

DISCIPLINA	NOME
BI005	Tópicos Avançados em Processos de Fabricação de biocombustíveis

Objetivos:

The objectives are to provide a basic and up-to-date view of bioethanol production processes and to encourage students to suggest improvements in ethanol production. Based on genetics applications the students will be encouraged to propose modifications in the yeast metabolism, aiming improvements in ethanol yields with less by-products formation, as well as suggestions to obtain improved new yeasts.

Programa:

Ethanol production is a complex biotechnological process that requires different areas of knowledges and expertise (Laluce et al., 2012). The evaluation of the performance of a fermentation process in large industrial reactors should take into account various risks that can compromise the process as a whole. The main risks are the raises in the production costs, decreases in product yields and rates of product formation and eventually the entering at stuck fermentation. However, such risks can be diagnosed, interpreted and minimized making use of the microbiology of contaminants (bacteria and wild yeasts) and starter yeasts, microbial metabolism at the level of enzymatic inhibition and regulation of the expression of genes relevant to the processes.

CONTENT AND SEQUENCE OF TOPICS- This course will be taught as follows

Topic I: Natural ecology, cell nutrition yeast growth media, kinds of microbial populations-yeast diversities (mutants and wild yeasts), resistance to stresses.

Topic II: DNA structure, gene expression, chromosome, Mendel's law, Heterozygous, Homozygous, dominance, variability (cell and colony morphologies) of yeasts, source of genetic variations, regulatory phenomena and effects of temperature.

III - Yeast and bacteria (isolated and built organism) and theirs relations with the efficiency of processes, as well as roles of coenzymes (NADH, FADH₂) in the transport and transfer/ storage of energy (ATP/ADP system) between metabolic pathways of degradation and syntheses of microbial cells.

Topic IV- Correlations between process conditions and the metabolic reactions during conversion of glucose into ethanol, formation of by- products, and the establishment of redox balance between catabolic and anabolic reactions

Topic V- First- generation ethanol: raw materials, type of processes and their stages, organism identification (contaminants, transitory variants, mutants) and processes management.

Topic VI- Second-generation ethanol: yeast characteristics, inhibitory effects on yeast cells, cocktail of enzymes, type and stages of processes.

Bibliografia:

Gallardo J. C., Souza C S., Cicarelli R. M, Oliveira K. F., Morais M. R., Laluce C. (2011). Enrichment of a continuous culture of *Saccharomyces cerevisiae* with the yeast *Issatchenkia orientalis* in the production of ethanol at increasing temperatures .*Industrial Microbiology and Biotechnology* 38(3):405-146.

Laluce C., Schenberg A.C., Gallardo J.C., Coradello L.F., Pombeiro-Sponchiado S.R.(2012) Advances and developments in strategies to improve strains of *Saccharomyces cerevisiae* and processes to obtain the lignocellulosic ethanol-a review. *Applied Biochemistry and Biotechnology*.166(8):1908-26.

Laluce C.; Longo E.; Pombeiro-Sponchiado S. R.; Cilli E. M.; Gallardo, J.C.M.; Masiero M.O.C. A complexidade da produção do bioetanol em fermentações abertas de matéria primas industriais. In: *Bioenergia, desenvolvimento e pesquisa* (Lemos, E.C.M. e Stradiotto N., NRT, Org.), *Produção de biocombustíveis (Pat I)*, Cultura Academia, pp.165-194, 2012.

Miranda I. Masiero O.; Zamai, T.; Capella, M. and Laluce C. (2015). Improved pretreatments applied to the sugarcane bagasse and release of lignin and hemicellulose from the cellulose-enriched fractions by sulfuric acid hydrolysis *Journal of Chemical Technology and Biotechnology* DOI 10.1002/jctb.4601published online

Souza, C S., Oliveira, K F., Trevisan, H. C.; Laluce, C. (2007). A strategy to compare yeast strains and improve cell survival in ethanol production process above 30°C. In *Communicating current Research and Education Topics and Trends in Applied Microbiology*, pp.410-417. FORMATEX; Verlag Wiley-VBC Publishing.

Walker, Graeme M. (1988). *Colonial yeast growth in yeasty physiology and biotechnology*, pp 127-131. Chichester: John Wiley and Sons Publishing.

Cecilia Laluce, Longinus Ifeanyi Igbojionu, Kelly Johana Dussán Medina (available after august 2018) Fungal enzymes applied to industrial processes for bioethanol production. In: Sachin Kumar, Pratibha Dheeran, Mohammad Taherzadeh and Samir Khanal (Eds), *Fungal Biorefineries*, Springer Verlag, Berlin, Germany.

Critérios de Avaliação:

STRATEGY TO BE ADOPTED DURING CLASSES EVALUATION CRITERIA

During the classes the slides will be presented and commented in English and whenever necessary in Brazilian Portuguese so that the students have the opportunity to learn the English language. In addition, selected bibliographic material will be suggested to the students to seek more information about the lessons, preparation review work and seminars.

Assessment of student learning will be based on the following criteria:

- Questions of students during classes;
- Preparation of critical reviews to be submitted for evaluation;
- Seminars presented orally