Production of Docosahexaenoic Acid by Marine Fungal Strain of Schizochytrium sp.

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ABSTRACT

Docosahexaenoic acid (DHA) is one of the n-3 polyunsaturated fatty acids. The effects of DHA on human bodies have received considerable attention in recent years, which have intimate connection with the development of retina and brain tissue, and could lower the cholesterol content in blood and reduce the occurrence of thrombus and atherosclerosis found in the cardiovascular disease. In this study, we compared the operation conditions using batch and fed batch cultures in order to increase the production of DHA by Schizochytrium goldstein S-3 strain ATCC 26185. The investigation was carried out in a three liter fermentor (Mituwa KMJ-3B). The basic medium was composed of 15g/L glucose, 5 g/L yeast extract and 8 g/L peptone. In the batch study, by changing one variable at one time, we studied how physical variables (incubation temperature, pH value, aeration volume, impeller shape, agitation rate and time) affected DHA productivity. Our study showed that higher productivity was achieved at a temperature of 20 ℃. The overall performance is better when pH was not controlled, as compared with fermentation in a medium of controlled pH (5.5, 6.5, 7.5 and 8.5). As to the shape of impeller (turbine, paddle, 45 ° axial flow and propeller), turbine was shown to be the best impeller for the highest productivity of both of biomass and DHA. DHA productivity was decreased at higher agitation speed. The optimal agitation speed for the productivity of biomass was found to be 200 rpm, and the optimal level of aeration to produce DHA was 1.5 vvm. Best incubation time was 7 days. When the above operation conditions were applied, the yields of biomass and DHA were 6.8 g/L and 310 mg/L, respectively, as compared with the yields of biomass and DHA of initial condition were 6.1 g/L and 150 mg/L, respectively. In fed-batch culture, the effect of two methods of fed-in on cell growth and DHA production were investigated. One method was gradient feeding with variable feed concentrations (2-fold, 4-fold, 6-fold and 8-fold of basic medium), and the other was gradient feeding at different intervals (6-hours, 12-hours, 18-hours and 24-hours). At first, each fed-batch experiment was incubated for 48 hrs with 1 liter medium, then proceeded with feeding for 72 hrs with the total feeding volume of 1,200 mLs. The result showed that, for the variable feeding concentration method, the best concentration was 6-fold of basic medium which gave the highest biomass and DHA productivity of 12.1 g/L and 450 mg/L, respectively. For feeding at different intervals, the best interval was 6 hr which gave the highest biomass and DHA productivity of 11.7 g/L and 438 mg/L, respectively. The result of the yields of biomass and DHA by fed-batch culture were 1.5-fold and 1.8-fold that of batch culture, respectively.

Keywords : DHA ; Docosahexaenoic acid ; Fungal ; batch ; fed batch

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