



UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Biotechnological processes and microorganisms to promote the circularity of resources

2324-BbetweenSDG-08-08

Module description

In this course, attention will be brought to how human activities very often lead to short-sighted use of resources. On the one hand, their use exceeds the planet's capacity to regenerate them, and on the other it generates large amounts of waste, which in addition to depleting the resources themselves negatively impacts the planet and the health of all living organisms. Rediscovering the possibility of returning to the circularity of resources through the study of biodiversity, with particular attention to microbial biodiversity, is a way to respect, enhance and restore it, actions that in cascade can benefit the entire system-planet. Starting with these concepts, we will discover what biobased processes are and how microorganisms can be one of the keys to developing new production systems that respect the principles of sustainability.

Learning goals

Acquire jargon skills and key concepts with respect to the topics of resource circularity, biobased, microbial-based processes, biomaterials and biorefineries. Also acquire the ability to critically discuss the above issues and the perception of the complexity and multidisciplinary of innovative biobased processes, which take into consideration both local and global aspects.

General goal

Acquire jargon skills and key concepts with respect to the topics of resource circularity, biobased, microbial-based processes, biomaterials and biorefineries. Also acquire the ability to critically discuss the above issues and the perception of the complexity and multidisciplinary of innovative biobased processes, which take into consideration

both local and global aspects.

Specific skills and competences

Skills and competencies on the topics described above and in particular: ability to define what is meant by planetary boundaries, division of phases with respect to greenhouse gas generation, and again biomass, what are the different generations from which to develop biobased processes.

Specific skills to distinguish between reuse, recycling and up-cycling, as well as the issues of redesign. Basic skills with respect to microbial biodiversity, metabolic and enzymatic capacities, and in-depth elements with respect to the topic of GMOs and conversely with respect to the topic of sustainability of production chains for the creation of goods and services, including nutraceuticals and alternative food sources, consisting precisely of microbial biomass or specific proteins/metabolites.

Sustainable Development Goals of the 2030 UN Agenda

The proposed module is consistent with some of the Goals of Agenda 2030: Goal 2: Zero Hunger, Goal 9: Business, Innovation and Infrastructure, Goal 12: Responsible Consumption and Production, Goal 13: Climate Change, Goal 14: Life Under Water, Goal 15: Life on Earth.

In particular, it is attributable to initiatives aimed at:

Goal 2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality.

Goal 9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities

Goal 12: all the targets

Goal 13: 13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning

13.B Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities

Goal 14: 14.A Increase scientific knowledge, develop research capacity and transfer marine technology, taking into account the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology, in order to improve ocean health and to enhance the contribution of marine biodiversity to the development of developing countries, in particular small island developing States and least developed countries

Goal 15: 15.A Mobilize and significantly increase financial resources from all sources to conserve and sustainably use biodiversity and ecosystems

Breakdown of meetings

The 12-hour module is divided as follows: 6 meetings, two hours each.

Detail:

2 hours: Fossil resources and freshly synthesized biomass: what is the difference? What are the generations?

2 hours: Role of microorganisms in circular processes of element and matter flows

2 hours: From biomass to biobased processes, with a focus on microorganism-led, natural and engineered

processes

2 hours: Concept of rethinking in a changing society, with a focus on biobased processes. Difference between reuse, recycling and upcycling

2 hr: Case study: production of proteins and edible oils by microbial upcycling processes of waste biomass

2 hours: Case study: upcycling of traditional plastics into newly synthesized products

During the lectures, explicit reference will be made to the concepts of planetary boundaries, emissions and scopes, SDGs, and it will be clearly explained how to do the assignment for the assessment of skill acquisition.

Number of participants

Max 30

Language used in meetings

Italian, English upon request

Delivery period of the module

June 2024

Methods of assessing the outcomes of the learning process

lin-depth reading of the materials provided; return of a short paper from questions pertaining to the topics covered.

Department of affiliation of the teacher

Bitechnology and Biosciences

Sustainable Development Goals

ZERO HUNGER | QUALITY EDUCATION | RESPONSIBLE CONSUMPTION AND PRODUCTION | CLIMATE ACTION | LIFE BELOW WATER | LIFE ON LAND
