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A model for arabidopsis thaliana cell suspension growth and sugar uptake kinetics (Article)

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Abstract

Arabidopsis thaliana (A. thaliana) is a small weed which is related to the cabbage and mustard family. This flowering plant has been used widely as a model plant in genetics and molecular biology research since it is the first plant the full sequenced genome. Thus, A. thaliana literature provides plentiful information from genomics and transcriptomics point of view. However, there is still a lack of physiological information regarding its cell suspension cultures which can be powerful research tools in Plant Biotechnology and especially in Plant Systems and Synthetic Biology. In this study, cell growth and sugar uptake of A. thaliana Col ecotype grown in the continuous dark condition were modelled using the modified Monod and Michelis-menten equations. The model included sucrose hydrolysis by the cell-wall invertase enzyme into hexoses (glucose and fructose) and consumption of these hexoses at different rates to support cell growth. All kinetic model parameters were obtained from a control experiment where Col cells were grown on 30 gL^{-1} sucrose as well as other independent experiments where Col cells were supplied with different concentrations and combinations of sugars. The model adequately described and predicted the growth and sugars profile of A. thaliana cells. This model can also be applied for larger scale of growth with extended expressions for oxygen uptake rate, carbon dioxide production rate etc.

Author keywords

Arabidopsis thaliana Cell growth Columbia (Col) ecotype Kinetic mode Sugar uptake

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