30815 - Chemical analysis of food

Información del Plan Docente

Academic Year	2018/19
Subject	30815 - Chemical analysis of food
Faculty / School	105 - Facultad de Veterinaria
Degree	568 - Degree in Food Science and Technology
ECTS	6.0
Year	2
Semester	Second semester
Subject Type	Compulsory
Module	---

1.General information

1.1.Aims of the course

1.2.Context and importance of this course in the degree

1.3.Recommendations to take this course

2.Learning goals

2.1.Competences

2.2.Learning goals

2.3.Importance of learning goals

3.Assessment (1st and 2nd call)

3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives.

The course is structured in28 lectures (1 hour each), 6 seminars (1 hour each), 5 sessions of laboratory practice (4 hours each) and 2 visits (3 hours each). Furthermore, it includes the preparation and written and oral presentation of a report about the chemical analysis to perform from legal, technological and commercial perspectives in order to determine and assess the quality of a raw food ingredient.

4.2.Learning tasks

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The course includes the following learning tasks:

- **Lectures** are divided into three sections. The first is dedicated to the presentation of the subject and the recommended bibliography, and to the sampling strategies and sample preparation. In the second section, the principles and applications of different analytical chemical techniques to determine food components such as moisture, ash, carbohydrates, lipids, proteins, vitamins and minerals are included. The third section is focused on the study of some specific analytical techniques and its applications in food quality control including immunochemical techniques, molecular biology techniques (PCR techniques), electrophoretic techniques and enzymatic techniques. Lectures will have duration of 50 minutes. The first 40 minutes will be dedicated to the presentation of the contents and the remaining 10 minutes to solve questions or to comment suggestions raised by students. For the presentations, the powerpoint format will be used, as well as the board and supplementary material such as videos and web pages. The class presentations will be available for students at least one week before in the web platform of the university (Digital Teaching Ring), so they could revise them in advance.
- The **seminars** will have duration of 1 hour. They will be focused on practical real cases requiring the application of different analytical techniques to solve them as well as calculation exercises from analytical data. In some cases, tables or graphs in English language will be used in order to students to become familiar with the technical terminology in English of the contents of the subject.
- **Practice sessions** will be carried out in sessions of 4 hours in the laboratory. It is planned that in each session, the group is divided into several small subgroups so that everyone can perform the experimental work simultaneously. Protocols will be provided to students in advance to allow them to prepare practicals. In the laboratory practicals different food components will be determined using the most appropriate technique for each type of food. In some practices, the effect of different processing technologies or storage conditions on different food components will be determined. Students have to prepare a brief report of the results obtained in one session and discussion of them. The timetable schedule of practical classes and groups will be available on the web platform of the corresponding course. Some practices are carried out in coordination with the subject of Food Chemistry and Biochemistry.
- **External visits** will allow students to know analytical techniques that are currently used in food control laboratories. During the visits, the participation of students to expose doubts will be promoted.
- The mentored report will be performed in coordination with the subjects of Physical Analysis of Food and Microbiological Food Analysis. The work will be performed in groups of 3-4 students. At the beginning of the course, a type of food will be assigned to each group. The work will consist of the selection of the chemical parameters to determine as well as of the most suitable analytical techniques to perform the quality control of the assigned food. Students will have various tutorials with the lecturer who will lead in the planning and development of the work as well as in the search of bibliographic material. The report of each group will be presented in written form and an also will be presented orally in class.

4.3.Syllabus

The program offered to the students to achieve the expected results includes the following activities

LECTURES

Section I: Introduction

- **Lesson 1: Introduction (1 hour).** Introduction to Chemical Analysis of Foods. Objectives and organization of the subject. Criteria for the selection of chemical analysis techniques of food. Bibliography and databases recommended.
- **Lesson 2: Sampling and sample preparation (2 hours).** Sampling. Selection of sampling procedures. Preparation of samples. Homogenization: dry and wet solid samples. Homogenization equipment. Enzymatic and chemical treatment of samples. Storage of samples: container types. Enzymatic inactivation. Lipid oxidation protection. Protection against bacterial growth and contamination.

Section II: ANALYSIS OF FOOD COMPONENTS

- **Lesson 3: Determination of moisture and ash (3 hours).** Moisture determination. Drying methods. Oven drying methods. Halogen lamp drying. Infrared drying. Microwave analyzer. Distillation procedures. Chemical method: Karl

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Fischer titration. Physical methods. Dielectric methods. Hidrometry. Refractometry. Freezing point. Spectroscopic methods. Ash analysis. Dry ashing. Wet ashing.

