

Effect of Nutrient Limitations in Phycocyanin Formation by *Spirulina platensis*

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Abstract : The cyanobacterium *Spirulina platensis* is a prokaryotic photoautotrophic microorganism that is successfully cultivated for the commercialization as whole biomass due to its high protein content and promising valuable substance. For instance, phycocyanin has recently drawn the interest of the food and cosmetic industries due to its bright blue colour and its strong antioxidant capacities. The phycocyanin (PC) is the main protein-pigment in *S. platensis* (4% to 20%). In batches, the rate of overproduction of metabolites by cyanobacteria is limited or activated by the depletion of required substrates. The aim of this study was to develop a kinetic law that describes phycocyanin formation during batch cultivation. *S. platensis* was cultivated in 1 L bubble column photobioreactor with 30°C and 700 $\mu\text{mol m}^{-2} \text{s}^{-1}$. Culture samples were daily collected from the bubble columns in sterile conditions. The biomass (g l^{-1}) was measured directly after a biomass lyophilisation process, and phycocyanin extractions and measurements were done according to a well-established protocol. A kinetic law for phycocyanin formation that includes nitrate and bicarbonate limitations was proposed and linked to the biomass core model. The set of differential equations were solved in MATLAB. Concerning to product formation, the experimental results show that phycocyanin mass fraction is degraded as results of the complete nitrate depletion and nitrate additions during the cultivation help to keep constant this molecule until new macro-element limitation appear. According to the model, bicarbonate is this limitation.

Keywords : phycocyanin, nitrate, bicarbonate, spirulina

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