

## FOOD TOXICOLOGY

| MODULE   | CONTENT         | YEAR | TERM   | CREDITS | TYPE       |
|--|-----------------|------|--|---------|------------|
| Food Safety  | Food Toxicology | 3rd  | 2nd  | 6       | Compulsory |
| LECTURER(S)  |                 |      | Postal address, telephone n <sup>o</sup> , e-mail address  |         |            |
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| DEGREE WITHIN WHICH THE SUBJECT IS TAUGHT  |                 |      |  |         |            |
| Degree in Science and Food Technology  |                 |      |  |         |            |
| PREREQUISITES and/or RECOMMENDATIONS (if necessary)  |                 |      |  |         |            |
| Have completed the courses in Chemistry, Biochemistry, Physiology and Analytical Chemistry   |                 |      |  |         |            |
| BRIEF ACCOUNT OF THE SUBJECT PROGRAMME (ACCORDING TO THE DEGREE ¿??)   |                 |      |  |         |            |
| <ul style="list-style-type: none"> <li>• Abiotic pollution in food. Chemical hazards (toxic and contaminants). Types and causes, origin and prevention.</li> </ul> |                 |      |  |         |            |
| GENERAL AND PARTICULAR ABILITIES   |                 |      |  |         |            |
| A. General skills  |                 |      |  |         |            |
| CT1. Ability to express themselves correctly in Spanish in their disciplinary field  |                 |      |  |         |            |



CT2. Troubleshooting  
CT3. Teamwork  
CT4. Ability to apply theoretical knowledge in practice  
CT7. Capacity for analysis and synthesis  
CT8. Critical Thinking  
CT12. Ability to manage information

#### B. Specific skills

CE3. Learn the techniques and analysis of food to ensure optimal conditions for human consumption.  
CE7. Analyze the biological, chemical and physical food chain in order to protect public health.  
CE15. 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.  
CE16. 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 recognize the major foodborne illness according to the identification and characterization of chemical food hazards (abiotic pollution)
- Ability to relate knowledge about food hazards in the development of food risk analysis and food safety management
- Ability to perform analysis of food and / or 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. (1 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).

## **III. DESCRIPTIVE TOXICOLOGY**

Item 13. NATURAL TOXIC SUBSTANCES IN FOODS (I). Main natural toxics that may be present in food. Toxicological significance. Antinutritional agents. Substances with polyvalent activity. Substances that increase catabolism. (1 h)

Item 14. NATURAL TOXIC SUBSTANCES IN FOODS (II): Toxic foods: Alkaloids. Glycosides. Xanthines. (1 h)

Item 15. NATURAL TOXIC SUBSTANCES IN FOODS (III). Xenoestrogens. Carcinogens.



Favism. Lathyrism. Lectins. (1 h)

Item 16. TECHNOLOGICAL INGREDIENTS: Additives and flavorings. 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 18. AGRICULTURAL POLLUTANTS (I): nitrates and nitrites. Origin of pollution. Toxicological problems. (1 h)

Item 19. AGRICULTURAL POLLUTANTS (II): Mycotoxins: Aflatoxins. Origin of pollution. Toxicological problems. (1 h)

Item 20. AGRICULTURAL POLLUTANTS (III): Mycotoxins: Fusarium toxins, ochratoxin, patulin. Origin of pollution. Toxicological problems. (1 h).

Item 21. TOXICS PRODUCED DURING FOOD PROCESSING (I): Polycyclic aromatic hydrocarbons. Food contamination and toxic effects. (1 h)

Item 22. TOXICS PRODUCED DURING FOOD PROCESSING (II): Heterocyclic amines. Food contamination and toxic effects. (1 h)

Item 23. TOXICS PRODUCED DURING FOOD PROCESSING (III): Acrylamide. Food contamination and toxic effects. (1 h)

Item 24. OTHER TOXICS PRODUCED DURING FOOD PROCESSING (IV): Food contamination and toxic effects. (1 h)

Item 25. PERSISTENT ORGANIC POLLUTANTS (POPs). Dioxins. Furans. PCBs. Origin of pollution. Toxicological problems. (1 h)

Item 26. MATERIALS IN CONTACT WITH FOOD: Wood, glass, ceramics, elastomers and polymeric material, metal packaging. Food contamination and toxic effects (1 h)

Item 27. TOXICITY OF PESTICIDE RESIDUES (I). Pesticide residues in food. Classification. Organochlorine insecticides. Mechanism of action and major toxic effects (1 h)

Item 28. TOXICITY OF PESTICIDE RESIDUES (II). Organophosphate and carbamate insecticides. Pyrethrins. Mechanism of action and major toxic effects (1 h)

Item 29. METAL TOXICITY (I): Causes of food contamination by metals. Lead. Food contamination. Mechanism of action and major toxic effects. (1 h)



Item 30. METAL TOXICITY (II): Cadmium and mercury. Food contamination. Mechanism of action and major toxic effects (1 h)

Item 31. . METAL TOXICITY (III): Arsenic, tin and aluminum. Food contamination. Mechanism of action and major toxic effects (1 h)

Item 32. DRUG RESIDUES IN FOODS (I). Concept of residue. Origin of drug residues in food. Types of drugs used. Tolerance level: zero tolerance, tolerance negligible and finite. Problems posed by the residues. Suspension or withdrawal time (1 h)

Item 33. DRUG RESIDUES IN FOOD (II). Toxicological significance of drug residues in food. The short and long-term effects (1 h).

### **PRACTICAL SYLLABUS:**

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

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

2. SYSTEMATIC analytical food toxicology.

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

3. ANALYSIS OF CONTAMINANTS.

Colorimetric determination of nitrate in meat products. Analysis of clenbuterol in a sample of beef (liver) by thin layer chromatography (TLC). Preparation of the sample, extraction, analysis, calculations. Interpretation of results.

4. TOXICITY EVALUATION AND RISKS. Methodological issues and policy. Current situation in the European Union. Risk Assessment Methodology. 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. Acción Médica. Madrid. 2005.
- CASARETT & DOULL'S TOXICOLOGY. 5ª ed. C.D.Klaassen. McGraw Hill. New York. 1996.
- CASARETT Y DOULL: FUNDAMENTOS DE TOXICOLOGÍA. C.D.Klaassen y J.B. Watkins. McGraw Hill-Interamericana. Madrid. 2003.
- MEDICINA LEGAL Y TOXICOLOGÍA. 6ª ed. E. Villanueva (ed). Editorial Masson, S.A. Barcelona, 2004.
- 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.

### 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 (AESAN)

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



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Codex Alimentarius (FAO / WHO)

<http://www.codexalimentarius.net>

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)

