

gISQP: Chemical and Process Systems Engineering Group

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BACKGROUND

The field addressed by this group [education (undergraduate and postgraduate), research, and cooperation with the industry] is known as Process Systems Engineering (PSE). It involves the application of the concept of a unit (industry, process, unit operation, etc.) as conceived by the Systems Engineering. PSE joins efforts of mathematical programming and process engineering fundamentals in a systemic approach. Examples thereof may include: process, molecular, and biology systems; supply chain; energy systems, etc.

PSE provides tools for systematic development of product and processes, analysis and design of complex systems, and the techniques needed for this.

PSE has big relevance in various industrial sectors such as oil/gas, pharmaceutical, chemical, polymer, food and beverage, etc.

gISQP was founded in 2011 by members with background in wastewater treatment PSE, aiming to expand this filed along all process engineering.

PROJECTS AND THESIS

• Bio-refineries in Uruguay: Techno-economic evaluation of fuels and chemicals production from national raw materials and residues

Project ANII FSE; A.I. Torres (PI), S. Gutiérrez (co-PI), R. Kreimerman, P. Ures, C. Philippi (Ongoing)

• Biorefinery: Integrated Sustainable Processes for Biomass Conversion to Biomaterials, Biofuels and Fertilizer

Project MIT-Masdar Institute; A.I. Torres (External Consultant), PI: G. Stephanopoulos, J.E. Schmidt (Ongoing)

• Component separation by adsorption from aqueous solutions

S. Gutiérrez (PI), J. Lacuesta (Ongoing)

• Process synthesis and integration for residues handling in the dairy industry

S. Gutiérrez (PI), J. Ferreira (Ongoing)

• Techno-economic feasibility of the bio-refining of primary wood industrialization residues

PhD. Thesis N. Clauser (U. Misiones); Advisors: M. Vallejos, S. Gutiérrez (Ongoing)

• Modelling and optimization of milk spray drying

PhD. Thesis A. Ferrari (UdelaR); Advisors: S. Gutiérrez, G. Sin (Ongoing)

• Simulação dinâmica de evaporadores para aplicação em biorrefinarias

MSc. Thesis J. Ferreira (COPPE, UFRJ, Brazil); Advisor: A. Secchi.

• Biomass to chemicals: process design and kinetic studies for the conversion of sugars into HMF

