MINIMIZATION OF WATER LOSSES IN MANURE TREATMENT PROCESSES USING MICROALGAE

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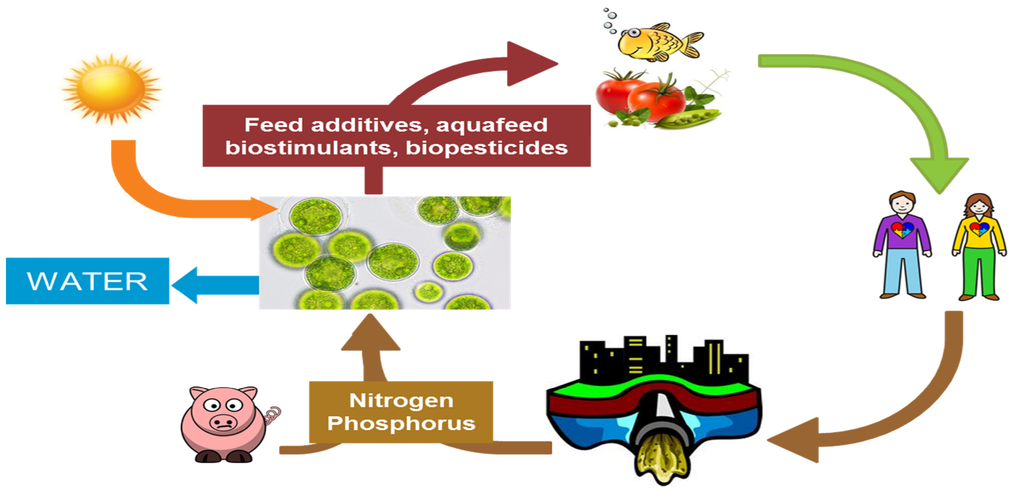
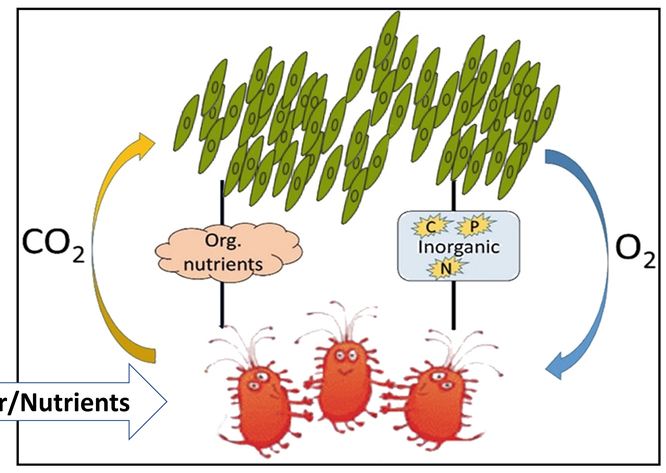
IX SIMPOSIO de Investigación EN CIENCIAS EXPERIMENTALES

Introduction

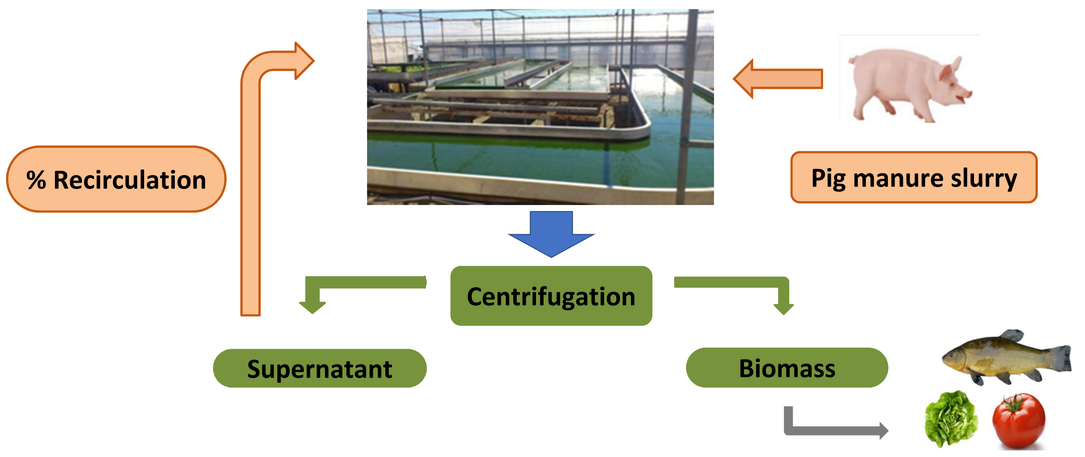




The use of pig manure slurry to produce microalgae is a good option to solve the environmental problems that they pose, additionally turning them into valuable products such as biofertilizers. However, due to the high concentration of contaminants already present on pig slurry large dilutions are required to avoid inhibitions phenomena. Moreover, on these processes the cultivation of open reactors is mandatory to reduce the treatment cost, large water losses by evaporation taking place when using both open raceway or thin-layer reactors. In this research is aimed to optimize the water reuse to improve the sustainability and economic profitability of these processes. For that, operation mode was optimized, both the dilution rate and recirculation rate being studied. The challenge is to accomplish the discharge limits while maximizing the productivity of the system.

