RESEARCH LINE: BIOENGINEERING AND BIOTECHNOLOGY

Description: Development and kinetic characterization of microbial and enzymatic processes. Alcoholic fermentation. Waste treatment. Biochemical reactors - design and operation. Modeling, simulation, and control of biochemical processes.

DEVELOPMENT OF BIOCHEMICAL PROCESSES

Bioprocess and Metabolic Engineering Laboratory-LEMeB

Professor Francisco Maugeri Filho

Description: Determination of the kinetics of the biochemical process (fermentative, enzymatic, or purification) and mathematical modeling of the process. Optimization using response surface analysis and process control. Production of free and immobilized enzymes using different fermentation media and reactors. Effect of aeration, temperature profile, and compaction of the medium on enzyme yield and productivity.

YEAST IMPROVEMENT FOR INDUSTRIAL APPLICATIONS:

Bioprocess and Metabolic Engineering Laboratory- LEMeB

Professor Andreas Karoly Gombert

Description: Generation of Saccharomyces cerevisiae strains more tolerant to the main process stress factors and strains with increased ethanol yield. Investigation at the genomic level the role of genes and gene expression in these improved phenotypes.

FERMENTATIVE AND ENZYMATIC PROCESSES FOR OBTAINING DIFFERENT BIOPRODUCTS

Bioprocess and Metabolic Engineering Laboratory- LEMeB

Professor Rosana Goldbeck

Description: Development of industrial biotechnological processes involving microorganisms and/or enzymes, in free or immobilized form. Bioprospecting of enzymes and/or inputs of industrial interest. Production, purification, and characterization of enzymes of industrial interest and application and development of industrial processes. Heterologous expression of genes of interest, aiming at the overexpression of enzymes in host systems. Simultaneous saccharification and

fermentation of sugarcane bagasse for the production of second-generation ethanol. Enzymatic hydrolysis and optimization of enzymatic cocktails for lignocellulosic biomass degradation. Evaluation of robustness and fermentation capacity of industrial yeast strains. Development of systems aimed at biotechnological processes, with advanced technological approaches, using a modern, unconventional view of industrial processes.

TREATMENT AND USE OF AGRO-INDUSTRIAL WASTE

Laboratory of Bioengineering and Treatment of Water and Waste-BIOTAR

Professor Tania Forster Carneiro

Description: Technologies for reusing waste for the production of new products with energy use have emerged as an efficient and economically viable alternative, with great production potential and market value. Anaerobic digestion under thermophilic conditions and high percentages of solids (dry type) stands out among these emerging technologies. This research line aims to design treatment units using anaerobic digestion technology leading to energy use. Other approaches include the optimization of process variables such as hydraulic retention time, organic load speed, biodegradation, biodegradability, waste nature, particle size, pre-treatments, inoculum nature, and inoculation percentage, among others. The use of biogas can occur through the treatment of effluents and organic residues from food processing using biogas generated by hydrolysis and gasification under sub and/or supercritical conditions (hydrogen and/or methane). The objective of this research line includes the identification and quantification of waste, which can be used as raw material for energy generation; assembly of sub/supercritical thermal reactors; assessment of biogas in the context of renewable energy sources; determination of the theoretical potential of hydrogen and methane production; interaction between the extraction, hydrolysis, and gasification processes in supercritical water, and proposal of kinetic models to describe the temperature profile of these processes.

PRODUCTION AND PURIFICATION OF BIOTECHNOLOGICAL PRODUCTS OF INDUSTRIAL INTEREST

Bioprocess and Metabolic Engineering Laboratory-LEMeB

Professor Marcus Bruno Soares Forte

Description: Development of strategies for the production of biomolecules via fermentation or enzymatic routes. Use of agro-industrial by-products. Alternative methods for the pre-treatment of sugarcane bagasse and other lignocellulosic biomasses for the production of second-generation ethanol and other high value-added bioproducts. Detoxification of hemicellulose hydrolysates. Separation and purification of biotechnological products using adsorption and ultra/nanofiltration columns. Use of batch and tubular biochemical reactors in different bioprocesses: purification of bioproducts, application of immobilized enzymes, and detoxification of hemicellulose hydrolysates. Determination of kinetic, equilibrium, and transport parameters in biochemical processes. Analysis and optimization of processes through experimental design and response surface methodology.