

## PRINCIPLES OF INSTRUMENTAL TECHNIQUES IN NUTRITION

MODULE	CONTENT	YEAR	TERM	CREDITS	TYPE
	PRINCIPLES OF INSTRUMENTAL TECHNIQUES IN NUTRITION	3º	2º	6	
<b>LECTURER(S)</b>			<b>Postal address, telephone nº, e-mail address</b>		
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<b>DEGREE WITHIN WHICH THE SUBJECT IS TAUGHT</b>					
<b>PREREQUISITES and/or RECOMMENDATIONS (if necessary)</b>					
<b>BRIEF ACCOUNT OF THE SUBJECT PROGRAMME (ACCORDING TO THE DEGREE ¿??)</b>					
<b>GENERAL AND PARTICULAR ABILITIES</b>					
<b>OBJECTIVES (EXPRESSED IN TERMS OF EXPECTED RESULTS OF THE TEACHING PROGRAMME)</b>					
<b>Objectives</b> <ul style="list-style-type: none"> <li>• To learn modern those analytical techniques mostly used in food analysis to separate, detect and quantify food components, residues and contaminants. To know the new trends in food analysis.</li> </ul>					



## DETAILED SUBJECT SYLLABUS

### 1-Presentation of subject.

Objectives, Information and organization. Evaluation. Bibliography.

### 2-Introduction of technology using in Food analysis.

Chemical instrumental analysis in food: principal properties and substances to determinate. Classification of Techniques. Application in food quality. Quantification. Steps and evaluation criteria in analytic method.

### 3-Preparation of food for analysis.

Selection of sampling procedure. Usual method to prepare food for analysis. Extraction. Techniques of extraction of non-volatile analyte of solid and liquid foods (Soxhlet, Soxtec, extraction with supercritical fluids (SFE), extraction accelerated with solvents (IT ROASTS), extraction attended by microwaves (MAE), extraction with ultrasounds). Techniques of extraction of volatile analyte of solid and liquid foods. Analysis of space of static and dynamic head. New techniques of sample preparation in foods: foundations and applications. Extraction in solid phase (SPE), microextraction in solid phase (SPME).

### 4-Determination of global parameters of foods.

Humidity analysis. Methods of drying (stove, furnace microwaves and infrared). Procedures of distillation. Physical and chemical methods (Karl Fischer). Methods of ash determination: calcination

### 5-Global determination of the main components of foods.

Methods of fat determination and composed of lipidic nature (Goldfish, Mojonnier, Babcock, Gerber, TO GO). Methods of protein determination and amino acids (Kjeldhal, Dumas, Biuret, Lowry, Bradford). Methods of carbohydrate determination (sulfuric fenol-acid, enzymatic Somogyi-Nelson, Potterat-Eschmann, methods). Determination of the fiber content (Scharrer-Kürschner). Determination of other components.

### 6- Spectroscopic techniques applied to the food analysis.

Introduction to the spectroscopy: the electromagnetic radiation. Spectroscopy of ultraviolet light (UV), visible (VIS) and infrared (TO GO). Spectroscopy of absorption, emission and molecular and atomic dispersion. Spectroscopy of fluorescence. Spectroscopy of atomic absorption (AA), spectroscopy of atomic emission with plasma of inductive connection (ICP). Applications to the food analysis: calibrated curve of.

### 7- Food analysis by hi-res gas chromatography (HRGC).

Introduction to the HRGC. Main applications of GC in foods. Analysis of the aroma of foods. Stereo-differentiation of chiral components of the aroma of foods. Volatile compounds and derivatisation. Analysis of components of the lipidic fraction

### 8- Analysis of remainders and food polluting agents by HRGC.

Environmental Analyses of remainders of pesticides and polluting agents in foods. Last advances: Specific detectors. Fast analyses by GC.

### 9- Analysis of majority components of foods by chromatography in liquid phase of hi-res (HPLC).

Introduction to the HPLC. Classification of the chromatographic techniques and its application in the food analysis. Chromatography of hi-res in liquid phase: instrumentation and mechanisms of separation (adsorption distribution, molecular exclusion, ionic, even interchange ionic). Analysis of majority nutrients: carbohydrates, proteins, peptides and amino acids, lipids (triglyceride and fatty acids, no saponified fraction of oils. Development of a chromatographic method of HPLC. Last advances in chromatography in liquid phase for the food analysis.

### 10- Analysis of minority components, food remainders and polluting agents by HPLC.

Specific techniques and chromatographic methods. Analysis of organic acids, vitamins, minerals, dyes and phenolic compounds in foods. Analysis of remainders and polluting agents.

