



SCALE-DOWN AND HYDRODYNAMIC AND MASS TRANSFER CHARACTERIZATION OF A FLAT-PANEL AIRLIFT PHOTOBIOREACTOR

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Introduction. Microalgae and cyanobacteria are photoautotrophic microorganisms widely used in bioprocesses for the production of high value compounds as biofertilizers, polysaccharides, pigments, etc. For the production of these microorganisms there are different types of photobioreactors (FBR), as the “flat panel”, which were specifically designed for optimal use of light and generally consists of thin layer structures with small distance between them to obtain the greatest possible ratio between the illuminated area and working volume (A/V). This kind of FBR allows adequate light penetration, and thus, an increase in photosynthetic efficiency.

The aim of this study was the scale-down of a previously tested FBR configuration described by Reyna *et al.* (2010) and to evaluate its hydrodynamic and mass transfer characteristics.

Methods. The hydrodynamic and mass transfer characterization was evaluated in a biphasic (water-air) and triphasic (air, culture medium and microbial consortium) systems by the following determinations: the volumetric mass transfer coefficient (k_{La})-dynamic method (4), the gas hold-up (ϵ)-volumetric expansion method (2), and the mixing time (t_m)-acid trace method (1).

Results and discussion. The design and scale-down criteria for the flat-panel airlift photobioreactor were the A/V ratio corresponding to 7.3 m^{-1} , maintaining the geometry. FBR's dimensions were: 19 L total volume, 16 L working volume, 0.41 m length, 0.34 m height and 0.14 m width (light path). Figures 1-3 show the results of the FBR hydrodynamic and mass transfer characterization.

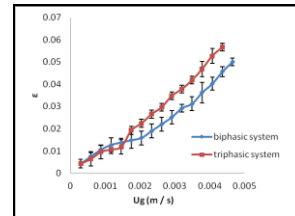


Figure 1. U_g vs ϵ

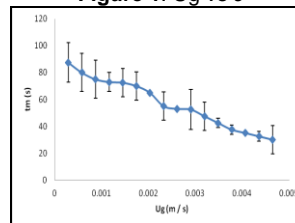


Figure 2. U_g vs t_m

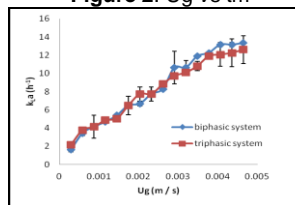


Figure 3. U_g vs k_{La}

k_{La} values obtained for the 19 L FBR in the biphasic and triphasic systems are 20 to 25 times higher than reported in the literature for Issarapayup *et al.* (2009) for FBR with similar configurations.

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