

Academic Year/course: 2021/22

## 30832 - Vegetable Product Technology

### Syllabus Information

**Academic Year:** 2021/22

**Subject:** 30832 - Vegetable 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

### 2. Learning goals

### 3. Assessment (1st and 2nd call)

### 4. Methodology, learning tasks, syllabus and resources

#### 4.1. Methodological overview

The methodology followed in this course is oriented towards achievement of the learning objectives. It is based on participation and the active role of the student favors the development of communication and decision-making skills. A wide range of teaching and learning tasks are implemented, such as lectures, laboratory sessions and seminars.

All the classroom materials will be available via Moodle (<http://add.unizar.es>).

Students must follow the regulations described in:

- Prevention: A guide for students at the University of Zaragoza:  
[https://uprl.unizar.es/sites/uprl.unizar.es/files/archivos/Procedimientos/guia\\_preventiva\\_para\\_estudiantes.pdf](https://uprl.unizar.es/sites/uprl.unizar.es/files/archivos/Procedimientos/guia_preventiva_para_estudiantes.pdf)
- Manual de seguridad en los laboratorios de la Universidad de Zaragoza y normas marcadas por la Unidad de Prevención de Riesgos Laborales:

[https://uprl.unizar.es/sites/uprl.unizar.es/files/archivos/Procedimientos/manual\\_de\\_seguridad\\_en\\_los\\_laboratorios\\_de\\_la](https://uprl.unizar.es/sites/uprl.unizar.es/files/archivos/Procedimientos/manual_de_seguridad_en_los_laboratorios_de_la)

<https://uprl.unizar.es/inicio/manual-de-procedimientos>

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

#### 4.2. Learning tasks

The 6 ECTS course includes the following learning tasks:

- **Lectures (4,5 ECTS): 45 hours.** Lectures: the professor will explain the theoretical contents of the course and solve illustrative applied problems. These problems and exercises can be found in the problem set provided at the beginning of the semester. Lectures run for 3 weekly hours. Although it is not a mandatory activity, regular attendance is highly recommended.

- **Laboratory sessions (1,2 ECTS): 12 hours.** Laboratory sessions: 3 sessions of 4 hours each. Students will work together in groups actively doing tasks such as practical demonstrations, measurements, calculations, and the use of graphical and analytical methods. Students will complete assignments, problems and exercises related to concepts seen in laboratory sessions.
- **Visit to a horticultural packinghouse: 3 hours.** Visit to a fruit and vegetable industry: the student will study the way a fruit travels from harvest to packaging and preservation. This visit will be accompanied by a talk where the company manager explained to the students all the functions that a food technologist can perform on it. Before the visit the processes that they develop and the salient features of the establishment will be explain. This will allow students to more easily follow the explanations of technicians and allow an exchange of views with students who are in contact with industrial problems.
- **Autonomous work:** students are expected to spend about 90 hours to study theory, solve problems, prepare lab sessions, and take exams.
- **Tutorials:** the professor's office hours will be posted on Moodle and the degree website to assist students with questions and doubts. It is beneficial for the student to come with clear and specific questions.

### 4.3. Syllabus

The course will address the following topics:

#### Theory sessions

##### Section I: 13 hours

- Topic 1. Introduction (1 hour). Objectives, methodology, learning tasks, syllabus, evaluation and resources. Economic and nutritional importance of food of plant origin in the world, Europe and Spain.
- Topic 2. Structure of vegetable products (2 hours). Cellular, tissue and organic structure. Implications in the post-harvest conservation of the different products.
- Topic 3. Chemical composition of fruits and vegetables (3 hours). General aspects. Water, carbohydrates, organic acids, amino acids and proteins, lipids, phenolic compounds, pigments, volatile compounds, vitamins, minerals and enzymes. Importance and factors on which they depend.
- Topic 4. Post-harvest metabolism of fruits and vegetables (4 hours). Dark respiration. Regulation of aerobic respiration: biochemical aspects. Influence of temperature and composition of the atmosphere on respiratory activity. The influence of ethylene. Anaerobic metabolism. Post-harvest respiration as an index of general metabolic activity and as a predictor of shelf life, influence of degree of maturation, response to temperature, oxygen concentration, carbon dioxide and ethylene. The organoleptic maturation of fruits and vegetables: changes and responsible agents. The response to ethylene from climacteric and non-climacteric fruits. The role of ethylene in the ripening of fruits and vegetables. The synthesis of ethylene and its regulation.
- Topic 5. Previous operations to post-harvest phase (3 hours). Determination of maturity index. Harvesting systems. Transfer of raw materials between the different areas of the factory. Dry cleaning. Washing. Inspection and classification by manual and automatic systems. Confection line.

