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Metabolic Manipulation as a Strategy for Optimization of Biomass Productivity and Oil Content in the Microalgae Desmodesmus Sp.

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Abstract : The microalgae oil emerges as a promising source of raw material for many industrial applications. Thus, this study had as a main focus on the cultivation of the microalgae species Desmodesmus sp. in laboratory scale with a view to maximizing biomass production and triglyceride content in the lipid fraction. Initially, culture conditions were selected to optimize biomass production, which was subsequently subjected to nutritional stress by varying nitrate and phosphate concentrations in order to increase the content and productivity of fatty acids. The culture medium BOLD 3N, nitrate and phosphate, light intensity 250,500 and 1000 µmol photons.m^2.s^{-1}, photoperiod of 12:12 were evaluated. Under the best conditions of the tests, a maximum cell division of 1.13 div.dia^{-1} was obtained on the sixth day of culture, beginning of the exponential phase, and a maximum concentration of 8.42x107 cell.mL^{-1} and dry biomass of 3.49 gL^{-1} on the 20th day, in the stationary phase. The lipid content in the first stage of culture was approximately 8% after 12 days and at the end of the culture in the stationary phase ranged from 12% to 16% (20 days). In the microalgae grown at 250 µmol fotons.m2.s-1 the fatty acid profile was mostly polyunsaturated (52%). The total of unsaturated fatty acids, identified in this species of microalga, reached values between 70 and 75%, being qualified for use in the food and pharmaceutical industry. In addition, this study showed that the cultivation conditions influenced mainly the production of polyunsaturated fatty acids, with the predominance of γ-linolenic acid. However, in the cultures submitted to the highest the intensity of light (1000 µmol photons.m^2.s^{-1}) and low concentrations of nitrate and phosphate, saturated and monounsaturated fatty acids, which present greater oxidative stability, were identified mainly (60 to 70 %) being qualified for the production of biodiesel and for oleochemistry.

Keywords : microalgae, Desmodesmus sp, fatty acids, biodiesel
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