Biochemistry, genetics and biotechnology of glycerol utilization in Pseudomonas species -
DTU Orbit (29/08/2019)

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The use of renewable waste feedstocks is an environment-friendly choice contributing to the reduction of waste treatment costs and increasing the economic value of industrial by-products. Glycerol (1,2,3-propanetriol), a simple polyol compound widely distributed in biological systems, constitutes a prime example of a relatively cheap and readily available substrate to be used in bioprocesses. Extensively exploited as an ingredient in the food and pharmaceutical industries, glycerol is also the main by-product of biodiesel production, which has resulted in a progressive drop in substrate price over the years. Consequently, glycerol has become an attractive substrate in biotechnology, and several chemical commodities currently produced from petroleum have been shown to be obtained from this polyol using whole-cell biocatalysts with both wild-type and engineered bacterial strains. Pseudomonas species, endowed with a versatile and rich metabolism, have been adopted for the conversion of glycerol into value-added products (ranging from simple molecules to structurally complex biopolymers, e.g. polyhydroxyalkanoates), and a number of metabolic engineering strategies have been deployed to increase the number of applications of glycerol as a cost-effective substrate. The unique genetic and metabolic features of glycerol-grown Pseudomonas are presented in this review, along with relevant examples of bioprocesses based on this substrate - and the synthetic biology and metabolic engineering strategies implemented in bacteria of this genus aimed at glycerol valorization.

General information
Publication status: Accepted/In press
Organisations: Systems Environmental Microbiology, Research Groups, Novo Nordisk Foundation Center for Biosustainability, Universidad Andres Bello, Universität des Saarlandes
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Publication date: 2019
Peer-reviewed: Yes

Publication information
Journal: Microbial Biotechnology
Ratings:
Web of Science (2019): Indexed yes
Original language: English
DOIs:
10.1111/1751-7915.13400
Source: FindIt
Source ID: 2444762622
Research output: Contribution to journal › Journal article – Annual report year: 2019 › Research › peer-review