##### Section II: 12 hours

- Topic 6. Cold storage (2 hours). The importance of pre-cooling. Pre-cooling systems in fruits and vegetables. The limits of refrigeration: chilling injury and physiological disorders. Recommended temperatures for different fruits and vegetables. Control of ethylene in cold storage.
- Topic 7. Modified and controlled atmospheres (3 hours). Beneficial and harmful effects. Recommended concentrations for different fruits and vegetables. Controlled atmosphere chambers: types and control systems.
- Topic 8. Ethylene management in the post-harvest phase (1 hour). Ethylene elimination systems. Inhibitors of ethylene production. Management of ethylene in controlled ripening and degreening.
- Topic 9. Post-harvest diseases and disorders of fruits and vegetables (4 hours). Definition and importance in the post-harvest phase. Mechanical damage. Pathological alterations: the responsible microorganisms, the infection process, pre- and post-harvest factors that influence their incidence, the most common post-harvest rot, methods of prevention and control. Physiological disorders: injuries due to nutritional deficiencies and injuries due to inadequate atmospheric conditions. Identification of diseases and disorders.
- Topic 10. Minimally processed products (2 hours). Definition. Types of products. Problems in the elaboration. Processing and conservation. Shelf-life. Sanitary quality. Fifth range vegetable products: Definition. Processing and preservation systems. Emerging technologies applied to conservation. Shelf-life. Sanitary quality.

##### Section III: 9 hours

- Topic 11. Preliminary operations in vegetable processing (2 hours). Raw materials selection. Inedible portions separation. Peeling. Chopping. Blanching. Principles, systems and equipment.
- Topic 12- Fruits and vegetables thermal processing (3 hours). Objectives and basic principles. Thermal treatment and preliminary and complementary operations. Installations and operations. Aseptic packaging and the new

vegetables thermal treatment systems. Canned fruits and vegetables.

- Topic 13- Fruits and vegetables drying (2 hours). Objectives and basic principles. Preliminary operations. Dryers for different vegetables. Complementary operations. Dried products processing: fruits, vegetables, juices.
- Topic 14- Fruits and vegetables freezing (2 hours). Basic principles. Preliminary operation. Fruits and vegetables freezing equipment and facilities. Complementary operations. Effects in fruits and vegetables.

#### **Section IV: 11 hours**

- Topic 15-Vegetables fermentation (2 hours). Objectives and basic principles. Acids sprouts, pickles and table olives processing technology. Other products. Other methods for chemical preservation.
- Topic 16- Confectionery and jellies processing (2 hours). Classification and legal types. Formulations. Pectines and sugar selections. Cooking and packing. Candied fruits: processing technology.
- Topic 17 Fruits and vegetable juice processing technology (4 hours). Objectives and basic principles. Classification and juices types. Preliminary operations. Extraction processes. Fruit juices concentration. Deaeration. Preservation. Other non-alcoholic fruit drinks.
- Topic 18- Legumes (1 hour). Production and classification. Chemical composition. Antinutritional factors. Seeds drying and storage. Soy flours, concentrates and isolated proteins processing. Soy products. Sprouted vegetables. Fermented vegetables. Proteins and starch production.
- Topic 19- Cereals and products, oils and sugar (2 hours). Processing technology introduction.

#### **Laboratory sessions**

- **Session 1. Determination of the respiration rate of different fruits and vegetables: influence of the species and temperature. Maturity indexes.**
  - Determination of the content of oxygen and carbon dioxide and ethylene in the headspace of containers containing different fruit species.
  - Calculation of the oxygen consumption and the production of carbon dioxide and ethylene per kilogram and hour.
  - Classification of the different species of fruits and vegetables depending on their respiratory activity
  - Determination of color: color charts and instrumental measurement
  - Instrumental measurement of the texture by manual penetrometry
  - Determination of pH and acidity by titration with sodium hydroxide
  - Determination of soluble solids contents by refractometry
  - Determination of starch content
  - Determine the degree of maturity according to the results obtained and specialized bibliography
- **Session 2. Pigments in fruits and vegetables**
  - Determination of chlorophyll: influence of species and heat treatment
  - Determination of anthocyanins
  - Determination of lycopene
- **Session 3. Elaboration of minimally processed products and products of fifth range**
  - Elaboration of minimally processed apple
  - Elaboration of fifth range vegetables
  - Sensory evaluation
- **Visit to a horticultural packinghouse**
  - Visit to the packinghouse
  - Informative talk about the work of the post-harvest technologist in the horticultural industrie

#### **4.4. Course planning and calendar**

For further details concerning the timetable, classroom and further information regarding this course please refer to the Faculty of Veterinary (<https://veterinaria.unizar.es/academico/plan-estudios-grado-cta/>)

#### **4.5. Bibliography and recommended resources**

[http://biblos.unizar.es/br/br\\_citas.php?codigo=30832&year=2019](http://biblos.unizar.es/br/br_citas.php?codigo=30832&year=2019)