- **Lesson 4: Analysis of lipids (4 hours).** Definition and classification of lipids. Determination of lipid content. Solvent extraction methods: Soxhlet method. Folch method. Rose Gottlieb method. Wet solvent extraction. Gerber method. Instrumental methods. Techniques for lipids characterization. Iodine index. Methods for determining lipid fractions. Determination of fatty acid profile. Determination of total cholesterol and sterols. Determining of the degree of lipolysis. Acidity index. Determination of the degree of oxidation. Peroxide value. Thiobarbituric acid test. Instrumental methods: Rancimat test.
- **Lesson 5: Analysis of carbohydrate (4 hours).** Classification. Functions in food. Determination of total carbohydrate content. Phenol-sulfuric acid method. Determination of reducing sugars. Luff-Schoorl method. Monosaccharides and oligosaccharides determination. High performance liquid chromatography. Gas chromatography. Enzymatic methods. Physical methods: polarimetry, refractive index. Determination of starch: qualitative and quantitative techniques. Degree of gelatinization and retrogradation. Determination of resistant starch. Determination of dietary fiber. Gravimetric methods. Chemical methods.
- **Lesson 6: Analysis of proteins and other nitrogenous compounds (4 hours).** Introduction. Kjeldahl method. Dumas method. Spectrophotometric methods. Utravioleta and infrared absorption methods. Colorimetric methods.. Determination of amino acid composition. Determination of the nutritional quality of proteins. Determination of the functional properties of proteins. Determination of nitrates and nitrites.
- **Lesson 7: Determination of vitamins and inorganic elements (2 hours).** Determination of vitamins. Bioassays methods. Microbiological assays. Chemical methods. High performance liquid chromatography. Volumetric method. Fluorimetric methods. Determination of inorganic elements. Determination by complexometric titration with EDTA. Determination of chloride by the Mohr and Volhard methods. Determination of phosphorus by colorimetry. Ion-selective electrodes.

Section III: SPECIAL FOOD ANALYSIS TECHNIQUES

- **Lesson 8: immunochemical techniques: fundamentals and applications in food analysis (2 hours).** Fundamentals. Monoclonal and polyclonal antibodies. Types of immunochemical techniques. Precipitation techniques. Enzyme immunoassay techniques. Competitive and sandwich formats. Immunoaffinity purification. Lateral flow strip assay. Paramagnetic techniques using nanospheres. Applications of immunochemical techniques to food analysis.
- **Lesson 9: Genetic techniques: fundamentals and applications in food analysis (2 hour).** Nucleic acid extraction. DNA and RNA analysis by hybridization techniques (Southern and Northern blot). In vitro amplification reaction using polymerase chain reaction (PCR). Conventional PCR. Real-time PCR. Application of genetic techniques in food analysis.
- **Lesson 10: Electrophoretic techniques: fundamentals and applications in food analysis (1 hour).** Gel electrophoresis. Principle. Types of gels. Components of a gel electrophoresis system. Types of electrophoresis. Electrophoresis native and under denaturing conditions. Horizontal, vertical and disk electrophoresis. Isoelectric focusing. 2D electrophoresis. Staining and densitometry of gels. Capillary electrophoresis. Principle. Applications of electrophoretic techniques to food analysis.
- **Lesson 11: enzymatic techniques: fundamentals and applications in food analysis (2 hours).** Fundamentals. Continuous determination or endpoint. Analysis by coupled reactions. Methods for measuring enzyme activity: spectrophotometry, fluorimetry, titration, etc. Applications. Determination of food components: sugars, starch, cholesterol. Determining the intensity of heat treatments: peroxidase, lipoxygenase, alkaline phosphatase. Determination of the activity of enzymes of commercial interest: a-amylase, rennet.

LABORATORY PRACTICALS (20 hours, 4 hours per session)

- Laboratory practical 1. Determination of moisture content in foods. Oven drying method. Thermobalance. Determination of lipids by Soxhlet method. Determination of fat content in milk by the Gerber method.
- Laboratory practical 2. Determination of nitrogen content by the Kjeldahl method. Determination of whey proteins by a colorimetric technique.Determination of sugars by an enzymatic technique and by polarimetry
- Laboratory practical 3. Determination of the oxidation degree of lipids in food. Determination of Peroxide index. Thiobarbituric acid method. Determination of acidity in butter.
- Laboratory practical 4. Determination of vitamin C in juice samples by the indophenol method. Determination of the hardness of water by a complexometric method. Determination of chloride in butter
- Laboratory practical 5. Browning reactions. Determination of the intensity of the Maillard reaction. Determination of

hydroxymethylfurfural in different milks. Determination of polyphenol oxidase activity in mushrooms under different conditions by a colorimetric method.

SEMINARS (6 hours)

* Presentation of practical cases to determine the identity, nutritional value and safety of different food by using various chemical techniques (4 hours)
* Session of problems (2 hours)

VISIT (2 visits, 6 hours)

- Visit to the Food Safety and Quality laboratory of the Food Research and Technology Center of Aragon. Montañana. Zaragoza. (3 hours).
- Visit to the Technology and Food Safety Center. San Adrian. Navarra (3 hours)

4.4.Course planning and calendar

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the Facultad de Ciencias web https://veterinaria.unizar.es/academico/plan-estudios-grado-cta

4.5.Bibliography and recommended resources

see spanish version