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From flask to airlift: Impact of environmental and operative conditions over a microalgae consortium composition and lipid production

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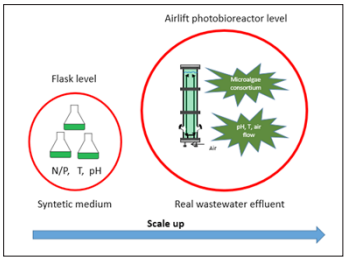

Microalgae produce lipids that can be converted in biodiesel, but also, the microalgae biomass itself can be employed to produce more energy by chemical or biological transformation (i.e., CH_4 production and hydrothermal liquefaction to produce biocrude). The capability to survive at extreme conditions and to metabolize different source of compounds (N and P) allows selecting microalgae consortia which could be used in a specific bioprocess. The environmental and operational conditions necessary to get highest biomass and lipid yields when using that consortium are not so obvious. This work study, at two scale levels (500 mL flasks and pilot photobioreactor) the interactions among variables such as pH, temperature, nutrient concentrations (N/P) and air flow in order to control the consortium behavior and hence, to obtain high biomass and other valuable products yields. The employed consortium is composed by Chlorella, Desmodesmus, Colpoda and a number of bacteria. This consortium was characterized by DNA probes. An experimental design was carried out to evaluate pH, temperature and N/P ratios when cultivating the microalgae consortium at flask level with synthetic medium, which resembles a wastewater. Consortium composition was evaluated at those different conditions. Best conditions were applied in a 20 L airlift photobioreactor. In this second stage, a new variable was integrated, i.e., air flow rate and real wastewaters were employed (parameters varied were T, pH and air flow). At flask level, the main variables responsible of biomass and lipids production were temperature, followed by N, N-P interaction and finally by P concentrations. pH level had no significant effect. In this first stage (flasks level), biomass, lipids and pigments productivities up to 61.6, 18.89 and 2.57 $mgL^{-1}d^{-1}$, respectively were obtained. In the airlift photobioreactor, best operative condition to growth the consortium were 0.5 vvm at pH of 10 and 25 °C. Lipid and chlorophylls productivities were the highest values (51.0 and 2.53 $mgL^{-1}d^{-1}$ respectively) and biomass productivity was 97 $mg.L^{-1}.d^{-1}$. The composition of the consortium was a function of temperature mainly. This study determined the effect of different variables at the same time to get maximum growth and lipid production when scaling up the culture of a microalgae consortium from flasks to 20 L photobioreactor.

Biography

Yaremi López-Hernández is a Biochemical Engineering from ITM, Morelia, Mexico and has a Master's degree on Bioprocess by IPN, Mexico. She has expertise in bioprocess using microalgae and wastewater treatments, as well as in photobioreactors hydrodynamics characterization. Presently she is a proactive PhD student and collaborates in the research work group of bioprocesses in UPIBI-IPN, México.

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