Tatsuo Omata, J Fundam Renewable Energy Appl 2016, 6:3(Suppl)
http://dx.doi.org/10.4172/2090-4541.C1.008

Milking of Cyanobacterial cells as a strategy for sustainable production of biofuels

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Photosynthetic microorganisms are thought to be good materials for biofuel production, but the productivity of algae-based biofuel production is too low to be sustainable. The intrinsic problem is the low product yields on a per-cell basis. Although green algae can accumulate TAG to a level as high as ~50% of cell dry mass (i.e., product-to-cell ratio=1), simple calculations revealed that a much higher product-to-cell ratio (>4) is required for environmentally sustainable production. To achieve this, the strategy of "milking" cells needs to be adopted. It requires: 1) high rate of production of a fuel-related compound; 2) limitation of cell growth without inhibiting photosynthesis; and 3) rapid excretion of the product into the medium. None of these is, however, compatible with the nature of photosynthetic microorganisms. Our goal is to achieve milking of cyanobacterial cells for production of free fatty acids (FFAs), using genetically engineered *Synechococcus elongatus* PCC7942. We chose this strain because it was found to have an unusually high capacity of FFA synthesis, fulfilling the requirement 1) shown above. The cells are, however, severely suffering from over-accumulation of FFA in the cell. We are growing the cells under nitrate-limited conditions to fulfill the requirement 2), and trying to enhance active and passive FFA transport across the cell envelope to fulfill the requirement 3). The latest results of our effeorts will be presented and evaluated in relation to the target values set for the product-to-cell ratio and the rate of production.

Biography

Tatsuo Omata has completed his PhD from University of Tokyo. He is a Professor of Nagoya University. He has been working on CO_2 and nitrate assimilation of Cyanobacteria and published more than 80 papers in reputed journals.

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