

IDENTIFICATION

Course code : E2CP4A3
ECTS : 2.5

DURATION

Lectures : 8
Tutorial classes : 12
Labs : 16
Total : 36

Project :
Personnal work :

ASSESSMENT

2 Written exams (2h/2h) + 1 Lab report

TEACHING MATERIALS

LANGUAGE

English

CONTACT

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UE : AGROALIMENTAIRE

COURSE : Food and Biological Engineering

SCOPE OF THE COURSE

OBJECTIVES

- The aim of this course is to introduce students to the fundamental principles of process engineering applied to the transformation of biological resources. It seeks to help students understand how to transform a raw material into a safe and stable finished product, while controlling energy and mass transfers, as well as the impact of these operations on the nutritional and sanitary quality of the food.

COMPETENCE AND SKILLS

- Identify and justify the choice of a unit operation in an agri-food production line.
- Quantify the impact of a heat treatment on the microbial population (calculation of pasteurization or sterilization value) and on nutritional, sensory, etc. characteristics.
- Establish a complete manufacturing diagram including material flows and, if possible, critical control points (CCPs).
- Study size reduction, mixing, and agitation operations.
- Experimentally analyze a growth (fermentation) and mortality (pasteurization) kinetic.

PROGRAM

1. Design of agri-food processes and hygiene : methodology for manufacturing diagrams : steps, flows, critical points, and integration of cleaning/disinfection protocols.
2. Study of food transformations : evolution of nutritional, sensory, and microbial properties according to processes.
3. Low-temperature and ambient processes (Cold : Refrigeration vs Freezing (crystallization, kinetics). - Mechanical : Grinding, sieving, mixing, and homogenization (energy consumption, efficiency)).
4. Thermal processes and biological impact : - Blanching, pasteurization : heat transfers. - Destruction kinetics : Notions of D, z, and pasteurization/sterilization value (PV, SV). - Consequences on food safety, nutritional properties, enzymes, and shelf life (DLC/DDM).
5. Practical Work : Lab 1 : Batch Fermentation Kinetics : Monitoring microbial growth (biomass, substrate) and calculating the growth rate. - Lab 2 : Pasteurization and Microbial Decay : Heat treatment of an inoculated sample, enumeration, and calculation of decimal reduction.

BIBLIOGRAPHY

- Mafart, P., & Béliard, E. (2011). *Génie industriel alimentaire - Tome 1 : Les bases du génie des procédés*. Lavoisier.
- Jeantet, R., et al. (2021). *Génie des procédés appliqué à l'industrie agroalimentaire*. Lavoisier.

- Brennan, J. G., & Grandison, A. S. (2012). *Food Processing Handbook*. Wiley-VCH.
- *Collection de Techniques de l'Ingénieur*.

REQUIREMENTS

- Biology/Microbiology : Structure of microorganisms and basics of bacterial growth.
- Physics/Chemistry : Concepts of temperature, heat, pressure, and simple mass balances.
- Mathematics : Use of logarithmic and exponential functions, reading graphs.