Universidad Zaragoza

Year : 2020/21

30830 - Milk and Egg Product Technology

Syllabus Information

Academic Year: 2020/21
Subject: 30830 - Milk and Egg Product Technology
Faculty / School: 105 - Facultad de Veterinaria
Degree: 568 - Degree in Food Science and Technology
ECTS: 6.0
Year: 4
Semester: First 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 learning process that has been designed for this subject is based on 41 hours of lectures, 13 hours of laboratory practicals, 5 hours of visits and 6 hours of seminars.

For the lectures, the students will have available in the ADD the presentations that will be shown in the lecture. In the classrooms there will be Internet connection to have access to complementary material, such as videos and web pages. The lectures will consist in 40 minutes to present the theoretical content and to encourage the students to participate there will be 10 minutes for questions on the topic or for comments on any matter of the previous lecture.

The laboratory practicals will be carried out in the Pilot Plant of Food Technology of Zaragoza University. The students will have available the laboratory protocols in advance.

The practical works will be supervised by the lecturers and will allow the students to apply the basic knowledge acquired, and also to learn how to search the information to deepen in specific subjects to complement those studied in the lectures. The dissertations will be carried out individually, and the work for oral presentation will be done in groups.

Students must follow the regulations described in:

- Prevention: A guide for students at the University of Zaragoza:
  http://uprl.unizar.es/publicaciones/estudiantes_ingles.pdf
- Manual de seguridad en los laboratorios de la Universidad de Zaragoza y normas marcadas por la Unidad de Prevención de Riesgos Laborales:
  http://uprl.unizar.es/seguridad/pdfs/seglaborUZ.pdf
  http://uprl.unizar.es/seguridad/pdfs/laboratorios.pdf

In addition, students will follow as well any instructions related to biosecurity given by the professor

4.2.Learning tasks

The learning activities of this subject are in the first place lectures, in which the students will receive the basic knowledge on milk and egg composition, and on the technological processes of dairy and egg products. Furthermore, there is a relevant part of the subject devoted to laboratory practicals, in which the student will apply a protocol in the laboratory, acquiring the practical knowledge to carry out an analytical methodology.

Another learning activity to be carried out by the students will be a report of one of the laboratory practicals, in which the students will include the results obtained after their analysis and discussion, analyzing the problems that could have occurred during the course of the practical.

The students will carry out two practical works, one as a written document and another one as an oral presentation. The dissertation will be done by the students individually, in which they will deepen in specific subjects, related with dairy or egg products, which had not been studied in the lectures. The second work will be carried out in small groups and will be done preferentially on a Spanish cheese or other dairy product with appellation of origin or acknowledged quality. The work will be reported as an oral presentation in the seminars.

Finally, the external visits to a dairy control laboratory and to a dairy industry will allow the students to know the actual activities related with the quality control of milk and eggs, and with the manufacture of dairy and egg products. The students will be encouraged to ask questions to the technical personnel of the industries on all the subjects related with the manufacture and quality control of the products.

4.3.Syllabus

The course will address the following topics:

Section I. Milk composition (10 hours)

Chapter I.1. Composition, structure and properties (4 hours)

- Topic 1: Introduction, composition and structure (2 hours)
  Objectives and organization of the subject. Bibliography. Components and structure of milk. Factors influencing milk composition.
- Topic 2. Properties of milk (2 hours)
  Physico-chemical properties: density, pH and acidity, redox potential, optical properties, freezing point. Thermal and electrical conductivity. Instrumental measurements. Organoleptic properties of milk. Factors influencing milk properties. Application in the quality control of milk.

Chapter I.2. Milk components (4 hours)

- Topic 3: Protein and enzymes (1 hour)
  Structure of casein micelles: factors influencing stability. Acid and enzymatic coagulation. Whey proteins: a lactalbumin, b-lactoglobulin, immunoglobulins, lactoferrin. Biological and technological properties of whey proteins. Milk enzymes and technological relevance.
- Topic 4: Lipids (1 hour)
  Lipid composition of milk. Structure of milk fat globule. Emulsion stability. Lipid crystallization. Enzymatic lipolysis. Lipid oxidation. Effect of lipolysis and oxidation in dairy products. Prevention of lipolysis and lipid oxidation in dairy products.
- Topic 5: Carbohydrates (1 hour)
  Lactose. Physico-chemical properties. Mutarotation, solubility and crystallization. Effects of crystallization on dairy products. Effect of heat treatments on lactose. Maillard reaction. Isomerization. Fermentation of lactose and derived products. Obtention of lactose and hydrolyzed lactose. Low lactose milk and milk products.
- Topic 6: Vitamins and minerals (1 hour)
  Vitamin content of milk. Effect of technological treatments on vitamins Colloidal calcium phosphate. Changes in salts and influencing factors: acidity, heat treatment and concentration. Other minerals in milk.

Chapter I.3. Microbiology of milk (2 hours)

- Topic 7: Spoilage and pathogenic microorganisms (1 hour)
  Microorganisms of raw milk. Sources of contamination. Pathogenic microorganisms. Spoilage microorganisms and dairy products quality. Chemical contamination of milk.
- Topic 8: Lactic acid bacteria (1 hour)
  Microorganisms involved in elaboration of dairy products: lactic acid bacteria, moulds and yeasts. Classification and applications. Use of starters in dairy products technology.

Section II. Technological processes (6 hours)

- Topic 9: Previous processing (2 hours)
  Milk collection and storage. Milk cooling: effect on psychrotrophs and milk components. Cooling systems. Filtration

and clarification. Bactofugation. Thermization. Skimming and standarization. Homogeneization.

