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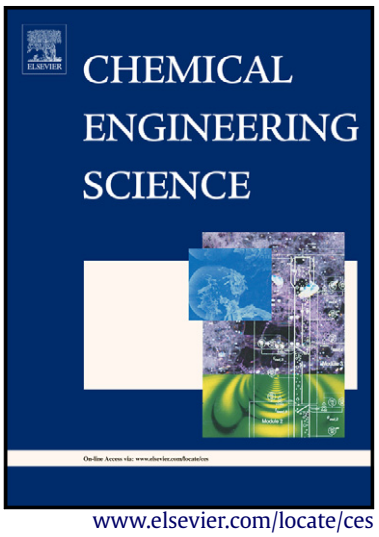

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Optimization of CO_2 Fixation by *Chlorella kessleri* using Response Surface Methodology

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Abstract

Biological fixation of CO_2 using microalgae is an environmentally sustainable option for CO_2 capture. In this study, response surface methodology (RSM) was used to model the CO_2 uptake rate and specific growth rate of *Chlorella kessleri*, which had been identified previously as a promising strain for CO_2 fixation, cultivated in oil sands process water (OSPW). The quadratic models developed were used to determine the optimal sets of CO_2 concentration, phosphate concentration and light intensity for CO_2 uptake rate and specific growth rate in batch operation. The optimal CO_2 concentration, phosphate concentration and light intensity of 35%, 29 mM and 70 μmol photons.m^{-2}.s^{-1}, respectively, were estimated to maximize the CO_2 uptake rate to 65.03 mg/L/day. Also, the maximum specific growth rate of 0.310 per day was obtained at 22% CO_2 concentration, 29 mM phosphate concentration and 70 μmol photons.m^{-2}.s^{-1}. Finally, a multi-objective optimization technique was used to maximize the CO_2 uptake rate and specific growth rate simultaneously. The optimal Pareto set was found to occur at CO_2 uptake rate of 62.98 mg/L/day and specific growth rate of 0.309 per day at 28% CO_2, 29 mM phosphate concentration and 70 μmol photons.m^{-2}.s^{-1} light intensity. Thus, each of the optimal conditions correspond to high phosphate concentration and high light intensity in the ranges investigated, while the CO_2 concentration varied

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