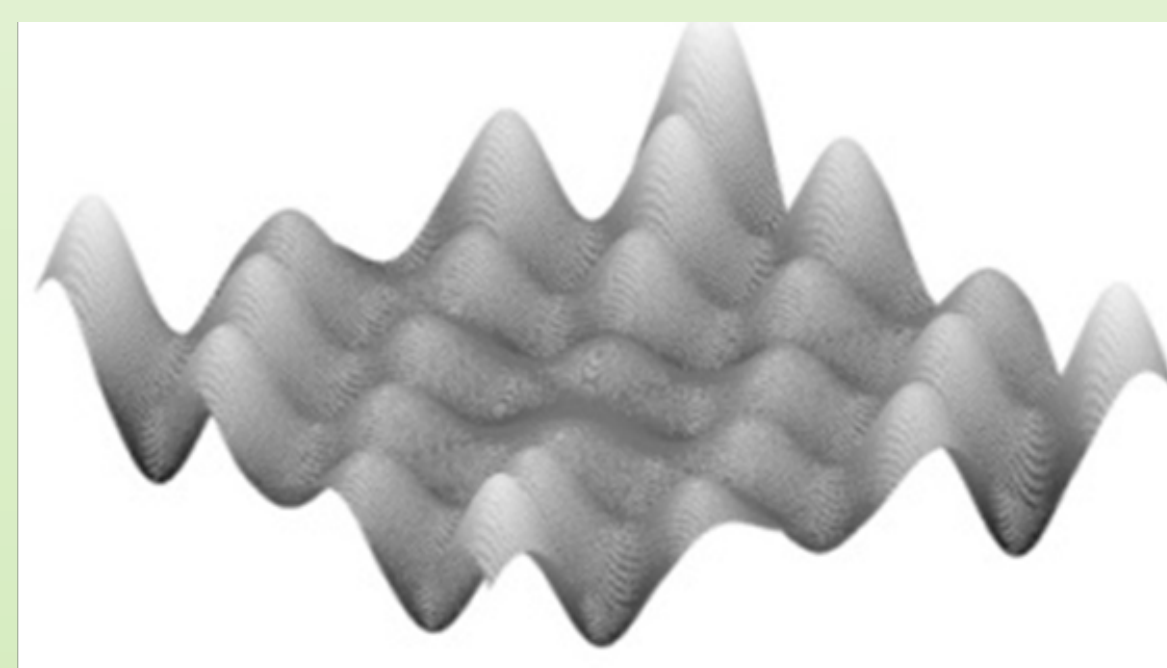
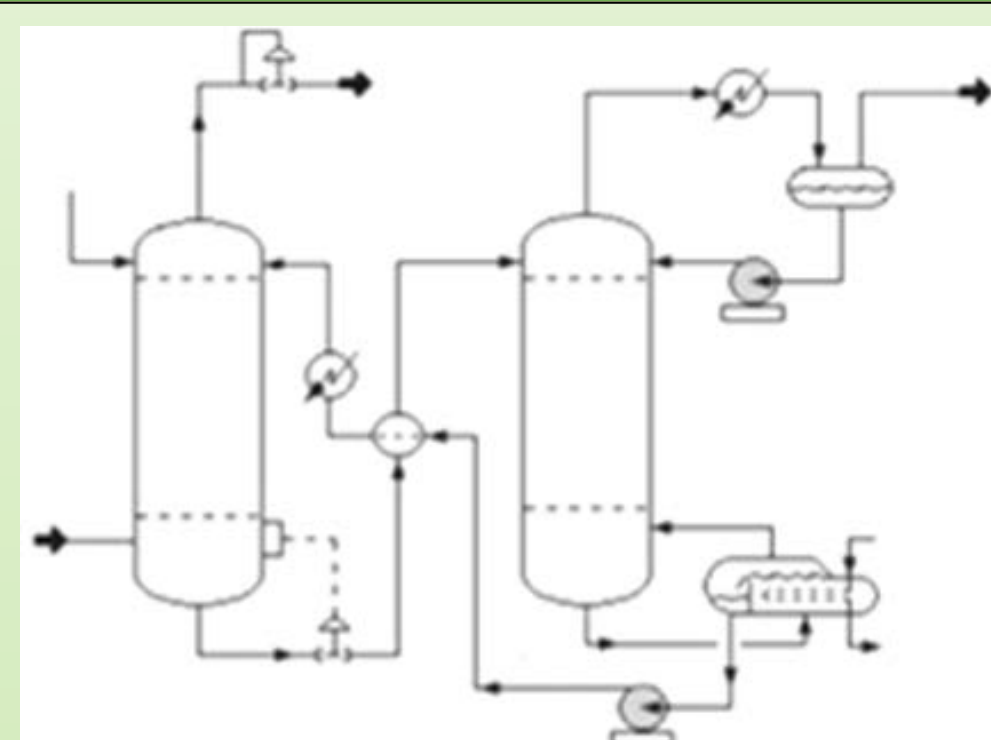
