
Lectures	26	1.04	4, 5, 3, 7, 9, 10, 11, 13
Seminars	9	0.36	1, 2, 12, 6, 9, 10, 16, 14
Type: Supervised			
Mentoring	4	0.16	4, 8, 9, 10, 16
Type: Autonomous			
Study	70	2.8	4, 5, 3, 8, 7, 9, 15, 10, 11, 13
Study cases and problems	18	0.72	1, 2, 12, 5, 8, 6, 9, 10, 11, 16, 14

Assessment

The subject will be evaluated by means of cases and problems carried out in the classroom and as homework (35%), a test of the laboratory practice that will be carried out during the last session programmed for each group (15%), and a final exam of all subject contents (50%).

To pass the subject, the mark for the final exam will have to be equal to or greater than 5 and, additionally, the overall mark of the subject (calculated from the weighted average of all activities) must be equal or higher to 5.0. Therefore, it will be considered that the subject is suspended when:

- The final exam does not reach a minimum of 5. In this case the final grade will appear as 'fail' regardless of the note of the rest of the activities

- The final exam is equal to or greater than 5, but the overall average of the subject is less than 5.0

When the student does not perform any of the assessment activities, this will score as 0. It will be considered that a student is not evaluable when their participation in assessment activities represents ≤ 15% of the final grade. To participate in the reevalutaion the student must have been previously evaluated in a set of activities that represent a minimum of two thirds of the final mark of the subject.

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
Final exam	50%	2	0.08	2, 4, 5, 3, 7, 9, 15, 10, 11, 13
Study cases and problems	35%	5	0.2	2, 12, 8, 6, 9, 15, 10, 16, 14
Test of laboratory practice	15%	1	0.04	1, 4, 5, 3, 7, 9, 10, 11, 13

Bibliography

BOOKS

CONNELL D. et al. Introduction to ecotoxicology. Blackwell Science, 1999

CROSBY D.G. Environmental Toxicology and Chemistry. Oxford University Press. 1998

HARRISON R.M. Pollution: Causes, Effects, and Control. Royal Society of Chemistry, 1990

HELFERICH W, WINTER CK. Food Toxicology. CRC Press, 2001

HILL MK, Understanding Environmental Pollution, Cambridge University Press. 2010

HODGSON E, A. Textbook of Modern Toxicology. Wiley-Interscience, 2004

* KLAASSEN CD, WATKINS JB. Fundamentos de Toxicología. McGraw-Hill, 2005

NEWMAN MC, UNGER MA. Fundamentals of Ecotoxicology. Lewis Publishers. 2002

PÜSSA T. Principles of Food Toxicology. CRC Press, 2007

* REPETTO M, REPETTO G. Toxicología Fundamental. Ed. Díaz de Santos, 2009

TIMBRELL JA. Principles of Biochemical Toxicology. Taylor &Francis, 2000

WALKER C.H. et al. Principles of ecotoxicology. Taylor &Francis, 2006

* Recommended as textbooks

TUTORIALS

TOXTUTOR https://toxtutor.nlm.nih.gov/

TOXLEARN http://toxlearn.nlm.nih.gov/

LINKS OF INTEREST IN FOOD TOXICOLOGY

Rapid Alert for Food and Feed //ec.europa.eu/food/safety/rasff_en

Open Food Tox www.efsa.europa.eu/en/data/chemical-hazards-data

Pesticides EU-MRL
//ec.europa.eu/food/plant/pesticides/eu-pesticides-database/public/?event=homepage&language=EN

European Food Safety Authority www.efsa.europa.eu/

Agència Catalana de Seguretat Alimentària //acsa.gencat.cat/ca/inici

Environmental Protection Agency www.epa.gov

Toxnet toxnet.nlm.nih.gov

Tox Town toxtown.nlm.nih.gov/espanol/index.php

Environmental Health and Toxicology sis.nlm.nih.gov/enviro.html

Buscatox busca-tox.com/

Software

none