- Topic 10: Heat treatments (2 hours)
  Methods of heating: in batch process, heat exchangers, packaged form, steam injection. Equipment. Heat regeneration. Control of heat treatments. Effect of heat treatments on milk components and properties.
- Topic 11: Concentration processes (2 hours)
  Concentration methods. Evaporation methods. Drying methods. Atomization. Equipment. Effect of concentration in milk components and properties. Membrane-filtration technology and applications: reverse osmosis, nanofiltration, ultrafiltration and microfiltration.

Section III. Technology of dairy products (16 hours)
Chapter II.1. Technology of milks (6 hours)

- Topic 12: Milk for liquid consumption (2 hours)
  Types of pasteurized milks. Manufacture. Packaging and storage. Extended shelf-like milks. Sterilized milks: in-bottle sterilized milk, UHT milks. Manufacture. Pasteurized and sterilized manufacture plant. Enriched milks. Nutritive and organoleptic properties of pasteurized and sterilized milks. Defects and alterations of liquid milks.
- Topic 13: Concentrated and powdered milks (2 hours)
  Types of evaporated milks. Manufacture. Heat stability. Sweetened condensed milk. Manufacture. Types of milk powder. Manufacture. Concentrated and powdered milk manufacture plant. Nutritive and organoleptic properties of concentrated and powdered milks. Defects and alterations of concentrated and powdered milk.
- Topic 14: Fermented milks (2 hours)
  Types of fermented milks. Preparation of milk to elaborate yoghurt. Elaboration of set and stirred yoghurt. Physico-chemical modifications in the transformation of milk into yoghurt. Yoghurt manufacture plant. Thermal treated yoghurts. Special fermented milks: with probiotics, prebiotics, with other ingredients. Defects and alterations in yoghurt

Chapter II.2. Dairy products enriched in fat (13 hours)

- Topic 15: Cream and butter (3 hours)
  Cream manufacture and thermal treatments. Quality parameters of cream. Defects and alterations in cream. Butter manufacture: cream maturation, churning and mixing. Continuous processes of butter production: NIZO method. Other continuous methods: concentration and combination. Butter making plant. Butter derivatives: industrial applications. Low-fat butter. Defects and alterations in butter.
- Topic 16: Ice-cream (2 hours)
  Ice-cream composition. Ingredients, additives and manufacture of ice-creams: mix preparation, homogeneization, thermal treatment, maturation, freezing and moulding, Deep freezing. Ice-cream structure. Ice-cream manufacture plant. Defects and alterations in ice-cream.
- Topic 17: Cheese manufacture (3 hours)
  Milk standardization. Starter culture. Clotting enzymes and coagulation phases. Factors that influence coagulation: intrinsic factors, previous treatments of milk. Gel formation and syneresis. Acid and acid-enzymatic coagulation. Cutting and dewheying of curd operations. Moulding and salting operations. Membrane filtrations operations in cheese manufacture.
- Topic 18: Cheese maturation (3 hours)
  Maturation agents: ripening starters. Transformations in maturation: lactic fermentation, proteolysis and lipolysis. Conditions of maturation: temperature, humidity and atmosphere composition. Treatments of cheese rind and packaging. Development of cheese characteristics: flavor and texture. Fast maturation. Mechanization of cheese manufacture.
- Topic 19: Cheese varieties (2 hours)
  Main varieties of cheese: manufacture and characteristics. Fresh cheeses by acid and enzymatic coagulation. Cheeses externally and internally mold-ripen. Hard cheeses. Semi-hard cheeses. Pasta filata cheeses. Processed cheese. Defects and alterations in cheese.

Section IV: Egg and ovoproducts (6 hours)

- Topic 20: Egg components (2 hours)
  Egg components and properties. Functional and technological properties of eggs and ovoproducts: foaming, crystallization control, emulsification, binding capacity, thickening capacity, and improvement of texture, colour and flavor. Modification of egg composition: omega 3 eggs. Egg fractionation: bioactive proteins and lecithin.
- Topic 21: Liquid and frozen ovoproducts (2 hours)
  Fresh eggs storage. Breaking and separation. Processing of liquid ovoproducts: whole egg, white and yolk. Filtration.
  Homogeneization. Stabilization. Pasteurization and ultrapasteurization. Frozen and ultrafrozen ovoproducts. Industrial applications of liquid ovoproducts.

- Topic 22: Concentrated, dehydrated and processed ovoproducts (2 hours) Concentration of ovoproducts. Desugaring. Atomization drying and freeze-drying: powder egg, white and yolk. Other ovoproducts (egg bar, egg yolk garnish, spray egg) and cooked ovoproducts. Desserts with egg and milk: ingredients and processing

LABORATORY PRACTICALS

- Practical 1: Determination of quality parameters in raw milk: density, pH, acidity and antibiotics. Determination of lipids and lactose in bovine milk. 3 hours.
- Practical 2:
  - Session 1. Skimming, homogenisation and pasteurization of raw cow milk. Determination of fat content. 3 hours.
  - Session 2. Effect of heat treatments on denaturation of whey proteins, Maillard reaction intensity and coagulation properties of milk. 3 hours.
- Practical 3:
  - Session 1. Manufacture of butter from sweet and cultured cream. 1,5 hours.
- Practical 4. Study of the functional properties of egg white and whole egg in the quality of bakery products: effect of technological treatments. 2,5 hours.

SEMINARS AND VISITS
The seminars will consist in the oral presentations of the practical works carried out by the students.
? Visit to Interprofessional Dairy Laboratory of Aragón (Movera, Zaragoza). 1 hour.
? Visit to Pascual Dairy Industry (Aranda de Duero, Burgos) in their dairy and egg products plants. 4 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 (http://add.unizar.es/add/area/index.php).

4.5.Bibliography and recommended resources

The bibliography and recommended sources are updated and can be consulted in the web of the library (search recommended bibliography in biblioteca.unizar.es).