UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Organic Compounds of Industrial Relevance

2122-3-E0201Q055

Aims

Aims of the course are:
To know some organic substances of natural / synthetic origin and of great commercial importance: aromas and fragrances, dyes and food preservatives, sweeteners and perfumes. .
To learn some biosynthetic processes, with particular reference to the action of enzymes and enzymatic co-factors, in particular vitamins..
Knowledge and understanding
At the end of the course the student will know:
the classes of organic compounds with high commercial value, their basic structures, their properties and their bio-synthetic pathways;
the industrial contexts application of these compounds as well as their commercial importance.
Applying knowledge and understanding
At the end of the course the student will be able to apply the acquired knowledge and to recognize and understand the role of the various compounds in commercial products.
Making judgements
The student must be able to process what he has learned and to recognize the situations and problems in which the classes of compounds studied can be used.
Communication skills
The student must be able to describe the topics in a clear and concise way and with properties of language and mastery of chemical structures
Learning skills
Being able to apply the acquired knowledge to contexts / products different from those presented during the course.

Contents

The course is divided into the following parts

1. Biosynthetic processes leading to the formation of secondary metabolites, with particular reference to compounds of mercantile interest (such as aromas, food colors, cosmetic fragrances).
2. Classes of synthetic compounds such as sweeteners, their characteristics, properties and some synthetic aspects.
3. Compounds of cosmetic interest, with reference to some exemplary substance / fragrance.

Detailed program

Mevalonate pathway
Detailed topics:
Biosynthetic pathway that leads to the formation of monoterpenes, synthesis of the isoprene units, head to tail conjugation.
Characteristics and organoleptic properties of linear monoterpenes
Cyclic monoterpenes and their organoleptic properties.
Biosynthesis and chemical synthesis of menthol.
Commercial interests of monoterpenes.
Biosynthesis of longer terpenes: triterpenes, tetraterpenes, carotenoids and their commercial importance as food colouring material.
Shikimate pathway
Detailed topics:
Biosynthetic pathway that leads to the formation of Corismic Acid
Transformation of corismic acid into aromatic aminoacids, and into cynnamic-benzoic acid derivatives.
Transformation of corismic acid into benziquinones (vitamin K)
Transformation of corismic acid into Flavonoids and Stilbenes.
Tocoferol derivatives and their antioxidant properties.
Acetate pathway
Detailed topics:
Fatty acid biosynthesis and catabolism (?-oxydation)
Polyketides biosynthesis and cyclization (orsellinic acid and floracetophenone)
Anthrones and anthraquinones
Enzymatic cofactors
Detailed topics:
Description of the principal enzymatic co-factors and their role in biological transformations.
NAD+/NADH (NADP+/NADPH) structure and mechanism
FAD/FADH2
Vitamin B1 (Thiamine): decarboxylation of ? ketoacids (pyruvate decarboxylase and acetyl CoA biosynthesis), transketolases
Vitamin B6 (pyridoxal phosphate-PLP): transamination e decarboxylation of ? aminoacids.
Metylation (SAM)
Vitamin B9
Fat-soluble vitamins
Induced Metabolites
Thioglucosinolates, cyanogenic glycosides, cysteine sulfoxide derivatives
Sweeteners
Classification of various sweeteners: natural, synthetic, intensive and mass. Structure, characteristics and properties.
Fragrances
Fragrances of animal and vegetable origin, with some reference to synthetic derivatives and their use.

Prerequisites

Background: basic organic chemistry
Specific prerequisites: none.
General prerequisites: Students can take the exams of the third year after having passed all the exams of the first year of the course.

Teaching form

Classroom lessons supported by PowerPoint presentations.
Teaching language: italian.

Textbook and teaching resource

Learning material (slides of the lessons, scientific papers) is available at the e-learning web page of the course.

Recommended textbooks
"Chemistry, Biosynthesis and Bioactivity of Natural Substances",
Author Paul M. Dewick. Ed. PICCIN
Organic Chemistry by J.C. Smith, Ed. McGraw-Hill
Organic Chemistry of W.H. Brown, Ed. EDISES

Semester

First semester

Assessment method

Written examination. Open questions focussed on the entire course content.

Office hours

Contact: on demand, upon request by mail to lecturer.