



Universitat de Lleida

DEGREE CURRICULUM
**ADVANCED METHODS IN FOOD
ANALYSIS**

Coordination: MARSOL VALL, ALEXIS

Academic year 2023-24

Subject's general information

Subject name	ADVANCED METHODS IN FOOD ANALYSIS			
Code	102252			
Semester	1st Q(SEMESTER) CONTINUED EVALUATION			
Typology	Degree	Course	Character	Modality
	Bachelor's Degree in Food Science and Technology	4	OPTIONAL	Attendance-based
Course number of credits (ECTS)	6			
Type of activity, credits, and groups	Activity type	PRALAB	PRAULA	TEORIA
	Number of credits	1.4	1.6	3
	Number of groups	2	1	1
Coordination	MARSOL VALL, ALEXIS			
Department	ENVIRONMENT AND SOIL SCIENCES AND CHEMISTRY			
Important information on data processing	Consult this link for more information.			
Language	Català			

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
GATIUS CORTIELLA, FERNANDO	fernando.gatius@udl.cat	1	
MARSOL VALL, ALEXIS	alexis.marsol@quimica.udl.cat	5,2	
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Subject's extra information

Laboratory practices are of utmost importance in this course, so they are mandatory, i.e., to pass the course it is a requirement to have performed the practices and submit the corresponding report.

Learning objectives

The student, when passing the subject, must be able to:

- Argue the need and importance of chemical evaluation in the field of quality control and development of new products.
- Know the bibliographic sources on food analysis procedures.
- To know the chemical analytical methodologies, with criteria that allow to justify their application in routine analysis.
- To know the chemical analytical methodologies, with criteria that allow to justify their application in research and development analysis.
- Demonstrate knowledge of emerging analytical techniques and have criteria for applying them in the appropriate circumstances.
- Pose and document an analytical problem, as well as formulate the necessary specifications for the analysis.
- Proper handling of materials, instruments and usual laboratory equipment, taking into account safety and hygiene standards.
- Elaborate and interpret analytical results related to food and have the ability to draw conclusions.

Competences

CB1. That students have demonstrated to possess and understand knowledge from the base of general secondary education at a level that, while supported by advanced textbooks, also includes some aspects that involve knowledge from the forefront of their field of study.

CB2. That students know how to apply their knowledge to their work or vocation in a professional way and possess the skills that are usually demonstrated through the development and defense of arguments and problem solving within their area of study

CB3. That students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include reflection on relevant social, scientific, or ethical issues.

CB4. That students can convey information, ideas, problems and solutions to both specialized and non-specialized audiences

CB5. That students have developed those learning skills necessary to undertake further studies with a high degree of autonomy.

CG1. Analyze specific situations, define problems, make decisions and implement action plans in the search for solutions.

CG2. Interpret studies, reports, data and analyze them numerically.

CG3. Select and manage available written and computerized sources of information related to professional activity.

CG4. Work alone and in a multidisciplinary team.

CG5. Understand and express themselves with the appropriate terminology.

CG6. Discuss and argue in various forums.

CG7. Recycle in the new technological advances through continuous learning.

CG8. Value comprehensive training, personal motivation and mobility.

CG9. Analyze and assess the social and ethical implications of professional activity.

CG10. Have a critical and innovative spirit.

CG11. Analyze and assess the environmental implications in their professional activity.

CT1. Present information correctly orally and in writing

CT2. Communicate and master a foreign language

CT3. Use existing computer and communication tools as support for the development of their professional activity

CT4. Respect the fundamental rights of equality between men and women, the promotion of human rights and the values of a culture of peace and democratic values

CT5. Apply the gender perspective to the tasks of the professional field

Specific skills

The graduate in Food Science and Technology after completing his studies will have acquired the following knowledge and skills:

CE2. Identify and apply the chemical fundamentals necessary for the development of other disciplines and activities of the profession.

CE14: Understand the chemical composition of food and its chemical reactions.

CE15: Relate the composition of food with its physical, chemical and technological properties.

CE17: Select and apply methods and instrumentation for physicochemical and sensory analysis of food.

CE24: Identify and evaluate raw materials, ingredients, additives and technological adjuvants for use in the agri-food industry.

CE41: Carry out chemical, physical, microbiological and sensory analyzes of food evaluation.

Subject contents

SUBJECT 1. INTRODUCTION TO THE INSTRUMENTAL TECHNIQUES (6 h)

The analytical problem. Phases and execution of the analytical process. Traceability. Standards. Calibration methods.

Analysis of majorities, minorities, traces and ultratraces. Screening.

SUBJECT 2. MOLECULAR SPECTROSCOPIES (8 h)

Raman emission spectrophotometry.

Electronic paramagnetic resonance or electronic spin CSR.

NMR nuclear magnetic resonance. ^1H , ^{13}C NMR experiments. Two-dimensional NMR.

