



UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Bio-Based Processes

2627-2-F7603Q008-F7603Q00801

Aims

The overarching objective of the course is to address contemporary challenges associated with waste reclamation (reuse of waste) issues, from a sustainability and process circularity perspective aimed at valorising biological matrices incorporated into existing productive processes. Specifically, the course comprises two complementary modules (Bioprospecting and Bio-based processes), each comprising four CFUs for a total of eight CFUs. The primary objective of this second teaching module is to equip students with the necessary skills to effectively and appropriately communicate the concepts pertaining to the methods employed to valorise natural matrices from an applicative and economic standpoint, while considering the sustainability implications (i.e., green extraction processes) and the essential knowledge required for conducting an economic evaluation of microbial and biobased processes. By the conclusion of this teaching, students will be able to independently delve into these modern issues, leveraging the interaction with industry experts and consulting recommended websites and/or relevant literature.

Contents

The primary objective of this teaching module is to examine the economic implications of biomanufacturing and precision fermentation from a scientific and technological standpoint. These processes involve the utilization of either naturally occurring or genetically engineered microorganisms to replace traditional ones that have adverse effects throughout the entire supply chain, from production to disposal. The goal is to develop productive solutions that can be considered “Nature-positive” and “Safe and Sustainable by Design.”

A significant portion of the teaching will focus on case studies that require addressing environmental and industrial concerns through the adoption of an approach that emphasizes the valorisation of components within the productive process. This approach will adhere to the principles of circular bioeconomy and industrial symbiosis.

By interpreting the significance of biodiversity (as covered in the first module) in the context of the valorisation of biological matrices in practical and applicable scenarios, such as the repurposing of agricultural and supply chain waste, and the value of naturally occurring compounds, students will be able to achieve one of the primary objectives of this teaching.

Detailed program

Key concepts and principles of the Module:

- The role of bioactive compounds in natural ecosystems: classification and diversification, coupled with study approaches both of analytical and economic concern;
- From manufacturing to biomanufacturing;
- Insufficient and unsustainable food supply chain: precision fermentations as possible solutions, with economic considerations and implications;
Case study: application of plant-derived compounds into commercial products: functional foods, cosmetics, herbicides, drugs and pharmaceutical products;
Case study: production of proteins and edible oils by microbial processes of upcycling of waste biomasses;
Case study: traditional plastic products upcycling into new synthetic products.

Throughout the whole course the concepts of planet boundaries, emissions and scopes, sustainable development goals (SDGs) will be taken into consideration.

Prerequisites

Basic knowledge of microbiology will be useful to better understand the topic of this teaching, nonetheless the focus will be always on the overall process and needed information will be always given during lessons. Teacher will provide students with material to fill the gaps based on the student feedback and requirements.

Teaching form

The teaching form will be provided both in a frontal manner by presence (60%) and interactively by presence (40%). The course will also provide the organization of visits to laboratories and/or companies involved in activities dealing with resources revalorization and re-waste from different supply chains, as well as synchronized lessons between the teachers of the two modules, with the possibility to involve also professionals of the different sectors. During the lessons space will be given to shared activities, such as case studies evaluation, flipped class and open discussion, in order to verify that the concepts are clearly understood by all the students and also to let the students to understand the prerequired skills, which will be propaedeutic to reach the learning objectives.

Textbook and teaching resource

The slides used during the different lessons will be made available online on the e-learning platform, together with scientific literature and bibliography to better understand the topic explained throughout the course, by also exploiting the interactive activities that will be provided interactively during the course.

Semester

Semester: I semester

Assessment method

The final exam consists of a single oral exam at the end of the course, with a score between 18-30 / 30 cum laude, which comprises the discussion of various topics covered in the course, with an emphasis also on the connections between concepts and processes, such as to arrive at a critical evaluation.

The final score will be between 18/30 and 30/30 cum laude, based on the overall assessment considering the following criteria:

- (1) knowledge and understanding;
- (2) ability to connect different concepts;
- (3) autonomy of analysis and judgment;
- (4) ability to correctly use scientific language

Office hours

Always after scheduling an appointment via e-mail.

Sustainable Development Goals

ZERO HUNGER | GOOD HEALTH AND WELL-BEING | DECENT WORK AND ECONOMIC GROWTH |
INDUSTRY, INNOVATION AND INFRASTRUCTURE | RESPONSIBLE CONSUMPTION AND PRODUCTION |
LIFE ON LAND