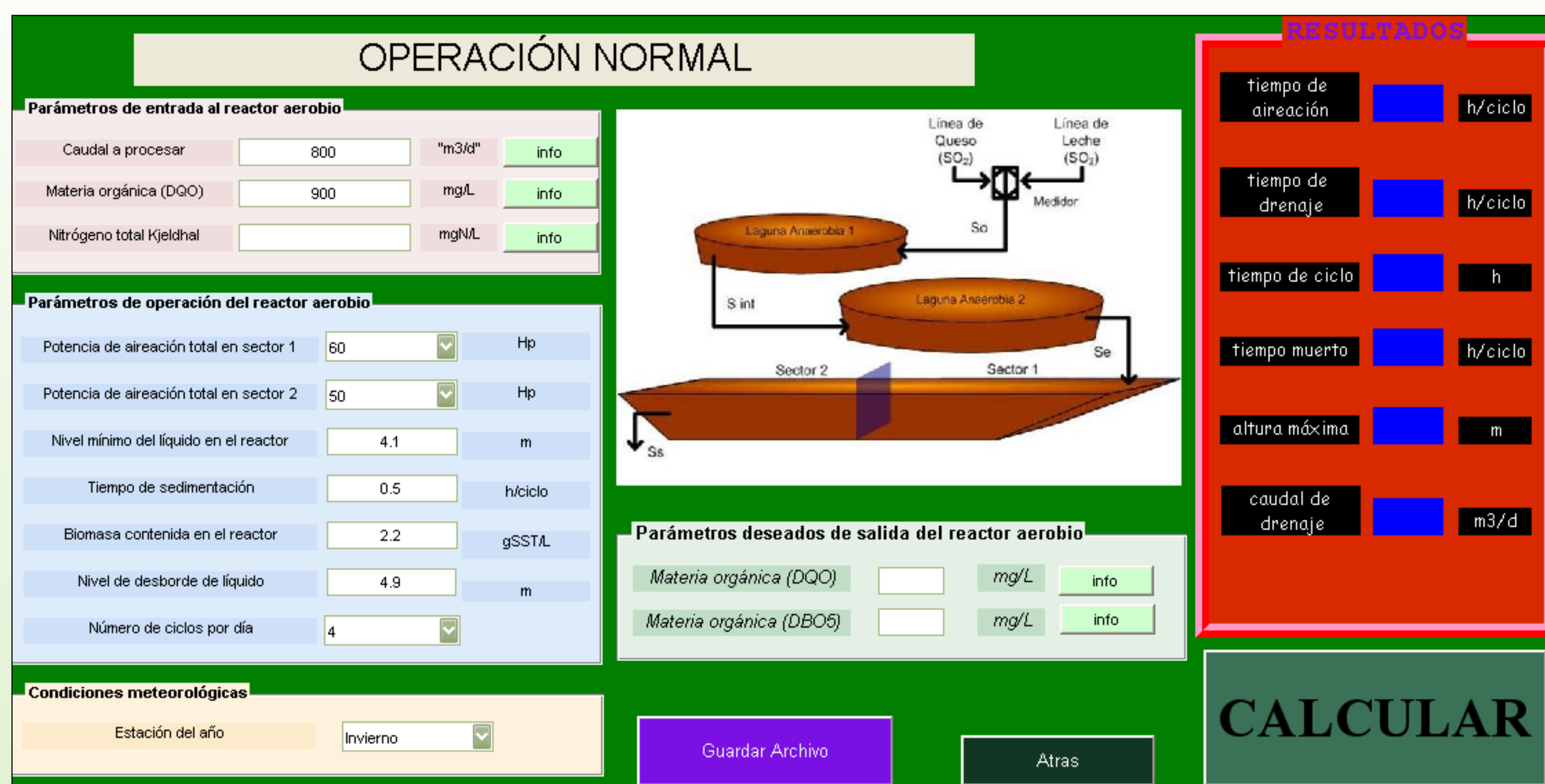
PhD. Thesis A.I. Torres (UMN, USA); Advisors: M. Tsapatsis, P. Daoutidis

