

A hybrid of Simple Constrained artificial bee colony algorithm and flux balance analysis for enhancing Lactate and Succinate in *Escherichia Coli*

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ABSTRACT

In the past decades, metabolic engineering has received great attention from different sectors of science due to its important role in enhancing the over expression of the target phenotype by manipulating the metabolic pathway. The advent of metabolic engineering has further laid the foundation for computational biology, leading to the development of computational approaches for suggesting genetic manipulation. Previously, conventional methods have been used to enhance the production of lactate and succinate in *E. coli*. However, these products are always far below their theoretical maxima. In this research, a hybrid algorithm is developed to seek optimal solutions in order to increase the overproduction of lactate and succinate by gene knockout in *E. coli*. The hybrid algorithm employed the Simple Constrained Artificial Bee Colony (SCABC) algorithm, using swarm intelligence as an optimization algorithm to optimize the objective function, where lactate and succinate productions are maximized by simulating gene knockout in *E. coli*. In addition, Flux Balance Analysis (FBA) is used as a fitness function in the SCABC algorithm to assess the growth rate of *E. coli* and the productivity of lactate and succinate. As a result of the research, the gene knockout list which induced the highest production of lactate and succinate is obtained.

KEYWORDS:

Gene knockout strategies; *Escherichia coli*; Lactate; Succinate; Simple Constrained Artificial Bee Colony; Flux Balance Analysis; Computational intelligence