UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Chimica Organica per l'Energetica Sostenibile

2122-1-F5401Q050

Aims

To provides an overview on organic and hybrid systems potentially exploitable in the production, conversion andstorage of energy using renewable energy sources.

O1 – knowledge and understanding

To the student is requested to show an adequate comprehension and skills of organic chemistry:

1) To recognize and to understand which are the organic systems or bonds where it is possible to store energy.

2) To recognize which type of energy is possible to store.

3) To recognize and to understand which organic chemical structure are able to interact with electromagnetic radiation (sun light) and useful in the production of renewable and environmental friendly fuels

4) To understand the chemical properties of organic systems useful for energy saving and competitive with convention inorganic ones (organic light emitting diodes)

5) To understand which organic systems are potentially exploitable in hydrogen storage

6) To understand the principal photophysical and photochemical processes involved in the absorption of electromagnetic radiation (UV/Vis light) and useful in the energy storage and in the production of renewable fuels.

O2 – Applying knowledge and understanding

The student, during the assessment method has to demonstrate an adequate capability of applying the knowledge and understanding of the provided concepts:

1) To individuate organic systems or bonds where it is possible to store energy.

2) To individuate which type of energy is possible to store.

3) To individuate organic chemical structures are able to interact with electromagnetic radiation (sun light) and useful in the production of renewable and environmental friendly fuels

4) To individuate the chemical properties of organic systems useful for energy saving and competitive with convention inorganic ones (organic light emitting diodes).

5) To individuate which organic systems are potentially exploitable in hydrogen storage

6) To individuate the principal photophysical and photochemical processes involved in the absorption of electromagnetic radiation (UV/Vis light) useful to energy storage and to production of renewable fuels.

O3 – Making judgements

To be able to conduct a reasonable analysis on organic systems with potential utility in energy saving and environmental issues.

O4 –Communication skills

To be able to show and identify organic systems of interest for energy and environmental sustainability also illustrating the protocols for their preparation with an appropriated language.

O5 –Learning skills

To be able to apply the acquired knowledge to energy and environmental sustainability issues.

Contents

Overview on the strategies for the preparation of organic materials with specific optical and electronic properties exploitable in the field of photonics, organic semiconductors and on the synthesis of principal polymers with application as organic conductors or electroluminescent devices. An overview provides on organic photochemistry.

Detailed program

Overview on systems used for energy production, conversion and storage. Concept of chemical energy and its application in planning organic systems for energy storage. Energy stored in highly strained organic molecules (for example cubanes). Systems for photovoltaic applications (dye-sensitized solar cells, organic photovoltaics, perovskite solar cells, tendem cells). Systems for hydrogen production via water photosplitting and photocatalytic reduction of water, systems for the production of hydrocarbons (methane) from carbodioxide and solar energy.

Organic and/or organometallic systems mimic the photosynthesis in the production of fuels (solar fuels). Polymeric systems containing moieties able to be easily hydrogenated as potential solution to hydrogen storage in fuel-cell engines. Molecules and polymers for the conversion of solar energy to electricity (last generation photovoltaics). Overview on principal fuel cells and on indoor and outdoor lighting.

Prerequisites

For an optimum understanding of the topic treated, a consolidated organic chemistry background is required together with basic knowledge on the interaction of electromagnetic radiation with the matter or molecules (excited states, relaxation mechanisms, absorption and emission properties)

Teaching form

Lectures in classroom

Textbook and teaching resource

Notes, slides and articles provided by the lecturers

Semester

I year and II semester

Assessment method

Oral examination is the assessment method employed to check the level of understanding of the concepts taught during the course. Questions will ask to the student regarding the entire topic treated during the course. A mark will be proposed to the student expressed in thirtieths. The exam is passed with a minimum mark of 18/30. From 2016/2017 academic year, the positive final examinations show an average mark of 27.9/30; minimum mark 24/30 and a maximum mark 30 with honors. On request, the assessment can be hold in English.

Office hours

Prof. Papagni receives students Friday from 14.30 to 16.30. Prof. Abbotto receives students every day. Students must fix an appointment in advance