

## FOOD TOXICOLOGY

(Date last update: 03/07/2020)

(Date approved in Department Council: 20/07/2020)

MODULE	CONTENT	YEAR	TERM	CREDITS	TYPE
Food Safety	Food Toxicology	3rd	2nd	6	Compulsory
<b>LECTURER(S)</b>			<b>Postal address, telephone nº, e-mail address</b>		
<ul style="list-style-type: none"> <li>LOURDES RODRIGO CONDE-SALAZAR (AD)</li> <li>ANTONIO PLA MARTINEZ (CU)</li> </ul>			Department of Legal Medicine, Toxicology and Physic Antropology Faculty of Medicine (PTS). Avenida de la Investigación, 11. 18016 - Granada. Tel: 958-243546. Fax: 958-246107 Email: <ul style="list-style-type: none"> <li><a href="mailto:apla@ugr.es">apla@ugr.es</a></li> <li><a href="mailto:lourdesr@ugr.es">lourdesr@ugr.es</a></li> </ul>		
<b>DEGREE WITHIN WHICH THE SUBJECT IS TAUGHT</b>					
Degree in Science and Food Technology					
<b>PREREQUISITES and/or RECOMMENDATIONS (if necessary)</b>					
It is recommended to have previously studied the subjects of Basic Training Module and be completed prior or simultaneously the subjects covered by the Food Science Module.					
<b>BRIEF ACCOUNT OF THE SUBJECT PROGRAMME (ACCORDING TO THE DEGREE ¿??)</b>					
<ul style="list-style-type: none"> <li>Abiotic pollution in food. Chemical hazards (toxic and contaminants). Types and causes, origin and prevention.</li> </ul>					
<b>GENERAL AND PARTICULAR ABILITIES</b>					
A. General skills <ul style="list-style-type: none"> <li>Ability to express themselves correctly in Spanish in their disciplinary field</li> <li>Troubleshooting</li> <li>Teamwork</li> <li>Ability to apply theoretical knowledge in practice</li> <li>Capacity for analysis and synthesis</li> <li>Critical Thinking</li> </ul>					



- Ability to manage information

#### B. Specific skills

- Analyze the biological, chemical and physical hazards in food chain in order to protect public health.
- Inform, train and give legal advice, scientifically and technically to the public, the food industry and consumers to design intervention strategies and training in the field of science and food technology.
- Implement the principles and methodologies that define the professional profile of the scientist and food technologist, demonstrating an integrated acquisition of skills and competencies provided by the degree.

### **OBJECTIVES (EXPRESSED IN TERMS OF EXPECTED RESULTS OF THE TEACHING PROGRAMME)**

- Knowledge of the fundamentals and basic principles of toxicology.
- Ability to relate knowledge about food hazards in the development of food risk analysis and food safety management
- Ability to evaluate the toxicity, interpret the results and formulate opinions on the hygienic and sanitary quality of foods analyzed

### **DETAILED SUBJECT SYLLABUS**

#### **THEORETICAL SYLLABUS:**

#### **I. TOXICOLOGY BASIC OR FUNDAMENTAL**

Item 1. ORIGINS AND SCOPE OF TOXICOLOGY: Concept of Toxicology, poisoning and toxic. Historic milestones (1h)

Item 2. INTRODUCTION TO TOXICOLOGY: Forms of intoxication. General etiology of poisoning. Subdivisions of Toxicology. Food Toxicology: framework and concept (1h).

Item 3. THE TOXIC PHENOMENON: Concept of toxicity. Phases of toxic phenomenon. Factors affecting toxicity. Chemical structure-toxicity. Dose-response relationships (1 h).

Item 4. TOXICOKINETICS (I): General: Toxicological Interest of toxicokinetics. Main routes of absorption. Absorption through the digestive tract: Toxicological aspects. (1 h).

Item 5. TOXICOKINETICS (II): Distribution and elimination of toxics. Toxicological concern of distribution and elimination of toxics (1h)

Item 6. TOXICOKINETICS (III): The metabolism as the main determinant of toxicity. Types of metabolic reactions. Factors affecting the biotransformation of toxics. Metabolism-toxicity relationships (1 h).