### 11-Applied electrophoretic techniques in the food analysis.

Introduction to the electrophoretic techniques. Capillary electrophoretic. Instrumentation of aelectrophoretic system. Mechanisms of separation. Applications in foods: bioactive, transgenic proteins and peptides. Analysis of juices, wines and milk.

### 12-Spectrometry of mass.

The Spectrometry of Mass (MS) in the food analysis. Types of Ionization. Ion separation: main types. Detection. Connections with chromatographic gas techniques (GC/MS). Common applications of HPLC/MS with different separators (Quadupolo, Q-TOF, Triple Quadupolo). Systems tandem (MSn).



### 13-Connections and automatization of instrumental techniques.

Connection between techniques of preparation of sample and techniques of separation (SPE-GC, SPE-HPLC, SPME-GC). Connection between chromatographic techniques: LC-GC and multidimensional Chromatography. Automatization.

### 14- Refractometry.

Introduction to the r Refractometry.. To describe the Abbe refractometer. Possibilities, precautions and way to make the measures. Degree brix, like making its determination.

#### Lab class.

- 1-Drink caffeine determination by UV-Vis spectrometry applying the Beer's law
- 2-Tonic water quinine determination by fluorescence spectroscopy applying the Kavanagh's law.
- 3-Heat determination of food combustion with a calorimetric pump
- 4-Determination of the thermal food conductivity certain.

### READING

#### BIBLIOGRAFÍA FUNDAMENTAL:

##### Bibliografía básica:

- Principios de Análisis Instrumental.** (5ª Edición) Skoog-Holler-Nieman. Editorial Mc Graw Hill.  
**Análisis Instrumental.** K.A. Rubinson- J.F. Rubinson. Editorial Prentice Hall.  
**Métodos Instrumentales de Análisis.** H.H. Willard y col. Grupo Editorial Iberoamérica.

#### BIBLIOGRAFÍA COMPLEMENTARIA:

- Química Física** (Vol. 1). M. Díaz Peña, A. Roig Muntaner. Editorial Alhambra.  
**Química Física.** P. Atkins. (8ª Ed). Editorial Médica Panamericana.  
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**Fisicoquímica: Problemas y Soluciones.** L. Labowitz. Editorial Paraninfo.  
**Fisicoquímica.** (Vol. 2). Ira N. Levine. 5ª Ed. Editorial Mc. Graw Hill.  
**Química Física.** J. Morcillo Rubio. 2ª Ed. Publicaciones UNED.

#### LIBROS DE CONSULTA

- ALEIXANDRE, J.L. "Prácticas de procesos de elaboración y conservación de alimentos". Ed. Universidad Politécnica Valencia, 1996
- BRENNAN, J.G. y col. "Las operaciones de la ingeniería de los alimentos". Ed. Acribia. Zaragoza, 1998.
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- CENZANO, I. y col. "Nuevo manual de industrias alimentarias". Ed. AMV. Madrid, 1993.
- CHARLEY, H. "Tecnología de alimentos: procesos químicos y físicos en la preparación de alimentos". Ed. Limusa. México, 1989. 5
- CHEFTEL, J.C. y col. "Introducción a la bioquímica y tecnología de los alimentos". Vols. I y II. Ed. Acribia. Zaragoza, 1989.
- EARLE, R.L. "Ingeniería de los alimentos". Ed. Acribia. Zaragoza, 1987.
- FELLOWS, P. "Tecnología del procesado de los alimentos: principios y prácticas". Ed. Acribia. Zaragoza, 2007.
- JEANTET, R. y col. "Ciencia de los alimentos: Bioquímica-Microbiología-Procesos-Productos. Volumen1: Estabilización biológica y fisicoquímica. Volumen 2: Tecnología de los productos alimentarios. Ed. Acribia, Zaragoza (2010).
- LAMUA, M. "Aplicación del frío a los alimentos". Ed. AMV. Madrid, 2000.
- MESAS, J.M. y VAZQUEZ, M. "Laboratorio de Industrias Fermentativas". Ed. Anubis, Sevilla, 2011.



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- POTTER, N.N. y HOTCHKISS, J.H. "Ciencia de los alimentos". Ed. Acribia. Zaragoza, 1999.
  - SATIN, M. "La irradiación de alimentos". Ed. Acribia. Zaragoza, 2000.
  - SHARMA, S.K. "Ingeniería de alimentos: operaciones unitarias y prácticas de laboratorio" Ed. Limusa, 2003.

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**RECOMMENDED INTERNET LINKS**

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