UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

# COURSE SYLLABUS

## Low Environmental Impact Processes

**2223-2-F7501Q053**

### Aims

The course aims to provide the knowledge and methodological basis to define a process with low environmental impact. The course will then focus on some chemical processes that can currently be defined as having a low environmental impact.

Knowledge and ability

At the end of the course the student knows

What are the main parameters to be evaluated to define a process with a low environmental impact

The correct definitions of green-chemistry and circular economy

The scientific issues to move from the oil-based economy to the green economy.

Knowledge and understanding skills applied

The green-chemistry concepts learned in the course are applicable to all current production processes and form the basis of sustainable development according to the 2030 UN Agenda

Autonomy of judgment

The student is able to correctly evaluate the environmental compatibility of a process and to evaluate if there are processes that concern the circular or non - circular economy.

Communication skills

Be able to use also with examples concepts and definitions such as green chemistry, biorefinery, renewable sources, biodegradable materials, life cycle assessment.

## Contents

Environmental sustainable chemical processes definitions and applications. Biorefinery concept Green Chemistry approach. Carbon economy approach. Green Chemistry approach: alternative feedstock and starting materials, alternative synthesis and reagents, alternative reaction conditions. Biorefinery: biomass utilisation, white biotechnology, biofuel. Carbon economy: application of the concept. Important Case History.

## Detailed program

Evolution of low environmental synthesis from 50 to 90 with examples

Twelve green chemistry rules Evolution of green chemistry paradigm Carbon economy concept

The renewable resources description with particular emphasis about lignocellulosic materials

Evolution of pulp and paper industry evaluated under the environmental point of view

Recycle and reuse ( advantages and problems )

Synthesis of new materials (biodegradable and not biodegradable )starting from renewable resources with low environmental impact processes

Chemicals synthesis starting from renewable resources with low environmental impact processes

Biorefinery concept with examples and applications in Italy and Europe

Integration of biorefinery idea in the circular economy concept

## Prerequisites

Basic knowledge of Chemistry and Biology

## Teaching form

Lessons frontal teaching, 6 credits, 48 h

the course will be delivered in English if requested by incoming foreign students

## Textbook and teaching resource

Slides

Chapters book from:

Green Chemistry Theory and Practice PT Anastas 1998 Oxfod University Press,

Introduzione alla Chimica Ambientale Bruno Rindone Città Studi Edizioni, 1996.

Scientific Articles

Textbooks and teaching resources are available in english language

## Semester

2nd semester

## Assessment method

Oral examination mark range 18-30/30 The questions during oral examination verify the knowledge about the development of green-chemistry concept, also using case-study, with particular attention about the biorefinery concept.

## Office hours

Every day. It is necessary to fix the meeting by E-mail

## Sustainable Development Goals

DECENT WORK AND ECONOMIC GROWTH | INDUSTRY, INNOVATION AND INFRASTRUCTURE | RESPONSIBLE CONSUMPTION AND PRODUCTION | CLIMATE ACTION