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A symbiotic gas exchange between fermenters and photobioreactors enhances microalgal biomass and lipid productivities: taking advantage of complementary nutritional modes. Concept, applications and future directions

Alberto Reis[1], C. A. Santos[1], J. C. Miranda[1], T. Lopes da Silva[1], L. Gouveia[1] and J. M. Novais[2]
[1]National Laboratory of Energy and Geology (LNEG), Portugal
[2]Institute for Biotechnology and Bioengineering, Instituto Superior Técnico, Portugal

The association of two bioreactors, photoautotrophic and heterotrophic, connected by the gas phase, allowing an exchange of O_2/CO_2 gases between them, benefiting from a symbiotic effect, is described. The O_2-rich outlet gas flow from the autotrophic bioreactor was used as the inlet gas flow for the heterotrophic bioreactor. In parallel, the CO_2-rich outlet gas flow from another heterotrophic bioreactor was used as the inlet gas flow for the autotrophic bioreactor.

One mixotrophic bioreactor was also used as a model, for its claimed advantage of CO_2 and organic carbon being simultaneously assimilated. Chlorella protothecoides was chosen as a model due to its ability to grow under auto, hetero, and mixotrophic nutritional modes, yielding high biomass productivity and lipid content, suitable for biodiesel production. Heterotrophic growth achieved the highest biomass productivity and lipid content (>22%), as well as the most suitable fatty acid profile in order to produce high quality biodiesel. Both associations showed higher biomass productivity (10–20%), compared to the sum of the two separately operated bioreactors (controls). A more remarkable result would have been obtained if the two bioreactors had been inter-connected in a closed loop. The biomass and lipid productivity gain would have been 30% and 100%, respectively, by comparing the productivities of the symbiotic assemblage with the sum of the two non-connected control bioreactors. These results show an advantage of the symbiotic bioreactors association towards a cost-effective microalgal biodiesel production. The concept can be extended to any single-cell-oil rich heterotroph, such as the yeast Rodotorula glutinis.

Biography

Alberto Reis, chemical engineer, Ph.D. degree (biochemical engineering) from the Technical University of Lisbon in 2001. In 2001, he was appointed as a Researcher at the National Institute of Engineering, Technology, and Innovation (INETI) in Lisbon, now the National Laboratory for Energy and Geology (LNEG). He was awarded as a postdoc at the Birmingham University (UK) for one year. He currently conducts research at the Bioenergy Unit of LNEG being a Coordinator of the Bioengineering Program at the same institute. He authored over 40 international peer-review scientific publications. He is the Editorial board member of Journal of Biomedicine and Biotechnology.

alberto.reis@lneg.pt

Microbial desalination cell for simultaneous water desalination and current production

A. Carmalin Sophia[1], T. Vel Rajan[2] and R. Lalitha[2]
[1]National Environmental Engineering Research Institute (NEERI), Chennai Zonal Lab, India
[2]Department of Civil Engineering, Thiagarajar College of Engineering, India

A microbial desalination cell (MDC) is a new approach for desalinating water. Electrical current in this cell is generated by exoelectrogenic bacteria. This is accomplished by using a source of organic matter as the fuel to desalinate water. This study aims to achieve desalination using a laboratory scale H type three chamber reactor. Graphite electrodes were used as cathode and anode. The microbial desalination cell (MDC) was demonstrated using water at different initial salt concentrations (5 to 20 g/L) with sodium acetate used as the substrate for the bacteria. The maximum voltage produced during MDC operation with an initial concentration of 20 g/L (10Ω external resistor) was 190 mV, with a maximum current of 19 mA. The water in the middle chamber was desalinated. The 30 % chloride removal was obtained for initial NaCl concentration of 20 g/L.

Biography

A Carmalin Sophia is a Scientist in National Environmental Engineering Research Institute (NEERI). She is a recent Fulbright – Nehru Environmental Leadership Scholar (2011-2012). She is a Young Scientist Awardee of the Indian Science Congress 2004. She has innumerous International and National research articles published to her credit. She has travelled extensively to many countries around the globe like US, Brazil and Dubai.

ac_sophia@neeri.res.in