Item 7. MECHANISM OF ACTION OF TOXICS (I): General. Selective toxicity. Classification. (1 h)

Item 8. MECHANISM OF ACTION OF TOXIC (II): Main mechanisms of toxicity (1 h)



## II. EVALUATION OF TOXICITY AND RISKS

Item 9. INTRODUCTION TO THE EVALUATION OF TOXICITY AND RISKS. Concept of evaluation of toxicity and risk assessment. Fundamental principles of toxicity testing. General variables in the toxicological evaluation. Regulations of toxicity evaluation and international agencies involved. Classification of toxicity tests (1 h)

Item 10. TOXICITY TESTS. Providing information, methods and limitations. (2 h)

Item 11. TOXICITY CRITERIA (I). Toxicity parameters obtained in the toxicological evaluation. Indices of acute, subchronic and chronic toxicity. Calculations. (1 h).

Item 12. TOXICITY CRITERIA (II). Extrapolation to humans: tolerable limits of exposure and maximum concentration allowed. Calculations and practical application (1 h).

Item 13. INTRODUCTION TO RISK EVALUATION. Methodological issues and policy. Current situation in the European Union. Risk Assessment Methodology (1h)

## III. DESCRIPTIVE TOXICOLOGY

Item 14. NATURAL TOXIC SUBSTANCES IN FOODS (I). Main natural toxics that may be present in food. Toxicological significance. Antinutritional agents. Substances with polyvalent activity. (1 h)

Item 15. NATURAL TOXIC SUBSTANCES IN FOODS (II): Alkaloids. Glycosides. Xanthines. (1 h)

Item 16. NATURAL TOXIC SUBSTANCES IN FOODS (III). Xenoestrogens. Carcinogens. Favism. Lathyrism. Lectins. (1 h)

Item 17. NATURAL TOXIC SUBSTANCES IN FOODS (IV). Biotoxins of animal origin. (1 h)

Item 18. TECHNOLOGICAL INGREDIENTS (I): Additives. Toxicological and food safety problems. (1 h).

Item 19. TECHNOLOGICAL INGREDIENTS (II): Additives. Toxicological and food safety problems. (1 h).

Item 17. CHEMICAL CONTAMINATION OF FOOD. Definition. Origin of pollution. Major chemical contaminants in food. Toxicological problems arising from chemical contamination. (1 h)

Item 20. AGRICULTURAL POLLUTANTS (I): nitrates and nitrites. Origin of pollution. Toxicological problems. (1 h)

Item 21. AGRICULTURAL POLLUTANTS (II): Mycotoxins: Aflatoxins. Origin of pollution. Toxicological problems. (1 h)

Item 22. AGRICULTURAL POLLUTANTS (III): Mycotoxins: Fusarium toxins, ochratoxin, patulin. Origin of pollution. Toxicological problems. (1 h).

Item 23. TOXICS PRODUCED DURING FOOD PROCESSING (I): Polycyclic aromatic hydrocarbons. Food contamination and toxic effects. (1 h)

Item 24. TOXICS PRODUCED DURING FOOD PROCESSING (II): Heterocyclic amines. Compounds derived from the oxidation of fats and oils. Food contamination and toxic effects. (1 h)

Item 25. TOXICS PRODUCED DURING FOOD PROCESSING (III): Compounds derived from the Maillard reaction:



Premelanoidins and melanoidins. Acrylamide. Food contamination and toxic effects. (1 h)

Item 26. OTHER TOXICS PRODUCED DURING FOOD PROCESSING (IV): Furan. 3-MCPD. Food contamination and toxic effects. (1 h)

Item 27. PERSISTENT ORGANIC POLLUTANTS (POPs). Dioxins. Furans. PCBs. Origin of pollution. Toxicological problems. (1 h)

Item 28. MATERIALS IN CONTACT WITH FOOD: Wood, glass, ceramics, elastomers and polymeric material, metal packaging. Food contamination and toxic effects (1 h)

Item 29. TOXICITY OF PESTICIDE RESIDUES (I). Pesticide residues in food. Classification. Mechanism of action and major toxic effects (1 h)

Item 30. TOXICITY OF PESTICIDE RESIDUES (II). Pesticide residues in food. Classification. Mechanism of action and major toxic effects (1 h)

Item 31. METAL TOXICITY (I): Causes of food contamination by metals. Lead. Food contamination. Mechanism of action and major toxic effects. (1 h)

Item 32. METAL TOXICITY (II): Cadmium and mercury. Food contamination. Mechanism of action and major toxic effects (1 h)

Item 33. METAL TOXICITY (III): Arsenic, tin and aluminum. Food contamination. Mechanism of action and major toxic effects (1 h)

Item 34. DRUG RESIDUES IN FOODS (I). Concept of residue. Origin of drug residues in food. Types of drugs used. Problems posed by the residues. Suspension or withdrawal time (1 h)

Item 35. DRUG RESIDUES IN FOOD (II). Toxicological significance of drug residues in food. The short and long-term effects (1 h).

