Identifying a Gene Knockout Strategy Using a Hybrid of Simple Constrained Artificial Bee Colony Algorithm and Flux Balance Analysis to Enhance the Production of Succinate and Lactate in Escherichia Coli

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ABSTRACT

In recent years, metabolic engineering has gained central attention in numerous fields of science because of its capability to manipulate metabolic pathways in enhancing the expression of target phenotypes. Due to this, many computational approaches that perform genetic manipulation have been developed in the computational biology field. In metabolic engineering, conventional methods have been utilized to upgrade the generation of lactate and succinate in E. coli, although the yields produced are usually way below their theoretical maxima. To overcome the drawbacks of such conventional methods, development of hybrid algorithm is introduced to obtain an optimal solution by proposing a gene knockout strategy in E. coli which is able to improve the production of lactate and succinate. The objective function of the hybrid algorithm is optimized using a swarm intelligence optimization algorithm and a Simple Constrained Artificial Bee Colony (SCABC) algorithm. The results maximize the production of lactate and succinate by resembling the gene knockout in E. coli. The Flux Balance Analysis (FBA) is integrated in a hybrid algorithm to evaluate the growth rate of E. coli as well as

the productions of lactate and succinate. This results in the identification of a gene knockout list that contributes to maximizing the production of lactate and succinate in E. coli.

Keywords: Gene Knockout Strategies; Escherichia Coli; Lactate; Succinate; Simple Constrained Artificial Bee Colony; Flux Balance Analysis

DOI: https://doi.org/10.1007/s12539-019-00324-z

Acknowledgements

We would like to thank Malaysian Ministry of Higher Education and Universiti Teknologi Malaysia for supporting this research as part of the Fundamental Research Grant Scheme (Grant number: R.J130000.7828.4F720) and the Flagship Grant Scheme (Grant number: Q.J130000.2428.03G57). We would also like to thank Universiti Malaysia Pahang for sponsoring this research via the RDU Grant (Grant number: RDU180307).