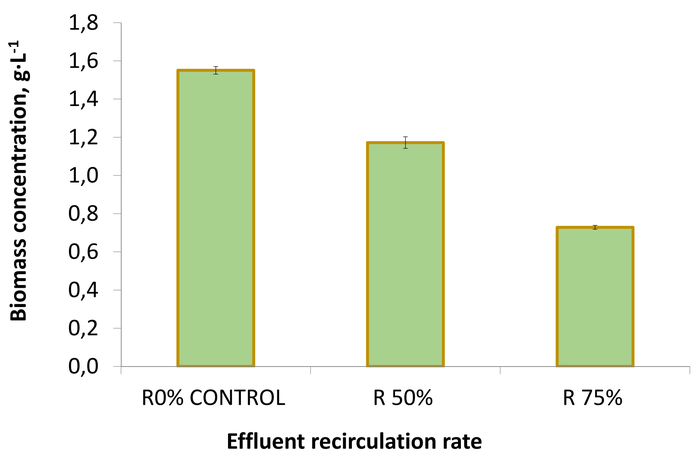
Methodology

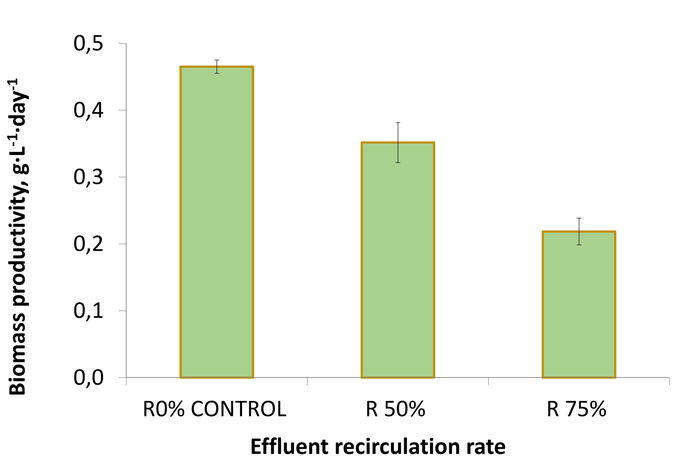
Operation mode

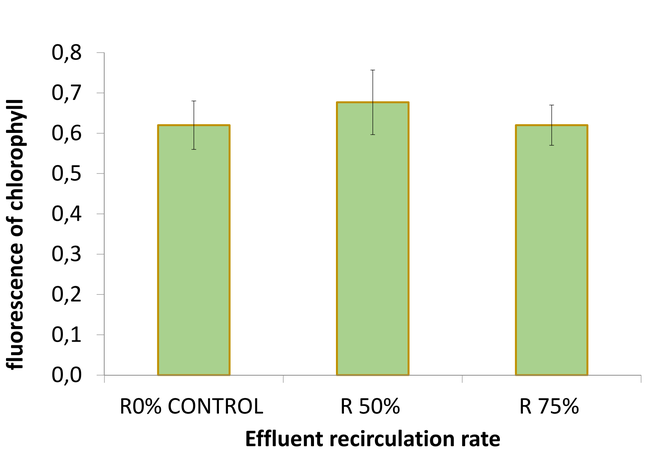


Experiments were carried out using the microalgae *Scenedesmusm sp.* in thin-layer reactors with a surface area of 30 m^2, a volume of 1200 L, a depth of 2 cm, and a pit volume of 550 L. The dissolved oxygen and pH of the culture were controlled below 250% Sat and 8.0 by on demand injection of air and CO_2. The reactor was operated in semicontinuous mode at 0.3 day^{-1} dilution rate, using a culture medium composed by water containing 10% of fresh raw pig manure slurry as nutrients source. The biomass contained into the volume of culture daily harvested by separated by centrifugation, the supernatant being recirculated to the reactor at different ratios (0%-control, 50%, and 75%).

Results







Results shows as increasing the recirculation ratio the performance of the system reduces. The biomass concentration at steady state decreases from 1.5 g/L at 0% recirculation (control), to 0.94 g/L at 50% recirculation, and 0.75 g/L at 75% recirculation. Productivity values ranged from 0.47 g/L·day at 0% recirculation (control), to 0.35 g/L·day at 50% recirculation, and 0.22 g/L·day at 75% recirculation (Figure 1). In spite of this reduction of biomass concentration and productivity, the fluorescence of chlorophyll measurements does not show any negative effects in the status of the cells, values remaining in the range of 0.65.

Conclusions

- In summary, results indicate that it is possible to recirculate the effluent on a large scale and that this operating form allows to maintain the biomass productivity, this strategy greatly enhancing the sustainability of the entire process.
- The 50% effluent recirculation rates it is the best performance treatment without compromising the productivity and the healthy state of the culture.
- These results must be validated with the closed photobioreactor to further save ware losses due to evaporation

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