CAPABILITIES

COMPUTATIONAL CAPABILITIES

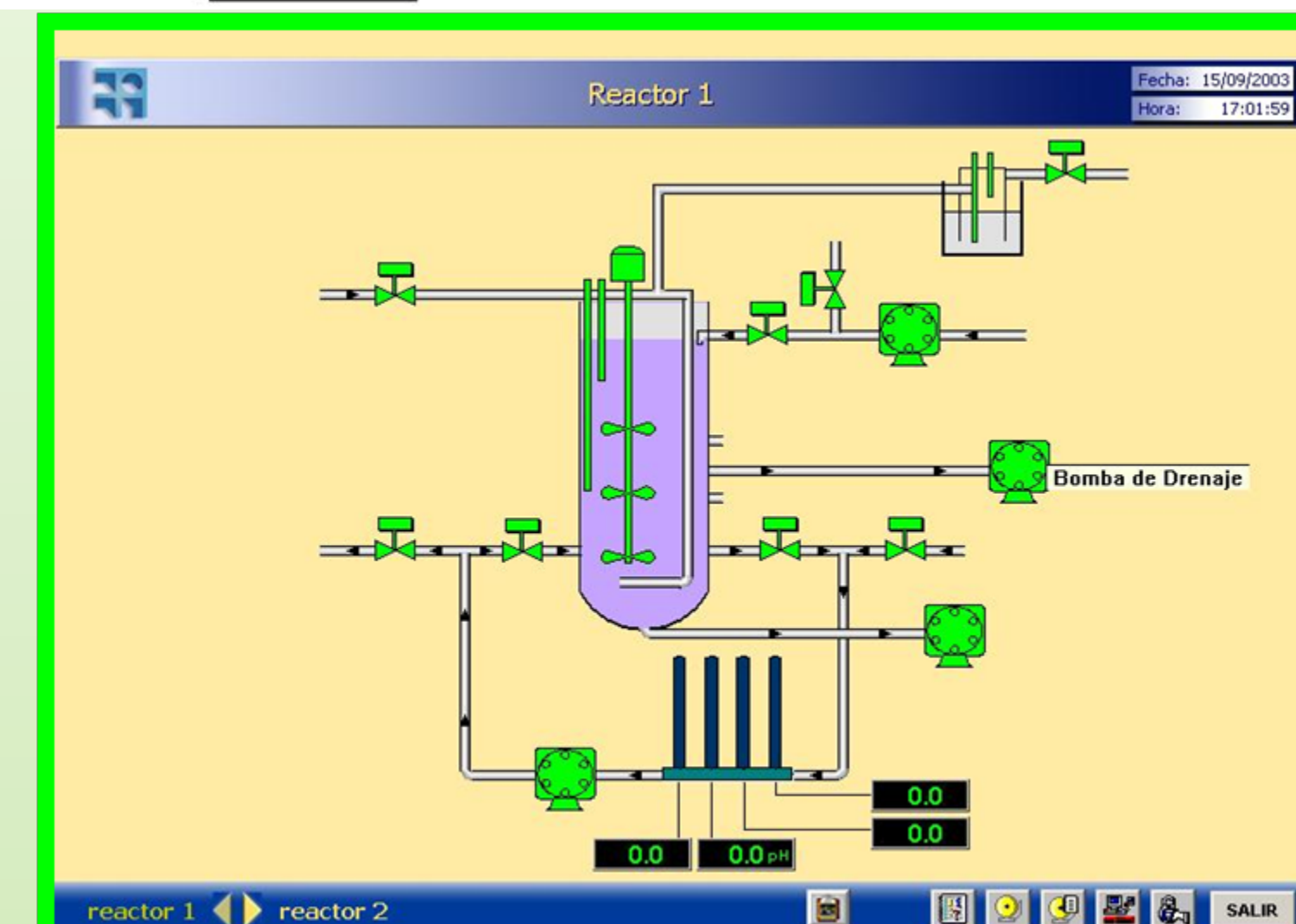
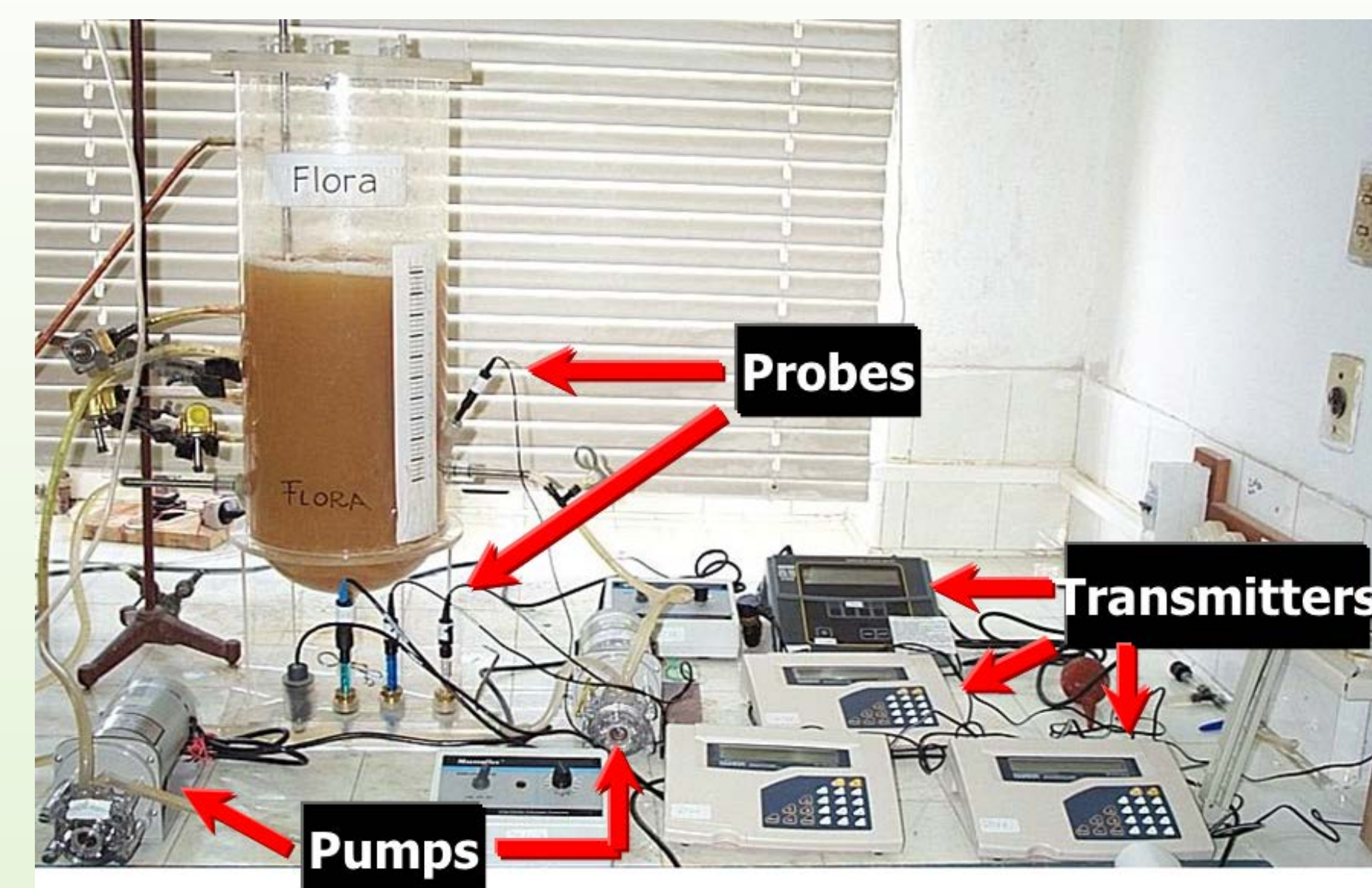
- SOFTWARE: vast experience in
 - **Process Modelling and Simulation**
ASPEN Plus
ASPEN Hysys
EMSO
 - **Mathematical Programming (Optimization)**
GAMS: Solvers CPLEX, BARON
 - **Parameter Estimation**
ATHENA
 - **Computational Fluid Dynamics**
CFX and Fluent
 - **Programming**
Matlab, Mathcad, Excel, Visual Basic

