Research Focus in this part of PEPs group

In all industrial applications, the (bio)reactor performance is related to the kinetics of the transformations. Space and time distributions of temperature, concentrations, pH, ... have a strong effect on these performances due to their impact on reaction kinetics. They are affected by hydrodynamics (phase distributions, mixing, ...) and by mass and heat transfer which depend on (bio)reactor design and operating conditions.

We thus use and develop experimental and modelling tools to characterize hydrodynamics, mixing and mass transfer in different types of (bio)reactors:
- Packed bed contactor and fixed bed bioreactors
- Stirred tank bioreactors
- Photobioreactors

In all cases, it is asked to PhD students to collect experimental results in order to build and validate a reactor performance model.

Stirred reactors

Applications: animal cell and stem cell culture, fermentations, pharmaceutical compound formulation, phosphoric acid fabrication...

Collaborations: Gblx AgroBioTech, U Lorraine, GSK, Prayon, Pall Lifescience ...

Experimental tools
- Particle image velocimetry - PIV
- Planar laser induced fluorescence - PLIF

Modelling tools
- Computational Fluid Dynamics - CFD
- Compartment model

Fluid velocity distribution
Tracer concentration distribution
Mixing and mass transfer

Fixed bed (bio)reactors

Collaborations: Gblx AgroBioTech, U Paderborn, TU Delft, U Pisa, Eloy Water, Sulzer Chemtech ...

Fixed bed fermenter
- Axial profiles: liquid retention – G/L interfacial area

Catalytic distillation column
- Follow-up of packing colonization

Fixing bed absorption column
- Dry packing image
- Irrigated packing image

High energy large scale x-ray tomograph

Photobioreactors

Culture of encapsulated microalgae

Encapsulated microalgae beads

Rectangular PBR

Measurement of bead trajectory (optical trajectography)

Vertical profiles of bead distribution

Follow-up of microalgae activity (dissolved oxygen measurement)