CHEMISTRY AND PROCESSES FIELD_10 ECTS

Introducing

Description

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Analytical methods II

Introducing

Forcing students to use all of their scientific knowledge in order to analyze the experimental results of their experiments and if necessary modify the protocols

Description

1. formulate a scientific problem related to analysis methods in order to illustrate it by manipulations.
2. Make a bibliography with the aim of proposing, adapting or creating experiments which will illustrate the chosen issue.
3. Gather its theoretical and practical knowledge of the previous years and implement them to solve the chosen problem.
4. Plan the experimental work of the group and organize the interactions with the other groups.
5. Explain the principle and learn how to implement the experimental techniques for the analysis.
6. teach yourself on the new analysis techniques necessary to undertake the project when this methods haven't been taught previously.
7. carry out an experiment at the laboratory
8. Analyze the experimental results.
9. Share and debate the results in the scientific point of view with both your teachers and inside your students group. Suggest improvements or work lead.
10. Verbally explain the objectives desired, the chosen scientific approach, and the results of the debate during an oral presentation.
11. Give explanation on the scientific approach followed and the results reached in a written scientific report.

Objectives

Learning by experimental project: illustrate a scientific problem using various experiments involving analytical techniques.

Necessary prerequisites

- Molecular structure and reactivity.
- Thermodynamics, chemistry, electrochemistry.
- Techniques of separation, extraction.
- Analytical methods: chromatographic, UV-visible, electrochemical.

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Practical info

Location(s)

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Mass transfer

Introducing

Description

Thermodynamic properties of gas/liquid equilibria in the perfect gas state, concepts of fugacity and Henry's equilibrium. Transfer properties (viscosity, thermal conductivity, diffusivity) and phase equilibria of multi-constituent real fluids.
Introduction to matter transfer: establishment of the continuity equation, resolution of this equation in a few special cases. Introduction to the notion of transfer coefficient, dimensional analysis, transfer models (film and double film), experimental determination of transfer coefficient, concept of Height of Transfer Unit (HUT) and Number of Transfer Unit (NUT). Introduction to basic sizing of some G/L exchangers (packed column, bubble column, spray column).

Objectives

At the end of this module, the student will be familiar with the equations needed to determine the thermodynamic equilibrium properties (fugacity) of real fluids in multiphase systems. This knowledge will be applied to the determination of exchange potentials and transfer properties (viscosity, diffusivity, etc.).
Students will master the notion of transfer coefficient and be able to estimate it in a given operation.
Students will be able to apply these quantities to the generalized material balance equation applied to multiphase contactors, and will be able to dimension industrial installations such as bubble, packed and spray columns.

The student should be able to: size industrial installations such as bubble, packing and spray columns.

Necessary prerequisites

Advanced thermodynamics and application to physicochemical systems: I2BETH11
Roustan M., Transferts gaz-liquide dans les procédés de traitement des eaux et d'effluents gazeux, Editions TEC & DOC, 2003

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Practical info

Location(s)

Toulouse

Chemical reaction engineering 2

Introducing

Description

Material balances in ideal reactors: general form of the balance, application to different ideal reactors, application to complex reaction schemes, yields and selectivities. Combining ideal reactors to optimize conversion and yield.

Influence of temperature on reactor performance. Notion of Optimal Temperature Progression (OTP). Energy balances for ideal reactors.

Description of real reactor flows. Residence time distribution. Hydrodynamic interpretation and modeling. Application to a packed reactor.

Mixing/reaction interactions: mixing mechanisms, methodology for identifying and solving a mixing/reaction problem, analysis and calculation of characteristic times, probability density function, micromixing models. Modeling/simulation of a case study.

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):

- reactors with variable volume / flow rates
- yield and selectivity in multiple stoichiometry reaction systems
- reactor arrangements (series, parallel, plug flow with recycling)
- mixing mechanisms and their relationship to reaction progress
- influence of reactor non-ideality on conversion: residence time distribution (transfer function concept) and concentration distribution (mixing)
- the influence of temperature on reactor performance, notion of Optimal Temperature Progression
- the general equation for energy conservation in a reactor.

The student should be able to :

- calculate ideal open reactors under variable flow conditions
- calculate the size or yield or selectivity of ideal open reactors for multiple stoichiometry systems, and the conversion rate that can be achieved by arranging the reactors
- determine the DTS of a reactor
- apply a mixing or flow model to predict conversion in a non-uniform reactor
- calculate the POT for a given system
- establish and solve enthalpy balances for reactional and non-reactional systems.

Necessary prerequisites

Ideal reactors, reaction rates and reaction progress parameters
Linear differential equations
Basis of Laplace transforms
Basis of transport phenomena
Basis of thermodynamics

Évaluation

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Practical info

Location(s)

Toulouse