Chemistry - Process Engineering

In brief

Course langage: French, English

Presentation

Prerequisites

Basic knowledge of chemistry, process engineering and fluid mechanics.

Learning objectives

Chemistry :
- Know the principles of kinetic or thermodynamic control, charge control, orbital or steric control underlying chemical reactions.
- Know the properties and reactivity of benzene and its derivatives. Know the properties and reactivity of the carbonyl function, a very versatile chemical function in organic chemistry.
- Know the electronic structure of organometallic complexes, the nature of the metal ligand bond and the mechanisms of ligand substitution - Oxidative addition - Reductive elimination - Insertions and eliminations.

Process engineering :
- Acquire knowledge of material transfer for a continuous medium and in the vicinity of an interface
- Apply this knowledge to liquid-liquid extraction without partial miscibility up to the dimensioning of a mixer-settler battery, a tray column and a packed column

Description of the programme

Chemistry - Organic and organometallic reactivity:
- Part 1: Electrophilic addition on alkene - benzene and its derivatives: aromaticity, resonance - reactivity of benzene and its derivatives: aromatic electrophilic addition (halogenation, nitration, sulfonation - Friedel and Crafts alkylation) - poly substitution: regioselectivity.

- Part 2: structure and properties of the carbonyl function - preparation of carbonyl derivatives: oxidation of alcohols, transposition - reactivity of carbonyl derivatives: nucleophilic attack by water, alcohols, amines, reduction by hydrides and organomagnesiums and organolithiums, ylides (Wittig reaction) - oxidation of ketones - enols and enolates: C-alkylation and O-alkylation, aldolization.
- Part 3: organometallic chemistry and catalysis, organometallic complexes: electronic structure of complexes - metal-ligand bonding - reaction mechanisms - ligand substitution - oxidative addition - reductive elimination - insertions and eliminations - reactions on coordinated ligands - general principles of catalysis: hydrogenation - hydroformylation.

Process Engineering:
- Matter transfer: Matter transfer in continuous medium, mechanisms: diffusion and convection. Local balance: continuity equation

- Matter transfer at an interface: film model, transfer coefficients, dimensional analysis and main adimensional numbers, analogy
- Liquid-liquid extraction: Introduction to separative methods, theoretical stage, cross-flow mixer-settler battery, tray column, packed column

Generic central skills and knowledge targeted in the discipline

Chemistry:
- Know how to approach the chemical reaction in terms of controls (kinetic or thermodynamic, charge control, orbital or steric).
-Predict the selectivity and stereochemistry of the products formed.
- Control the selectivity and stereochemistry of the products formed.
- Predict the reactivity of an organometallic complex.
- Predict its structural and electronic modifications throughout a catalytic cycle in contact with the reaction medium.

Process Engineering:
- Know how to approach a problem related to material transfer.
- Distinguish the different mechanisms of matter transfer and formulate their associated equations.
- Predict the performance of a liquid-liquid extraction operation.

- Predict the dimensions and operating conditions of a liquid-liquid extraction unit.

How knowledge is tested

DS chimie (2/3) - GP (1/3) : 50 %
CC (TD + TP + TA) chimie (2/3) - (TD + TA) GP (1/3) : 50 %

Bibliography

Online resources on the Ecole Centrale educational portal.
Books (documentation centre).

Teaching team

Chimie :
– Bastien Chatelet
– Didier Nuel
– Laurent Giordano
– Alexandre Martinez
– Innocenzo De Riggi
– Cédric Colomban
Génie des procédés :
– Pierrette Guichardon
– Pascal Denis
– Nelson Ibaseta
– Audrey Soric

- Jiupeng Du

Sustainable Development Goal



Responsible consumption and production

Total des heures		**72h**
CM	Master class	24h
TD	Directed work	22h
TP	Practical work	8h
AA		18h

Useful info

Name responsible for EU

Lead Instructor

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