#### **PRACTICAL SYLLABUS:**

##### **Seminars/ Practice**

1) BIBLIOGRAPHIC RESOURCES IN FOOD TOXICOLOGY. Major databases in Food Toxicology. Making practical cases.

2) SYSTEMATIC analytical in food toxicology.

Types and sample preparation in the analysis of toxic substances in food. Extraction of toxic food samples. Analytical techniques.

3) TOXICITY EVALUATION AND RISKS. Resolution of practical cases.



## READING

### KEY REFERENCES:

TOXICOLOGÍA ALIMENTARIA. Ana Cameán y Manuel Repetto (eds). Díaz de Santos. Madrid. 2006.  
TRATADO DE NUTRICIÓN. Angel Gil y M.D. Ruiz López (eds.) Tomo II. Cap. 21. Ed. Panamericana. Madrid. 2ª edición, 2010.  
KLAASSEN CD. Casarett and Doull's Toxicology. The basic science of poisons, 9ª ed., MacGraw Hill, New York, 2019.  
CASARETT Y DOULL: FUNDAMENTOS DE TOXICOLOGÍA. C.D.Klaassen y J.B. Watkins. McGraw Hill-Interamericana. Madrid. 2003.  
GISBERT CALABUIG, JA. Medicina Legal y Toxicología, 7ª ed., Elsevier, Barcelona, 2018.  
PRINCIPLES AND METHODS IN TOXICOLOGY. 5ª edición. A.W. Hayes. CRC Press, New-York, 2008  
VAN LEEUWEN CJ, VERMEIRE TG (edit.). Risk assessment of chemicals: An introduction. 2ª ed. Springer. Dordrecht, 2007.  
MANUAL DE TOXICOLOGÍA. 2ª ed. Antonio Pla, Antonio F. Hernández, Fernando Gil. Editorial Técnica Avicam. Fleming. Granada, 2019.

### FURTHER READING:

TOXICOLOGÍA AVANZADA. Repetto M.. Díaz de Santos, Madrid, 1995  
MANUAL DE EVALUACIÓN Y ADMINISTRACIÓN DE RIESGOS. Kolluru R, Bartell S, Pitblado R y Stricoff S. McGraw Hill, México. 1998  
TOXICOLOGÍA Y SEGURIDAD DE LOS ALIMENTOS. R. Derache. Ediciones Omega, S.A. Barcelona, 1990.  
TOXICOLOGÍA DE LOS ALIMENTOS. 2ª ed. E. Lindner. Editorial Acribia, S.A. Zaragoza.1995.  
INTRODUCCIÓN A LA TOXICOLOGÍA DE LOS ALIMENTOS. T. Shibamoto y L.F. Bjeldanes. Editorial Acribia, S.A. Zaragoza, 1996.

### RECOMMENDED INTERNET LINKS

Basic Toxicology.

<http://www.ugr.es/~ajerez/project>

Laboratory Practice:

<http://www.ugr.es/~fgil/project/index.php>

Regulation about notification of new substances and classification, packaging and labeling of dangerous substances. 30.06.1998 OM. Annex B.

[http://www.consumo-inc.es/Seguridad/normativa/363\\_95/home.htm](http://www.consumo-inc.es/Seguridad/normativa/363_95/home.htm)

Spanish Food Safety Agency (AECOSAN)

<http://www.aesan.msc.es/AECOSAN>

Codex Alimentarius (FAO / WHO)

<http://www.codexalimentarius.net>



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European Food Safety Authority (EFSA)  
<http://www.efsa.europa.eu>

OECD ([www.oecd.org](http://www.oecd.org) / document)

European Chemicals Bureau (<http://ecb.jrc.it/testing-methods>)

Joint FAO / WHO Food Additives (JECFA). [http://www.fao.org/ag/agn/agns/jecfa\\_index\\_es.asp](http://www.fao.org/ag/agn/agns/jecfa_index_es.asp)