SUBJECT 3. PROCESSING OF DATA IN MULTIVARIANT FIELD (8 h)

Introduction: Classical statistical concepts needed in the analysis of any type of data. The need for multivariate data analysis for the intelligent study (optimization) of all the information contained therein.

Projection techniques: the main components applied to descriptive data studies. Application of projection techniques to regression: instrumental calibration.

SUBJECT 4. SEPARATIVE TECHNIQUES (14 h)

Instrumental chromatographic separations. Equipment and components. Separations for quantitative purposes. Calibration. Standards.

Gas chromatography. Headspace injection, trap and purge and thermal desorption. HPLC and UHPLC instrumental liquid chromatography. Ion pair HPLC. Ion exchange HPLC. Exclude HPLC. Chiral HPLC. Two-dimensional chromatography. Couplings in chromatography. Capillary electrophoresis.

SUBJECT 5. SPECTROMETRY OF MASSES (24 h)

Mass Spectrometry Theory. Mass spectra.

Coupled systems: GC-MS. HPLC-MS. HPLC-ICP-MS. Interfaces, API ionization techniques, and analyzers. Identification of compounds by MS. Isotopic relationships. Too exact. MS-MS sequential mass spectroscopy. Quantification.

Practical activities SEMINARS / APPLICATION PRACTICES:

NMR spectrum analysis of metabolome components as an authentication tool.

Determination of acrylamide in commercial products made from fries by UPLC-PDA / MS and calibration with isotopically labeled patterns.

Screening of nutrients in food products of animal or vegetable origin by GC-MS

Methodology

Due to the exceptionality at the beginning of the 2020-2021 academic year, the methodology will be adapted to the guidelines set by the academic authorities. Thus, a significant part of the contact hours of the theory part can be done in non-contact mode. As for the problem and practice sessions, it is initially envisaged that they will be carried out in person. In the event that circumstances do not make it possible, alternatives would be implemented in a non-contact mode.

Type of activity	Description	Student face-to-face activity		Non-contact student activity		Evaluation	Total time / ECTS
		Targets	Hours	Student work	Hours	Hours	Hours
Master class	Master class (Classroom. Large group)	Explanation of the main concepts	30	Study: Know, understand and synthesize knowledges	40	6	76/3.04
Seminars	Participatory class (Medium group)	Carrying out discussion or application activities	15	Solve problems and cases. To argue	24		39/1.56
Laboratory	Laboratory Practice (Medium Group)	Execution of the practice: understanding phenomena, measuring ...	15	Practice report	20		35/1.4
Total			60		84	6	150/6

Evaluation

The evaluation tests can be face-to-face, semi-face-to-face or mixed. The modalities in case of non-face-to-face tests will be the appropriate ones among those that are included in the section of Test and questionnaires of the Virtual Campus.

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Activity	Evaluation	Weight rating
	Procedure	Number
Lliçó magistral	Test	2
		40

Laboratori	Delivery of reports, written or oral tests	4	20
Seminari	Written or oral tests	4	40
Total			100

Bibliography

Basic Bibliography

D.A. SKOOG, F. J. HOLLER, S.R. CROUCH. PRINCIPIOS DE ANALISIS INSTRUMENTAL (6ª ED.). EDICIONES PARANINFO, S.A., 2009. ISBN 9789706868299.

GARY D. CHRISTIAN. QUIMICA ANALITICA (6ª ED). MCGRAW-HILL / INTERAMERICANA DE MEXICO, 2009. ISBN 9789701072349.

J.C. MILLER, J.N. MILLER. ESTADÍSTICA Y QUIMIOMETRIA PARA QUÍMICA ANALÍTICA. (4ª ED.). PRENTICE HALL. 2002. ISBN: 842050228885.

Complementary Bibliography

T. A.M. MSAGATI. THE CHEMISTRY OF FOOD ADDITIVES AND PRESERVATIVES. WILEY-BLACKWELL. 2013.

FOOD ANALYSIS AND PRESERVATION: CURRENT RESEARCH TOPICS. EDITED BY M. G. KONTOMINAS. PUBLISHER:TORONTO. APPLE ACADEMIC PRESS. 2013.

FOOD ANALYSIS BY HPLC. EDITED BY L. M.L. NOLLET, FIDEL TOLDRÁ. PUBLISHER: BOCA RATON, FL. CRC PRESS, 2013.

NMR SPECTROSCOPY IN FOOD ANALYSIS. A. SPYROS, P. DAIS. PUBLISHER:CAMBRIDGE, UK : ROYAL SOCIETY OF CHEMISTRY, C2013.

CHEMICAL ANALYSIS OF FOOD TECHNIQUES AND APPLICATIONS. P. SCHUCK, A. DOLIVET, R. JEANTET. PUBLISHER: WALTHAM, MA. ACADEMIC PRESS, 2012.