- DEVELOPMENT OF AD-HOC DECISION SUPPORT SOLUTIONS FOR THE INDUSTRY: Relevant examples include
 - **OPERES:** Decision making tool for optimal operational strategy selection in a dairy wastewater treatment plant (cheese based factory).
 - Process simulator and decision making tool for optimal operational strategy selection in a dairy wastewater treatment plant (milk powder and butter based factory).
 - Software for design of waste handling systems in dairy farms.



EXPERIMENTAL CAPABILITIES

- LAB EQUIPMENT
 - **Chromatography:** HPLC, GC, TLC
 - **Wastewater and solution testing:** pH, dissolved oxygen, sulfur, nitrates/nitrites, ammonia, redox potential, conductivity, chemical and biochemical oxygen demand (COD, BOD).
 - **General lab equipment:** Rotavapor, liquid phase extractor, centrifuge, analytical scale, etc.
 - **Others:** Access to pilot scale distillation.



HUMAN CAPABILITIES

• **Dr. S. Gutiérrez**
G4 DT Professor, SNI member
Modeling, Biorefineries, Dairy farm waste management, adsorption process, lipid valorization.

• **Dr. A. I. Torres**
G3 DT Professor, SNI member
Modeling and Simulation (ASPEN), non-linear optimization, parameter estimation, TEA, Biorefineries

• **MSc. A. Ferrari**
G3 Professor, Conaprole
Control, uncertainty and sensitivity analysis, non-deterministic global optimization

• **MSc. J. Ferreira**
G2 Assistant
Modelling and Simulation (EMSO)

• **Eng. J. Lacuesta**
G1 Assistant
Adsorption
• **F. Mangone**
G1 Assistant
Chem. Eng.

• **C. Philippi**
Research Assistant
Production Eng. Biorefinery
• **P. Ures**
Research Assistant
Chem. Eng. Biorefinery