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Culture of *Spirulina platensis* in wastewaters: Enhancing biomass and lipids production manipulating temperature, irradiance, salinity or P/N contents

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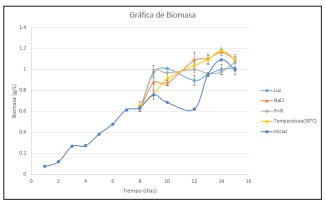

Spirulina is a well-known microalgae that has been used for centuries as a food, pigment and supplement. Recently, nutraceutic properties (antioxidant, anticancer, antibiotic, among others) have been reported for this strain. *Spirulina* produce triglycerides that can be converted in biodiesel. Also, *Spirulina* biomass can be converted in biocrude using a hydrothermal liquefaction process and the yield of biocrude depends on the microalgae C, H, O, N, and S contents, which in turn are a function of the strain employed, the available nutrients (P mainly) and some environmental parameters such as pH, light irradiance, aeration, etc. Our research group has previously published the higher heat value HHT for *Spirulina* and *Chlorella* after and before the extraction of proteins, lipids and pigments. The aim of this work was to develop cheap media for *Spirulina* production based in urine, seawater and/or secondary treated wastewaters. The strain employed in this work arises from the Texcoco Lake, Mexico. The experiments were carried out in 500 mL baffled flasks with 300 mL of each media (by triplicate). The microalgae were cultured in a shaker with 60 μmol photons/m^2s (12 h light/12 h dark cycles), at room temperature (23-25 °C). *Spirulina* was cultivated in treated wastewaters (minimum COD content) supplemented with 5 g/L NaCl and 10 g/L of $NaHCO_3$ for 7 days. Then, different treatments were applied for 8 days, such as change in temperature (30 °C), adding salt (up to 10 g/L), diluting with fresh medium so P and N were abruptly depleted, or increasing light irradiance (up to 120 μmols photons/m^2.s). *Spirulina* grew well in wastewaters treated with secondary treatment, removing P and N. After the application of different treatments, higher biomass, lipids and pigments yields were obtained. Best effect was observed when salt concentration was increased. *Spirulina* cells grew more than the blank (0.99 mg/L), i.e., up to 1.102 mg/L or 10% more. On the other hand, under that conditions 15% more lipids were produced and the distribution of pigments was rather different (more phycocyanine, pheophytine and β-carotene). P and N removals were as high as 100 and 77% (compared with the blank, i.e., 96 and 80%, respectively). In conclusion, this work showed that it is feasible to culture *Spirulina* using cheap media such as urine, seawater and wastewaters. Besides, it was possible to increment the biomass, lipids and pigments production, when changes in temperature, salinity, light irradiance or P/N starvation are applied to wastewater-microalgae culture. Best effect was observed when NaCl concentration was incremented to 10 g/L, forcing *Spirulina* cells to grow more than the blank (0.99 mg/L), up to 1.102 mg/L. Under those conditions 15% more lipids were produced and the distribution of pigments was rather different in a way that more profit can be reached in the whole process.

Biography

Luis G Torres is a Chemical Engineering with a Master in Biotechnology (UNAM). Also, he has a PhD in Environmental Engineering by UNAM, Mexico. He has worked in some of the more prestigious Mexico research centers with research lines on wastewater treatment, soil and aquifers remediation, fermentation engineering and more recently in developing technologies for the production of microalgae, lipids and other valuable compounds (such as pigments) using wastewaters and other residues in bioreactors. He has explored engineering aspects such as mixing, mass transfer and scale up of phototrophic process, microalgae harvesting and characterization of the products. He has produced more than 125 international papers and co-edited 5 books.

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